STATE OF DELAWARE

ENERGY SECURITY PLAN

August 2024

DELAWARE DEPARTMENT OF
NATURAL RESOURCES AND ENVIRONMENTAL CONTROL

Division of Climate. Coastal, & Energy
100 W. Water Street, Suite 10B
Dover, Delaware 19904

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DNREC DIVISION OF CLIMATE, COASTAL AND ENERGY

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Executive Summary

The Delaware State Energy Security Plan (SESP) is a comprehensive manual for state government leaders charged with the responsibility of ensuring the health, welfare, and safety of the citizens of the state during periods of energy emergencies. The plan describes the state's energy landscape, a high level overview of the risks to that landscape, mitigation actions that are underway or being considered, and the way the state will respond if an energy shortage of a substantial nature occurs or appears imminent. The Delaware Department of Natural Resources and Environmental Control (DNREC) is the lead agency for energy emergency planning. DNREC's Division of Climate, Coastal, and Energy (DCCE), which serves as the State Energy Office (SEO) for Delaware, is responsible for updating the SESP. The Delaware Emergency Management Agency (DEMA) director is the primary advisor to the governor in an emergency/energy crisis. DNREC and DEMA work in close consultation with the Delaware Public Service Commission (PSC) during energy emergencies.

The plan uses three basic strategies to minimize disruption of energy supply or the perception of an emergency. These strategies are voluntary and mandatory demand reduction measures, substitution of alternative resources when possible, and state government programs to curtail excessive use. Further, the plan defines emergency conditions and how to monitor the indicators; identifies key players, as well as their roles and responsibilities; identifies the flow of information among agencies, private industry, and the public; recommends "measures" to reduce demand on resources; and discusses the economic impact of higher priced fuel on low-income persons. The emergency response plan is organized around four emergency response phases that contain increasing levels of activity depending on the severity of the energy emergency. These are discussed in Section 1.8.

This plan outlines means the state can use to monitor an energy shortage and decide whether an energy emergency should be declared. It describes the actions that must be taken to declare a state of energy emergency. It outlines decision-making and administrative structure that will be used during a time of emergency. It suggests levels of emergency that may occur for shortages of each fuel type with voluntary and/or mandatory measures appropriate for the level of shortage. If a substantial shortage exists, or appears imminent, the SEO and the DEMA director may recommend that an energy emergency be declared for one or more fuel sources. At this time the Director of DEMA may open the Delaware Emergency Operations Center (State EOC), to be staffed jointly by SEO staff, ESF-12 Group, DEMA staff, relevant state agencies, and others. The Governor may call into order various agencies of state government, representatives of local governments, and non-governmental organizations.

Since the plan was last updated in 2022, the SEO has undertaken several new initiatives to further improve energy security and reliability. Those initiatives are summarized in the following paragraphs.

The Governor's Energy Advisory Council (GEAC) reconvened in June of 2023. The GEAC has a statutory requirement to provide recommendations to the SEO to assist in updating Delaware's Energy Plan. The council last met in 2008, and its recommendations were included in the 2009 Energy Plan. DNREC is releasing an updated Energy Plan in the Fall of 2024. The plan will include measures and actions to enhance Delaware's overall energy security, reliability, and resiliency.

The SEO has worked with PJM and other state agencies to establish a coordinated protocol for responding to PJM alerts and taken a more forward-looking approach to grid resilience and reliability planning. In June 2023, PJM sponsored a "call for conservation" exercise that included Delaware's four lead agencies on energy security and reliability. As a result of that exercise, key personnel in those agencies now receive alerts regarding upcoming weather and other events that may adversely impact Delaware's power grid. Important information that may be included in those alerts will be disseminated up the chain of command and acted on as appropriate. Individual state agencies may further distribute information to the public and other relevant state and local agencies through respective Public Information Offices (PIO) and appropriate staff.

In November 2023, the North American Electric Reliability Corporation (NERC) and Electricity Information

Sharing and Analysis Center (E-ISAC) held GridEx VII. GridEx exercises are a biennial, national grid security exercise that allows the electric industry, government agencies, and other relevant organizations the opportunity to simulate, drill, and coordinate emergency response and recovery plans in the event of cyber and physical security attacks and other contingencies that may affect North America's electricity system.

Delaware's four lead energy security agencies on energy security participated in this exercise including the SEO, DEMA, the PSC and the Division of the Public Advocate. This exercise provided an opportunity for Delaware to cooperate and interact with surrounding states in responding to an event that extends outside its borders.

The SEO has initiated discussions with Reliability First to discuss regional grid reliability and security in Delaware. The meetings also included Delaware's PSC and Division of the Public Advocate. Reliability First provided the state with an update of its short and long-term assessments of resource adequacy, including generating capacity trends for PJM and Delaware. The meeting included a discussion of impediments to connecting renewable energy to the grid as Delaware moves toward meeting its statutory renewable energy goal in 2035. This cooperation between Reliability First and Delaware represents an ongoing commitment to ensure energy reliability and security in the state.

The SEO submitted a grant application to the United States Department of Energy (DOE) in March 2023 for funding available under Section 40101(d) of the Infrastructure Investment and Jobs Act (IIJA, also known as the Bipartisan Infrastructure Law (BIL). The focus of the grant is to assist states in improving electrical grid resiliency and reducing the likelihood and consequences of disruptive events such as outages from extreme weather, natural disasters, and man-made disasters such as cyber-attacks or terrorism aimed at compromising the power grid.

Prior to submitting the grant application DNREC engaged with stakeholders to identify where the funding could best be deployed. Stakeholders agreed to prioritize funding projects that reduce overall power disruptions, reduce disruption time when incidents do occur, maximize the number of people that will benefit, and prioritize areas most at risk during severe weather and prone to flooding. Utilizing 40101(d) funds will help Delaware improve the state's overall energy security by funding projects that promote electrical grid resiliency and security. The SEO is planning to use other federal grant opportunities to enhance grid planning and investments in projects to strengthen grid resilience.

DNREC's Energy Section, including SEO staff, participate in two monthly meetings hosted by the National Association of State Energy Official's (NASEO). The first meeting is the Energy Security Committee All-Hazards call. These meetings typically include updates from internal sections within DOE (i.e., DOE's Division of Cybersecurity, Energy, Security, and Emergency Response (CESER)), but may also include federal agencies external to DOE such as the Federal Energy Regulatory Commission (FERC). These calls have provided a forum for Delaware to share information and experiences with other states, especially in the same region, and learn from other states and bring back lessons learned.

The second monthly NASEO meetings attended by DCCE's Energy Section staff are the Energy Security Committee calls. These calls are similar to the All-Hazards calls in format, but often are used to provide NASEO members with additional resources, education opportunities, etc. The meetings can be tailored specifically to current issues facing all states. For example, the meetings have been used to provide states instruction and updates on how to write and/or improve their State Energy Security Plans (SESP). The calls have proved invaluable in providing updates, resources, instruction, etc. to improve their plans. For example, the NASEO calls are an important component in the state's SESP in addressing risk assessment and mitigation by learning about what is happening in other states.

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Preface

The State of Delaware, its political subdivisions, and its citizens are highly dependent upon energy resources. A serious energy shortage could bring substantial injury to commercial and industrial activity and to the personal health, safety, and welfare of Delaware's citizens.

The State Energy Office (SEO), through the Delaware Department of Natural Resources and Environmental Control (DNREC)'s Division of Climate, Coastal, & Energy (DCCE) is designated as the coordinating agency for energy emergency planning, response, and mitigation. The SEO is the lead for Emergency Support Function 12 (ESF-12). This plan reflects the state's priorities for a response to an energy shortage. In order to implement this plan, a number of state agencies, entities, and others will work together to successfully mitigate energy shortages through conservation and other means. The goals and objectives outlined in the plan and within the appendices support this effort. Successful implementation of the SESP can be realized only by joint efforts, dedication, and commitment to energy shortage mitigation. The SEO recognizes energy producers and suppliers have emergency response plans of their own, many of which are required or approved by organizations such as the North American Electric Reliability Corporation, the Federal Energy Regulatory Commission, the Delaware Public Service Commission, and the US Coast Guard, which will be used in emergency situations.

DCCE encourages companies, institutions, and communities to continue to develop and exercise plans for energy emergencies. In addition to response measures, this plan looks at the current risks to Delaware's energy sector and proposes proactive mitigation measures that can be taken to increase the sector's resilience.

CHAPTER 1. DELAWARE ENERGY EMERGENCY RESPONSE PLAN

1.1 Introduction

The Delaware State Energy Security Plan (SESP) for the State of Delaware (referred to hereafter as "the plan") may be enacted by the state if an energy emergency occurs. An **"energy emergency"** is an actual or impending shortage or curtailment of usable, necessary energy resources, such that the maintenance of necessary services; the protection of public health, safety, and welfare; or the maintenance of a basically sound economy is imperiled in any geographical section of the state. Energy emergencies can result from a range of causes such as long-lasting temperature extremes, natural or human disasters, or political factors that disrupt energy production or distribution. Having a proper plan in place can help to mitigate the impacts of an energy emergency on vital resources such as food and water.

The Department of Natural Resources and Environmental Control (DNREC), Division of Climate, Coastal & Energy (DCCE) is responsible for implementation of the SESP. DCCE, in coordination with the Delaware Public Service Commission (PSC), and the Delaware Emergency Management Agency (DEMA) within the Delaware Department of Safety and Homeland Security (DSHS), will direct the energy emergency contingency operations in the state, at the direct order from the governor. This group (DNREC, PSC, DEMA) work together as the Energy Response Team.

The plan corresponds to the federal government's energy emergency policy. In support of this policy, the Energy Emergency Preparedness Program of the U.S. Department of Energy (USDOE) is directed toward reducing our vulnerability to energy supply disruptions and enhancing our ability to respond should a disruption occur.

1.2 Authority for the Plan

Federal authority for preparing the Delaware Energy Emergency Response Plan is based on the **U. S. Public Law 94-163, Section 362, of 1975**. This Law provides for the development of standby state energy conservation plans to reduce energy demand by regulating the public and private consumption of energy during a severe energy supply interruption.

The state's authority for preparing the plan is sections Title 20, Delaware Code, Chapter 31, 3101, 3102, 3107, and 3115.

The United States Infrastructure Investment and Jobs Act (IIJA) Section 40108, which amends Part D of Title III of the Energy Policy and Conservation Act (EPCA, 42 USC 6321) requires states to have a USDOE approved SESP to continue to receive certain financial assistance from USDOE in accordance with EPCA Section 366(c).

1.3 Purpose of the Plan

The purpose of the plan is to provide procedures to notify state government, private sector entities, institutions, the media and residents in a timely and coordinated way that an energy emergency is occurring. It is also intended to define appropriate actions to be taken during the emergency, including enactment of regulations, rules, laws and other actions by the state. The SESP was reviewed by and follows the State Energy Planning Guidelines from the National Association of State Energy Officials (NASEO).

1.4 Principles of The Plan

In cooperation with the other public institutions and the private sector, the state's primary goals in managing an energy emergency shall be:

- Ensure essential public services are provided during an energy shortage.
- Work with industries to reduce inequities in fuel distribution, including petroleum-derived fuels, such as diesel and gasoline.
- Assist in alleviating economic hardships caused by an energy shortage.
- Solicit and obtain business and public support and participation in the implementation of the

plan.

- Ensure timely gathering and dissemination of accurate information during an energy shortage to guide state actions in responding to an emergency.

1.5 Characteristics of Energy Emergencies

In general, an energy emergency exists whenever supplies of fuels or electricity are inadequate to meet demand. However, it is useful to delineate the following situations of an energy problem. These are:

1. Physical destruction of energy systems and/or components by natural factors such as hurricanes, earthquakes, or floods.
2. Industrial accidents
3. Sabotage of energy supplies and/or distribution facilities.
4. A sudden or unexpected surge in demand that cannot be met by actual or expected supply levels.

Potential causes of an energy emergency include severe, long-lasting temperature extremes or major fuel supply disruptions. Other events that contribute to an energy emergency are natural or human disasters that disrupt energy production or distribution such as fires, tornadoes, floods, storms, or breakdowns. Energy emergencies may result in a sharp, sudden escalation in the price of energy products, resulting from a curtailment of supply. Situations at the local level that may affect energy emergencies are:

- A national security emergency, a mobilization of defense resources, or a natural disaster creating a sudden surge in demand.
- A widespread public perception of an imminent energy event related to any of the above listed, causing a surge in the purchase of products.
- Delaware's economy is affected by an international or national energy emergency.
- Residents are unable to receive energy products due to reduced supply from the wholesale suppliers to retailers.
- Political, social and economic factors — Most potential causes of an energy emergency can be classified within the above categories or situations. However, unforeseen events may contribute to an energy emergency in more than one of the above ways mentioned. For example, an oil embargo may reduce supplies of several fuels or byproducts and as a result increase the demand locally for alternate fuels or substitutes.

1.6Achieving and Maintaining Operational Readiness

The success and effectiveness of this plan relies on three factors to achieve and maintain operational readiness. First, the Energy Response Team, including DNREC, DEMA, and the PSC, must continuously monitor world events that have the potential to affect the global energy system. Second, strategies developed by the Energy Response Team must be familiar to the agency staff involved in implementation and adaptable to changing conditions. Third, personnel, including but not limited to the Energy Response Team, must be trained and prepared to implement the plan. The Energy Response Team, particularly the DCCE, PSC, and DEMA, including its State Emergency Operations Center (SEOC), are responsible for carrying out the following steps to achieve and maintain operational readiness of the SESP:

- Monitor international and domestic events for probable impact on Delaware energy prices and supplies.
- Ensure appropriate review and revisions to the Energy Chapter of the Delaware Emergency Operations Plan.
- Review and update the plan periodically to ensure that the response strategies reflect the changing trends and conditions in the world energy industry.

- Convene regular meetings and conduct training of DNREC, PSC, and DEMA staff, as well as representatives from other state government agencies, local governments, the press, and energy suppliers, to identify the roles and responsibilities of each in responding to an energy emergency or extreme shortage.
- Update and maintain lines of communication with federal government, state, and industry contacts.
- Prepare detailed guidelines and appropriate forms necessary for implementation of the plan's energy emergency response programs.

Since the plan was last updated, Delaware and other states in PJM's territory participated in a call for conservation drill/exercise sponsored by PJM on June 1, 2023. The drill mapped out a test processes for a "call for conservation" in an effort to prevent another Winter Storm Elliot (December 2022) type of electrical power emergency. The exercise included all states and jurisdictions within PJM's service territory.

For the purpose of the drill PJM requested individual states provide a list of all state agencies and key personnel that should receive a notification (alert) of upcoming weather events that may adversely impact the power grid. In addition to being a general alert, the notification might also contain important information states could disseminate through its chain of command and general public if necessary.

Delaware identified four (4) state agencies that should be included in PJM's notifications, as well as the key individuals to be notified within those agencies. Those agencies included: DEMA, DNREC, PSC, and the Division of the Public Advocate. Those individual agencies would further disseminate the information through their chain of command, and act as appropriate depending on the information. Further distribution of the information to the public and other relevant state and local agencies would be done by staff at respective Public Information Offices (PIO).

The exercise was successful and created communication avenue for future actual alerts and notifications. Since the exercise PJM has sent out several alerts surrounding hot weather, and those have been shared and distributed as intended.

On November 14 and 15, 2023, the North American Electric Reliability Corporation (NERC) and Electricity Information Sharing and Analysis Center (E-ISAC) held GridEx VII. GridEx exercises are a biennial, national grid security exercise that allows the electric industry, government agencies, and other relevant organizations the opportunity to simulate, drill, and coordinate emergency response and recovery plans in the event of cyber and physical security attacks and other contingencies that may affect North America's electricity system.

As in years past, PJM took the lead on helping member organizations develop scenarios and served as the simulation coordinator for the PJM region. For this year's exercise PJM invited state agencies to participate.

Several of Delaware's state agencies participated as observers in anticipation of being full participants in future events. These agencies included: DNREC's State Energy Office, DEMA, the Delaware Division of the Public Advocate, and PSC. The aforementioned Delaware agencies routinely cooperate with each other and PJM during events resulting in electrical power disruption. However, this exercise provided an opportunity to cooperate and interact with surrounding states in responding to an event that extends outside the Delaware's borders.

1.7 Delaware Emergency Operations Plan

The Delaware Emergency Operations Plan (DEOP) is a plan of emergency operations maintained by the Delaware Emergency Management Agency (DEMA) and utilized in the Delaware Emergency Operations Center (EOC) when a current or potential state emergency event is declared. The DEOP is currently being updated by DEMA, DNREC, and other state entities as appropriate.

The purpose of the DEOP Energy Group is to coordinate response to and recovery from shortages and

disruptions in the supply and delivery of electricity, natural gas, and other forms of energy and fuels that impact or threaten significant numbers of citizens and visitors. Shortages and disruptions in the supply of electricity may be caused by such events as unusually cold or hot weather, storms, disruptions to power generation fuel supplies, and electric transmission/distribution disruptions. Other energy and fuel shortages affecting the private sector may be caused by such events as severe weather, flooding, and labor strikes.

The DEOP Energy Group works closely with the electric and natural gas utilities operating in the state to ensure that the integrity of the power supply systems is maintained during emergency situations and that any damages that may be incurred are repaired and services restored in an efficient and expedient manner. The Group also coordinates with private sector providers of energy and transportation fuels such as propane, fuel oil, diesel fuel, and gasoline. The PSC will have primary responsibility to monitor and coordinate with the private sector suppliers of such fuels to ensure that adequate supplies of other energy.

Since the DEOP was last updated, the DNREC Energy Office met with Reliability First, PSC Staff and the Public Advocate in 2023 to discuss the reliability of the regional grid. Reliability First is the regional NERC (North American Electric Reliability Corporation) affiliate that monitors electric grid reliability. Reliability First provided an update on its short- and long-term assessments of resource adequacy, including generating capacity trends for PJM and Delaware. The meeting included a discussion of impediments to connecting renewable energy to the grid. This was the second meeting between Reliability First and the state agencies and represents an ongoing commitment on the part of Reliability First to establish and maintain close communications with the states it serves.

1.8 Energy Emergency Response Phases

A formal process for evaluating the severity of an energy shortage is essential, serving as a basis for determining the extent and duration of the problem to the state. To respond best to this process, the Emergency Support Function (ESF-12) is structured into four phases of activity: Phase I - Monitor and Alert, Phase II - Assess and Determine Action, Phase III - Actions and Feedback, and Phase IV Review Lessons Learned (see Figure 2.3 below). During an energy shortage, the activities prescribed in each phase intensify depending on the severity of the shortage. These phases a more fully described below and are summarized in tables found in section 1.9 of this chapter.

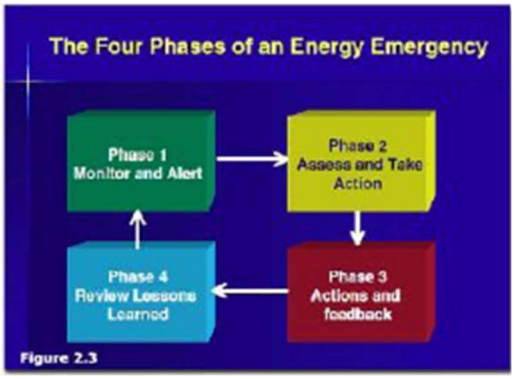

Figure 2.3

1.8.1 Phase I Monitor and Alert - Response Activity

Upon entering this phase, DNREC, PSC and DEMA begin frequent communications with the U.S. Department of Energy (DOE), Delaware Petroleum Association (DPA), private industry, regulated and unregulated utilities and appropriate state and local government agencies.

DNREC also initiates the necessary activities for comprehensive and continuous energy supply and demand monitoring. This assessment serves as the basis of a formal Verification Report for submission to DEMA to manage an actual, verified energy emergency. Several statistical indicators are used for petroleum products, electricity, and propane supply-demand factors to determine the extent of the potential or existing energy emergency.

Phase I involves the normal ongoing energy supply, demand and price monitoring. State agencies regularly monitor data and information as it becomes available through energy supply reporting systems (see Appendix H on Supply Monitoring) and information concerning supply and distribution problems.

1.8.2 Phase II Assess and Take Action – Response Activity

In Phase II, responding agencies have noticed early signs of what might become an energy emergency. The agencies intensify data and information collection efforts and ensure that the most recent information is available. This information is analyzed to evaluate potential outcomes and assess possible courses of action. Contacts throughout state government should be informed of the results of this assessment.

Appropriate action can then be determined. If no action is required, monitoring and evaluation continues, and further updates are made as changes occur.

The DEMA Director may recommend to the Governor that conservation messages and requests for the public to reduce consumption be issued. DEMA may activate a public information program if the shortages persist more than one week.

DNREC, in coordination with the PSC and industry, will advise DEMA on the status of affected fuels, effectiveness of demand reduction measures and supply management issues.

If voluntary measures have been requested from the public, DEMA and DCCE staff should assess their effectiveness to see if the fuel shortage is being mitigated. If the measures are working, and the shortage is not increasing, there is no need for additional measures. If, however, monitoring indicates further emergency response measures may be necessary, the DEMA Director may recommend that the Governor declare an Emergency thus activating the Phase III.

1.8.3 Phase III Actions and Feedback

Phase III is activated when energy shortages persist and voluntary industry and public conservation plus tariff-required utility and local distribution company mitigation measures have not balanced or sufficiently reduced the demand for fuel.

DEMA may also determine that the health, safety or welfare of the public is at risk because the energy supply cannot adequately be managed by the open market. In this case, the EOC will decide whether to recommend the declaration of an energy emergency in order to initiate mandatory demand restraint and crisis mitigation measures.

Also, if DEMA determines the health, safety, or welfare of the people is at risk and if the energy shortage cannot adequately be handled by the open market, the DEMA Director may recommend to the Governor the need to declare an energy emergency, as well as activating any mutual aid agreements or Emergency Management Assistance Compacts (EMACs) as needed.

Phase III continues all activities initiated during the Phase II, and adds additional voluntary or mandatory programs which may be needed to respond to a worsening energy shortage. The Governor may declare an emergency to impose mandatory programs.

1.8.4 Phase IV – Review Lessons Learned

As emergency operations are phased out, responding state agencies should evaluate the emergency preparedness programs and activities that were implemented and report the results to the Energy Response Team and other interested parties such as the Governor's Office, cabinet level officers, legislative committees and energy policy councils. Evaluation activities should include:

- Reports describing the nature of the energy emergency and a chronology of the actions taken to respond to it;
- Evaluation of mitigation action results and of the effectiveness of specific actions taken to respond to the emergency; and
- Critical reviews of the overall performance of the state's energy emergency plans in addressing an emergency, with recommendations drawn from after action reports for improvements to the plan.

1.9 Energy Emergency/Shortage Quick Guide

Table 1. Groups Responsible for Emergency Preparation and Response Activities

Activity lead color key:	Lead Response Effort	Lead Information and Outreach Effort	Implement and rescind emergency response activities

Group Name	Members	Role
Delaware Energy Response Team	DNREC in coordination with DE PSC and DEMA	Coordinate all activities in the event of an energy emergency.
Emergency Support Function-12 Advisory Group (ESF Group)	Gas producers, electric utilities, municipal utilities, industry, DNREC, DEMA, and other energy resource advocates	Provide direct coordination with all other departmental response elements.
DEMA Joint Information Center	DEMA Public Information Staff	Maintain a steady flow of information to the public.
DEMA Public Information Officer	N/A	Deliver copies of Situation Reports to State Legislators; prepares briefing packages for the Governor and the State Legislature and answer inquiries from state and local officials.
Governor	N/A	Implement restrictions and regulations, declare emergencies. Rescind in response to conditions and recommendation of the energy response team and ESF Group.
Applicable energy representatives, suppliers, and distributers are also expected to be involved in the assessment and response to energy emergencies.		

Table 2. Ongoing Emergency Preparedness Activities during Normal Energy Supply (All Fuels)

Lead=Delaware Energy Response Team and/or Emergency Support Function Advisory Group
Monitor energy supply and demand forecast.
Monitor international and domestic events.
Train appropriate DNREC staff on roles and responsibilities during an energy emergency.
Attend periodic exercises to establish and test emergency protocols.
Update and maintain a network of public and private sector contacts. Prepare internal memos.
Maintain lists of biggest energy users that may be asked to reduce operations in case of an energy emergency.

Colors Indicate Lead Group Responsible for Activity According the Key in Table 1.

Table 3. Response Activities Applicable to Phase I – III (All Fuels)

Lead=Delaware Energy Response Team and/or Emergency Support Function Advisory Group
Reach out to network of public and private sector contacts, such as representatives, suppliers, and distributors to assess causes, probable duration, and geographic extent of shortage.
Identify possible steps to take to alleviate or avert shortage.
If shortage is forecast to worsen, recommend to governor to prepare for escalation to a more advanced phase, notify all applicable in-state and out of state agencies and companies of the escalation.
Notify all applicable agencies, associations, and companies of plans for escalation or de-escalation.

Review public information announcements before they are released by the DEMA Joint Information Center.
If a shortage is forecast to diminish and energy markets return to normal, recommend to the Governor a de-escalation of emergency response.
Lead=DEMA Joint Information Center
Provide information to newspapers and radio and television stations for consumers on how to conserve energy.
Edit and revise public information announcements to describe the specific, current situation.
Communicate effectively with public with the intention of encouraging conservation and discouraging panic. Inform the public about the gravity of the situation and give specific instructions on the conservation measures the public and state government is requested to implement.
Coordinate with Energy Response Team and ESF-12 Group.
Inform media and public when supply conditions return to normal and restrictive rules are rescinded.
Inform the media and public when supply conditions worsen and restrictive rules are implemented.
Guide and inform the transition from voluntary measures to mandatory measures as the energy shortage escalates. As the shortage lessens guide the transition to voluntary measures, and to normal conduct of business based on status and forecast of shortage.
If shortage is forecast to last longer than one week, develop media release procedures. Establish a central media center and press briefings at scheduled times to facilitate news flow to the media.
The DNREC and the DEMA director may recommend that an energy emergency be declared for one or more fuel sources based on an existing or anticipated shortage. At this time the Director of DEMA may open the Delaware Emergency Operations Center (State EOC).
Lead=Governor
Request aid of USDOE and congressional delegations to secure additional supplies.
Escalate to Advanced Emergency Phase based on conditions and Energy Response Team Input.
De-escalate to Reduced Emergency Phase based on forecast conditions and Energy Response Team Input.

Colors Indicate Lead Group Responsible for Activity According the Key in Table 1.

Table 4. Fuel-Specific Response Resources Applicable to Phase I – III

This table is intended to provide details about specific resources and activities based on fuel type. Refer to table 2-3 and 5-8 for related implementation activities and groups responsible.

		Response Resources			
		Monitoring Sources	**Major Consumers**	**Conservation Measures**	**Additional Actions**
Fuel Type	**Motor Fuel**	EIA Monthly Fuel Outlook	Trucking and Construction Companies	Reduce speed limit from 65 to 55 and increase enforcement; reduction of non-essential automobile use; increased ridesharing and public transit; flexible work patterns	Request suspension of USDOT Drivers Hours of Service Restrictions; Request deferral of USDOT Vehicle Inspection Requirements
	Electricity	PJM, EIA	Manufacturing and Commerce	Modify working hours and building temperatures; reduce operating conditions	To be determined by Energy Response Team
	Propane	Network of contacts; surveys of seasonal supplies	Space heating; Industrial Processes	Reduce temperature of buildings heated by propane	Open temporary shelters for individuals or families that have run out of fuel.
	Heating Fuel/ Kerosene	Network of contacts; surveys of seasonal supplies	Residential space heating	Reduce temperature of buildings heated by propane	Open temporary shelters for individuals or families that have run out of fuel.
	Coal	EIA Energy Outlook	Electric Utilities	See electricity conservation	To be determined by Energy Response Team
	Aviation Fuel	EIA Petroleum and Other Liquids, Aviation contacts	Airplanes	Reduce flights, recommend alternative travel methods (car, bus, train)	To be determined by Energy Response Team
	Natural Gas	EIA Short-term energy outlook	Manufacturing, food services	Reduce operating conditions and temperatures of systems powered by natural gas	To be determined by Energy Response Team

Phase I

Phase I is activated when supply problems are reported by reliable sources.

Table 5. Response Activities Applicable to Phase I:

Lead=Delaware Energy Response Team and/or Emergency Support Function Advisory Group
Increase monitoring of forecast supply and demand and conduct surveys where applicable to monitor energy supplies and prices. Monitor media for local, national, and international events that might impact energy supplies and prices in Delaware.
Prepare public appeals for voluntary conservation. Appeals will be drafted by the energy response team and issued by the Governor.
Prepare for and implement state government conservation programs (implementation may be delayed to Phase II based on situation).
Direct DEMA's Joint Information Center to implement public information programs and issue public directives for mandatory and or voluntary conservation (this may occur in Phase I or Phase II depending on situation).
Lead=DEMA Joint Information Center
If shortage is forecast to escalate or last longer than one week, implement a public information program to issue public appeals for voluntary conservation.
Establish central media center and press briefings at scheduled times to facilitate news flow to the media.
Lead=Governor
Request reduced operations in major users.

Colors Indicate Lead Group Responsible for Activity according to the Key in Table 1.

Phase II:

Phase II is activated when supply problems increase and when monitoring indicates an impending energy shortage.

Table 6. Response Activities Applicable to Phase II:

Lead=Delaware Energy Response Team and/or Emergency Support Function Advisory Group
Communicate with network of contacts in private and public sectors to monitor local conditions in the electricity supply and distribution market.
Develop materials on voluntary conservation measures for the State and the public and coordinate with DEMA for their dissemination.
Coordinate with other states to facilitate access to energy supply.
Direct distributors to decline to accept new customers to discourage hoarding (not applicable for electricity shortage).
Implement state government conservation programs.
Prepare to implement mandatory bans and restrictions for major consumers.
Prepare to implement mandatory emergency conservation programs for government and public, especially major users.
Lead=DEMA Joint Information Center
Monitor supply and demand forecasts.
Advise the public to participate in voluntary conservation efforts.
Increase communication and flow of information to public.

Lead=Governor
Request major consumers to reduce operations

Colors Indicate Lead Group Responsible for Activity according to the Key in Table 1.

Phase III:

Phase III occurs when it is determined that specific state government action is necessary to assure health, welfare, and safety of citizens, and the continued economic well-being of the state.

Table 7. Response Activities Applicable to Phase III:

Lead=Delaware Energy Response Team and/or Emergency Support Function Advisory Group
Intensify level of monitoring of shortage.
Increase check ins with applicable contacts, including suppliers, distributors, and users.
Increase energy response team hours of operation and shift schedules to address current situation.
Prepare necessary mandatory rules and regulations to cope with the emergency shortage and recommend for implementation by the Governor.
Issue public directives for mandatory conservation, collaborate with DEMA JIC to inform public.
Inform all in-state and out of state agencies and companies when Emergency Phase III is terminated and the state has returned to normal and release of the mandatory conservation measures.
Ensure the media is apprised of the situation and given specific conservation measures for the public to implement.
Lead=DEMA Joint Information Center
Increase communication and flow of information to public.
Issue public appeals for mandatory conservation and to inform the public of resources and aid available to them.
Public information announcements must be extremely conscious of not being alarming in tone. They should be informative, but not cause panic.
Lead=Governor
Implement necessary mandatory rules and regulations to cope with the emergency shortage.
Convene emergency planning and response organizations to consider actions that might be taken by the various state departments and agencies, as well as activating any mutual aid agreements or Emergency Management Assistance Compacts (EMACs) if needed.
If the situation continues to deteriorate, declare a State of Energy Emergency or a State of Disaster.
If it appears that all other options available to the state prove inadequate, the next level of mobilization is to request federal assistance.

Colors Indicate Lead Group Responsible for Activity according to the Key in Table 1.

Phase IV:

Phase IV occurs as emergency operations are phased out and normal supply conditions are restored.

Table 8. Response Activities Applicable to Phase IV:

Lead=Delaware Energy Response Team and/or Emergency Support Function Advisory Group
Create reports describing the nature of the energy emergency and a chronology of the actions taken to respond to it.
Evaluate mitigation actions results and the effectiveness of specific actions taken to respond to the emergency.
Critically review the overall performance of the state's energy emergency plans in addressing an emergency.

Colors Indicate Lead Group Responsible for Activity according to the Key in Table 1.

CHAPTER 2. ROLES AND RESPONSIBILITIES

2.1 Organization

The responsibilities for responses to energy emergencies in the State of Delaware are delegated to the Department of Public Safety (DPS), the Delaware Natural Resources and Environmental Control (DNREC), Delaware Public Service Commission (PSC), and the Delaware Emergency Management Agency (DEMA). In the event of an energy emergency, DNREC, PSC, and DEMA will direct all response activities and may be assisted by other appropriate government agencies when required by DNREC, PSC, and DEMA.

The plan will be activated by DNREC, PSC, and DEMA if conditions warrant declaring an energy emergency. DNREC, PSC, and DEMA will direct all necessary energy emergency response actions, described below.

Other state agencies presented below will undertake the energy emergency response functions under the direction of DNREC, PSC, DEMA, and/or the Office of the Governor.

2.1.1 Responsibilities of State Agencies

The responsibilities for state government entities in the event of energy emergency are presented below.

2.1.2 Office of the Governor (OG)

Ultimate authority for all emergency response activities in the State of Delaware is vested in the Governor. The governor, acting in accordance with the appropriate laws of the State, declares all emergencies and authorizes all response activities. The Office of the Governor may issue voluntary energy conservation appeals and mandatory energy conservation directive regulations under energy emergency declarations. The Office of the Governor authorizes all energy emergency response activities undertaken by DNREC and DEMA and maintains close and continuous communications with appropriate federal, state, and local government agencies during energy emergencies. The governor will direct emergency operations through the regularly constituted government structure (DEMA).

When a critical level of an energy resource is reached, the governor may, on the recommendations of DNREC, DEMA, or at the request of a local governing body, declare a state of emergency to exist as a result of a resource shortage. By executive order, the governor may announce to the public the emergency actions to be imposed to conserve or limit the use of available energy supplies. To the extent feasible, the governor will provide advance copies and interpretation of such executive orders to concerned state agencies and local governments before they are released to the press and the general public. State emergency communications systems may be used for this purpose. Upon the declaration of a State of Energy Emergency, the DEMA Director and the State Energy Office will coordinate state assistance to local governments from the emergency operations center.

2.1.3 Office of Management and Budget (OMB)

Fleet Services

The Office of Fleet Services at OBM coordinates the rideshare and vanpool programs for the State.

2.1.4 Department of Natural Resources and Environmental Control (DNREC)

DNREC coordinates with the Environmental Protection Agency (EPA) to modify air pollution restrictions if low sulfur content fuel is not available within the State.

Division of Climate, Coastal & Energy

DNREC and DEMA are the lead agencies to direct, undertake, and coordinate the State's energy emergency response activities as presented in the plan. DNREC and DEMA maintain a high level of preparedness to direct energy emergency response activities. DNREC and DEMA staff are responsible for carrying out the following steps to achieve and maintain operational readiness of the plan:

- Prepare and implement plans to assure adequate supply of energy products for the State of Delaware.

- Maintain and update the Energy chapter of the Delaware Emergency Operations Plan (DEOP), with the remainder primarily maintained by DEMA.
- Maintain current databases for energy product suppliers.
- Monitor international and domestic events for probable impact on the State's energy supplies and prices.
- Regularly review and update the plan to ensure that the energy emergency response strategies reflect the changing trends and conditions in the world energy industry.
- Conduct regular training of DNREC and DEMA staff, as well as representatives from other government agencies, local governments, energy suppliers, appropriate institutions, and private sector entities, to identify the roles and responsibilities of each in responding to an energy emergency.
- Conduct periodic tests of the plan, under simulated emergency conditions, to reinforce the training process of DNREC staff as well as offer other government agencies, local governments, and energy suppliers an opportunity to test their own plans.
- Maintain communications with other state entities, agencies, and industries involved in energy emergency mitigation.
- Continue to improve federal government and regional coordination and information exchange.
- Prepare detailed guidelines and appropriate forms necessary for implementation of the plan response programs including the Fuels Set-Aside Program.
- Maintain protocol with the Governor's Office regarding when and where DNREC staff should participate in public affairs efforts.

During an energy emergency, DNREC in coordination with DEMA will:

- Direct state agencies in energy emergency response activities.
- Monitor the status of relevant energy supply indicators.
- Undertake appropriate analyses of the energy emergency status.
- Serve as a primary contact for all energy emergency public affairs activities.
- Conduct post-emergency analysis and make recommendations to change the plan's functions, responsibilities, etc.
- If an energy emergency is proclaimed, the contingency manager implements the emergency response programs which the governor, upon recommendation by DNREC, directs.
- Using the data and analysis provided by staff and the Energy Group, the SEO will present recommendations to the governor on how best to respond to the energy problem.

Contingency Planning Manager

The contingency planning manager, who reports to DNREC, is responsible for supply monitoring, data collection, program implementation, and log maintenance of all activities. The manager initiates multi-level communications with government and private industry.

Data Coordinator

The data coordinator, under the direction of the contingency manager, is responsible for the collection, analysis, and internal distribution of relevant data.

Emergency Support Function 12 (ESF-12)

Per the Delaware Emergency Operations Plan, the Energy Group is led by the Department of Natural Resources and Environmental Control, Division of Climate, Coastal & Energy (State Energy Office). The Delaware Public Service Commission, Delaware Emergency Management Agency, Department of Labor,

Department of Agriculture, and Department of Health and Social Services, Division of Public Health are listed as support agencies. Delmarva Power, Delaware Electric Cooperative, and Salem-Hope Creek Nuclear Generating Station (PSEG Nuclear) are the representatives from the private sector in the Energy Group. Federal partners include the US Department of Energy, US Army Corps of Engineers, US Department of Homeland Security, Information Analysis and Infrastructure Protection, and the US Environmental Protection Agency. The State primarily serves in a monitoring and oversight role. The Energy group may facility the provision of temporary energy supplies to critical and essential facilities such as hospitals, emergency operations centers, public safety facilities, and water and wastewater treatment plants until normal service can be restored.

2.1.5 Delaware Public Service Commission (PSC)

The Public Service Commission is authorized by the Delaware General Assembly under Title 26, Delaware Code, to regulate investor-owned utilities and companies providing electric, natural gas, water, telecommunications and cable services for public use within the unincorporated areas of the State of Delaware. The PSC receives and maintains the curtailment plans of appropriate natural gas, electricity, heating oil, and propane products. During an energy shortage, the PSC also monitors the impacts on the State's economy. The PSC, DEMA and DNREC and the ESF-12 Group members will determine the effects of rising prices on various population sectors, particularly on low-income households. A PSC member serves as an advisor to the ESF-12 Group.

The PSC has been conducting annual reviews and questionnaires of regulated utilities across cybersecurity categories since 2016. The PSC has determined through the utility interviews and public workshops, that the utilities are taking the actions they need to continue ensuring safe, adequate, and reliable utility service to its customers. For additional information on the interview categories, questions, utility responses, please visit the website.[1]

2.1.6 Delaware Emergency Management Agency (DEMA)

DEMA is the operational entity within Delaware's Department of Safety and Homeland Security (DSHS) that coordinates the emergency activities of all state agencies and departments during time of war, a state of emergency, or a local emergency. DEMA manages the State's emergency communications system. This system connects the three Delaware counties to the DEMA emergency operations center in Smyrna. If an energy emergency reaches a level of severity requiring communication capabilities beyond DNREC's capacity, DNREC will communicate through DEMA to monitor energy supply and distribution problems at the local level, and to ensure a coordinated, consistent emergency response by the State. Specific activities include:

- Plan and conduct periodic training seminars to assure proper updating of the Delaware Emergency Operations Plan (DEOP).
- When the governor declares a State of Emergency due to an energy crisis, assist DNREC and the ESF-12 Group in coordinating energy-related activities of state departments, divisions, and agencies responsive to the plan.
- Assist DNREC in coordinating the implementation of state and federal energy emergency response programs for the State.
- In the event of a State of Energy Emergency, the director of DEMA requests that a representative from DNREC, ESF-12 Group, appropriate state agencies, state departments, and quasi-public relief organizations report to the State Emergency Operations Center (SEOC) to assure centralized coordination of response according to guidelines established by the State's emergency response plan.

[1] https://depsc.delaware.gov/cybersecurity/

- When an energy emergency exists or is imminent, state agencies support DNREC and DEMA and assist the ESF-12 Group as requested to the extent of their capabilities.
- Under normal operating conditions, members of the ESF-12 Group will monitor their energy products and be prepared to respond to anticipated or minor shortages in accordance with established priorities and this plan. When conditions deteriorate and shortages become more severe, the governor may declare a State of Energy Emergency to implement more stringent management control measures.
- If the magnitude of the energy shortage warrants, the governor may seek assistance from federal agencies based on their own statutory authority.

2.1.7 Department of Health and Social Services (DHSS)

DHSS is responsible for consolidating and providing information to local governments on emergency assistance to individuals and families through ongoing state and federal programs. Divisions and staff within DHSS are responsible for activities as listed below:

Division of State Service Centers

- Prepare and maintain current, information pertaining to dealing public assistance requirements, with the assistance of the Division of Aging, other state agencies, and quasi-public and private relief organizations.
- Assist local governments in cooperation with the Community Services Office and local Social Services in providing assistance for individuals and families who are financially unable to pay for fuel to meet human needs.
- Provide, where possible, overall coordination of the activities of quasi-public and private relief organizations at the local level through the State Service Center Offices.

Division of Aging & Disabilities

- Render assistance to senior citizens during periods of energy shortages, as local resources permit. Coordinate with and assist local governments during energy emergencies.

Division of Public Health (DPH)

- Recommend priorities for fuel distribution to health care facilities to include fuel for emergency vehicles. Provide assistance and advice on proper levels of heat to ensure health and safety.

Division of Social Services

- Provide cash assistance and food stamp program benefits to individuals and families who become eligible resulting from income reduction due to energy emergency conditions.
- Provide information to applicants about other resources which communities have made available to meet the emergency needs.
- Coordinate with other service providers as appropriate.

Economic Assistance Coordinator

The governor will designate an economic assistance coordinator to serve on the multi- agency task force described in section 7.1.7. The coordinator must keep abreast of all current state and federal legislation and executive orders that may affect Delaware's Economic Assistance Programs (additional duties and responsibilities of the coordinator can be found in Chapter 7. Energy Related Economic Assistance Programs and Policies).

2.1.8 Department of Transportation (DELDOT)

The Delaware Department of Transportation coordinates rideshare, vanpool, and other mass transportation programs throughout the State which can be relied upon during an emergency to reduce transportation fuel demand. DNREC will rely upon DELDOT's extensive experience in operating the State's

highway system when developing an emergency response strategy for the transportation sector. Specific activities include:

- Implement, as required, pertinent portions of the Federal Emergency Highway Traffic Regulation Plan (USDOT).
- Lift operators' hours for fuel delivery.
- Issue overweight permits for fuel-hauling vehicles during the period of the energy emergency.

2.1.9 Department of Labor (DL)

The Delaware Department of Labor recommend priorities for fuel distribution to business and industries through the Fuel Management Advisory Board.

2.1.10 Division of Unemployment Insurance

The Delaware Division of Unemployment Insurance provides information and services related to unemployment insurance. During an energy emergency, specific activities include:

- Assist in the job placement and emergency unemployment assistance administered through the division by the U.S. Department of Labor.
- Arrange for payment of unemployment compensation made to individuals who are unemployed as a result of resource shortage.

2.1.11 Department of Agriculture (DA)

The Delaware Department of Agriculture works to sustain and promote the viability of food, fiber, and agricultural industries in Delaware through quality services that protect and enhance the environment, health, and welfare of the general public. During an energy emergency, specific activities include:

- Recommend priorities for fuel distribution to farms, dairies, and agricultural related businesses through ESF-12 Group.
- Provide information to the ESF-12 Group concerning gasoline stations operating in Delaware through its Weights and Measures Division.

2.1.12 Tribal Government in Delaware

The Tribal governments' roles and responsibilities typically mirror those of state and local governments as detailed above. Tribal governments are accountable for the public health, welfare, and safety of tribal members, as well as the protection of critical infrastructure and key resources under their jurisdiction. Tribal governments ensure close coordination with federal, state, local, and international counterparts to achieve synergy in the implementation of the critical infrastructure support and preparedness. This is particularly important in the context of information sharing, risk analysis and management, awareness, preparedness, planning, protective program investments and initiatives, and resource allocation.

2.1.13 Delaware Department of Technology and Information (DTI)

The Delaware Department of Technology and Information (DTI) is responsible for Cybersecurity for all three branches of government and the entire K-12 public and charter school network. This department is to provide direct education and assistance to nearly all governmental and educational organizations. The DTI also includes implementing the Delaware Cybersecurity Advisory Council (DCSAC) as mandated in Title 29, Chapter 90C[2] of the state code.

2.1.14 Delaware Information Analysis Center (DIAC)

The Delaware Information and Analysis Center (DIAC) serves as Delaware's designated fusion center. The DIAC takes an "all crimes, all hazards" approach to public safety and includes other disciplines or

[2] https://delcode.delaware.gov/title29/c090c/sc03/index.html

stakeholders in the information sharing environment within Delaware. The concept of a fusion center is the intake of information from multiple sources, determine their validity and relevancy, then analyze, collate, and organize this information into useful and many times of relevant analytical products for dissemination to Delaware stakeholders, that have a right and need to know this information, for public safety.

The DIAC offers comprehensive vulnerability assessments specifically tailored to safeguarding critical infrastructure from potential threats. The DIAC is also a vital conduit to advanced cyber support. Through its partners, the DIAC is able to identify malicious activity and provide details of that behavior in a timely and actionable manner. The DIAC also provides essential training to Delaware stakeholders.

CHAPTER 3. DELAWARE PROFILE

Despite being one of the smallest states in the United States, Delaware boasts a rich historical and economic significance. Delaware's diverse landscape ranges from beaches along the Atlantic coast to more urban areas inland. Delaware's size, location, geography, demographics, assets, and facilities provide key attributes and significance to consider in the development and execution of the State Energy Security Plan.

3.1 Geographic Overview

Delaware is located in the Mid-Atlantic region of the United States, bordered by Maryland, Pennsylvania, and New Jersey. Its eastern border is defined by the Delaware River, Delaware Bay and Atlantic Ocean. Its location on the Atlantic Coast makes Delaware susceptible to hurricanes and other storms. The state contains three counties, New Castle in the north, Kent in the center and Sussex to the south. Wilmington, which is located in the northern part of the state, is the largest city and contains the majority of the state's urban and industrial center. Central Delaware, which includes the City of Dover the state capitol, is largely known for its fertile soil and productive farms with topography characterized by flat terrain, marshes and agricultural land. Southern Delaware, including Sussex County, known for its beaches and related tourism, has topography characterized by coastal plains and sandy beaches along the Delaware Bay and Atlantic Ocean as well as productive farms inland.

3.2 Demographics

Delaware, home to a diverse population, reflects urban, suburban, and rural lifestyles. According to the 2020 Census, Delaware has a population of approximately 990,387 people.[3] This population density is relatively high, particularly in the northern part of the state around Wilmington and Newark. Delaware's population is racially and ethnically diverse. The largest racial groups include non-Hispanic, Black or African American, Hispanic or Latino, and Asian. Wilmington, Delaware's largest city and economic hub, is known for its financial services industry and cultural diversity. Dover, the state capital and second-largest city, includes a mix of government, education, and healthcare sectors. Newark and surrounding suburbs contain the University of Delaware and a growing population attracted by educational and employment opportunities.

3.3 State Assets and Facilities

The state has a variety of state-owned assets and facilities that serve both administrative and public service functions. These assets contribute to the state's governance, infrastructure, and education. Located in Dover, the Legislative Hall is the seat of the Delaware General Assembly, comprising the Senate and the House of Representatives. In addition to the Legislative Hall, the Delaware State Capitol Complex in Dover includes administrative offices for the Governor and state agencies responsible for governance and public service. Located in Newark, the University of Delaware is the largest university in the state and a hub for higher education and research. The university offers a wide range of academic programs and contributes significantly to Delaware's intellectual and economic landscape. Delaware State University provides a crucial role in providing educational opportunities and community outreach as a historically Black university known for its programs in education, agriculture, and other fields. There are several healthcare facilities located around the state that provide comprehensive medical services, including specialized care and community health initiatives. The Port of Wilmington is a vital maritime facility that handles container cargo, bulk goods, and vehicles. The Port has an important role in Delaware's economy by facilitating international

[3] https://data.census.gov/profile/Delaware?g=040XX00US10#race-and-ethnicity

trade and logistics. Connecting Delaware and New Jersey across the Delaware River, the Delaware Memorial Bridge is a key transportation link for commuters, travelers, and commercial traffic moving between the Mid-Atlantic states. Delaware's assets and facilities encompass a wide range of infrastructure, educational institutions, healthcare facilities, and more. These assets play critical roles in supporting governance, public services, economic development, education, healthcare, and cultural enrichment throughout the state.

3.4 Land Use and Development

Delaware's land use and development are guided by state and local policies aimed at balancing growth and preservation. Delaware has a strong focus on sustainable development, emphasizing smart growth principles to manage urban sprawl and protect natural resources. Local governments in Delaware handle zoning and land use through comprehensive plans and zoning codes. Local zoning regulations define land use categories, density, and development standards.

3.5 Natural Resources

Delaware's natural resources are diverse and crucial to the state's environmental and economic well-being. The state's natural resources include its land, water, wildlife, and mineral resources, all of which are managed through a combination of regulatory frameworks, conservation programs, and public policies. Delaware's water resources are vital for its agriculture, industry, and daily life. The state is divided into several major watersheds, including the Delaware River Basin and the Chesapeake Bay Watershed. The state's land resources include its soils, forests, and coastal areas. Delaware is also home to a variety of wildlife species and natural habitats, including wetlands, forests, and coastal areas.

CHAPTER 4. DELAWARE STATE ENERGY PROFILE

4.1 Introduction

The State of Delaware presents a unique energy landscape characterized by its geography, population, diverse economy, and positioning in the Mid-Atlantic region. This section of the Plan provides an overview of Delaware's energy generation, transmission, distribution, and consumption, as well as greenhouse gas emissions from the energy sector.

4.2 Overall Energy Consumption

The State of Delaware consumed 295 trillion British thermal units (BTU) of energy in 2021[4], ranking 47th in the nation for energy consumption. Delaware is the lowest energy producer of the 50 states; the only energy produced in Delaware comes from renewable sources, primarily solar. Delaware used almost 70 times more energy than it produced in 2020.

Delaware's economy is driven by industry, including chemical plants, poultry and food-processing companies, petroleum refining, and financial services for the more than two million corporations headquartered in the First State. In 2021 the industrial sector, including agriculture, was Delaware's largest energy consumer and accounted for 29% of the state's total energy consumption, with transportation a close second accounting for approximately 27%. Figure 1 shows the progression of Delaware's total energy consumption through 2020 based on US Energy Information Administration (EIA) data.

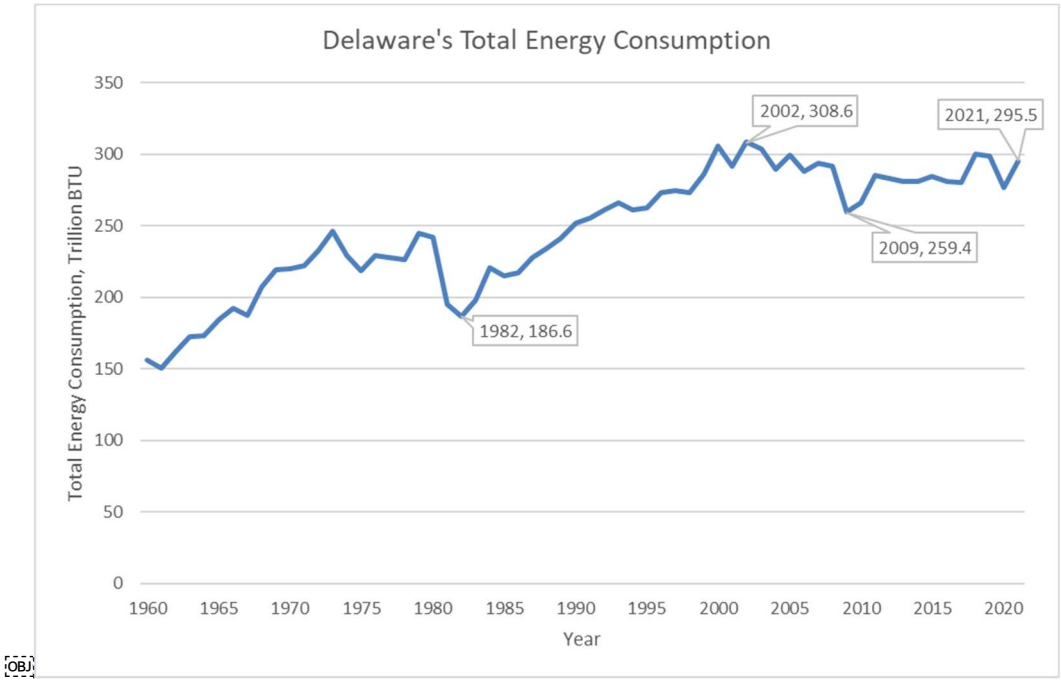

Figure 1: Delaware's Total Energy Consumption, 1960 - 2021

Between 1960 and 2002, the state's energy consumption rose at an average of 1.7% annually. Energy consumption peaked in 2002 at 309 trillion BTU and then dropped by approximately 17% between 2003 and 2010. Some of the factors responsible for the dips shown above are likely the Dotcom bubble "bust", the 2008 recession, and the transition from coal to natural gas for electric generation. Since 2011, consumption has been increasing at an average of 1% annually and is nearing 2005 levels at 299 trillion BTU, likely due to increased GDP and population growth without significant improvements in energy efficiency and

[4] https://www.eia.gov/state/print.php?sid=DE

conservation.

4.3 Delaware's End-Use Energy Consumption

In Delaware, the breakdown of end-use sector energy consumption highlights distinct patterns across various sectors. According to data from the EIA and Lawrence Livermore National Laboratory (LLNL), Delaware's industrial sector is the largest consumer of energy within the state, accounting for approximately 86 trillion British Thermal Units (BTU) of energy consumption annually. The transportation sector, critical for both personal and commercial mobility, is the second largest consumer, using approximately 80 trillion BTU of energy. The residential sector, which includes energy used for heating, cooling, and powering homes, is the third largest consumer and accounts for about 69 trillion BTU. Commercial activities, covering energy use in offices, schools, and healthcare facilities, consume roughly 61 trillion BTU.

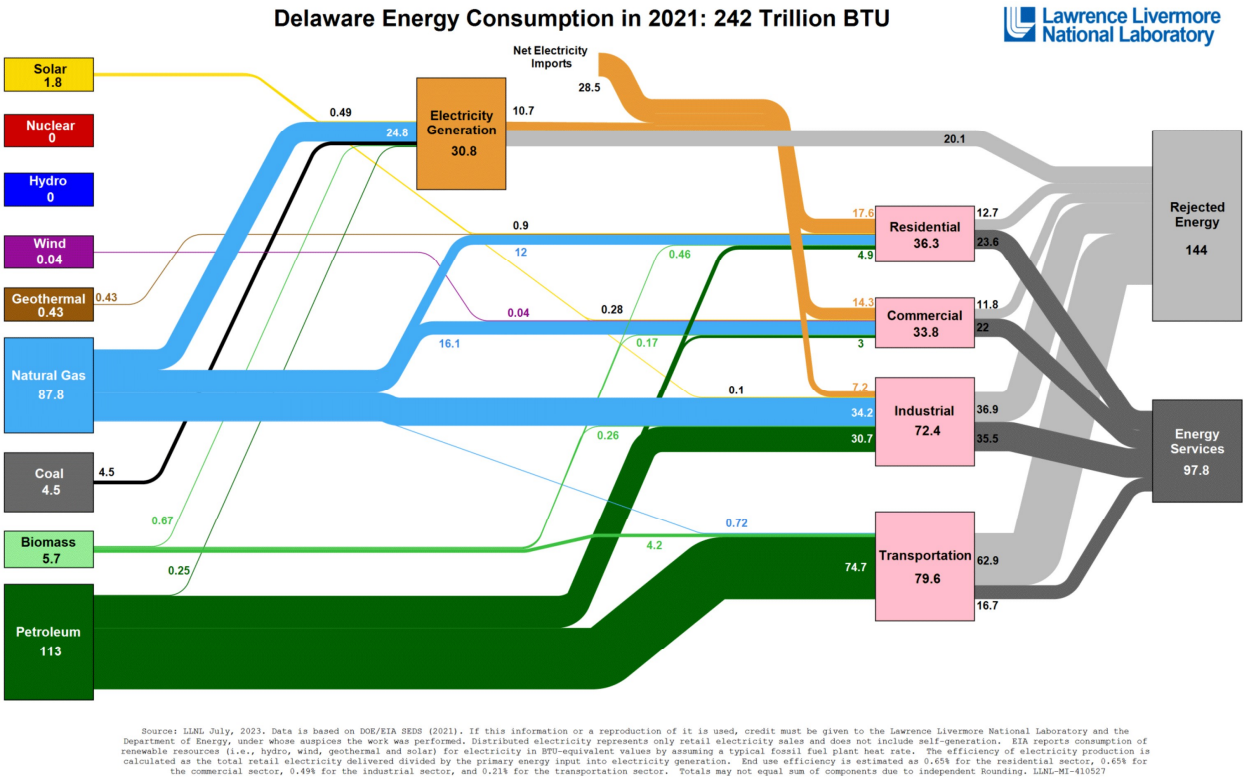

Figure 2: Delaware Energy Consumption by Sector in 2021, LLNL[5]

Figure 3 below to the left provides insight into Delaware's energy consumption by end use across the residential, commercial, industrial, and transportation sectors. Figure 4 demonstrates Delaware's energy consumption by fuel type.

[5] Rejected Energy usage is the assumed end-use efficiency averages for each sector, estimated as 65% for residential and commercial, 21% for transportation, and 49% for industrial, which was updated in 2017 to reflect DOE's analysis of manufacturing.

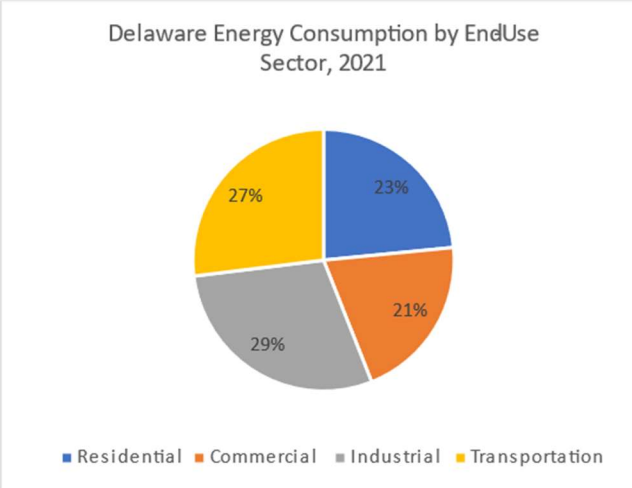

Figure 3: Delaware Energy Consumption by Sector, 2021 EIA

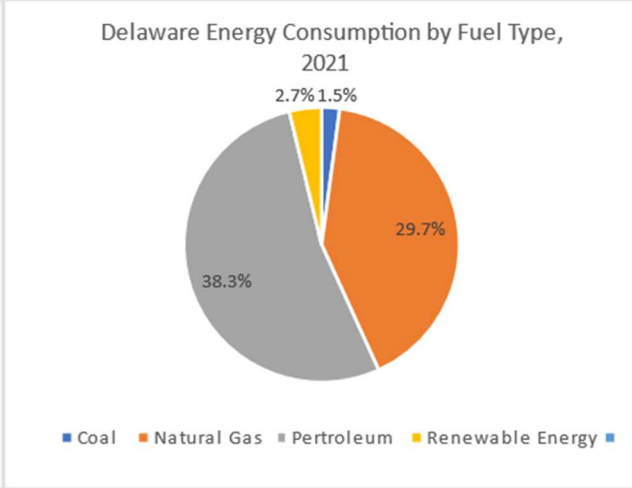

Figure 4: Delaware Total Energy Consumption by Fuel Type, 2021

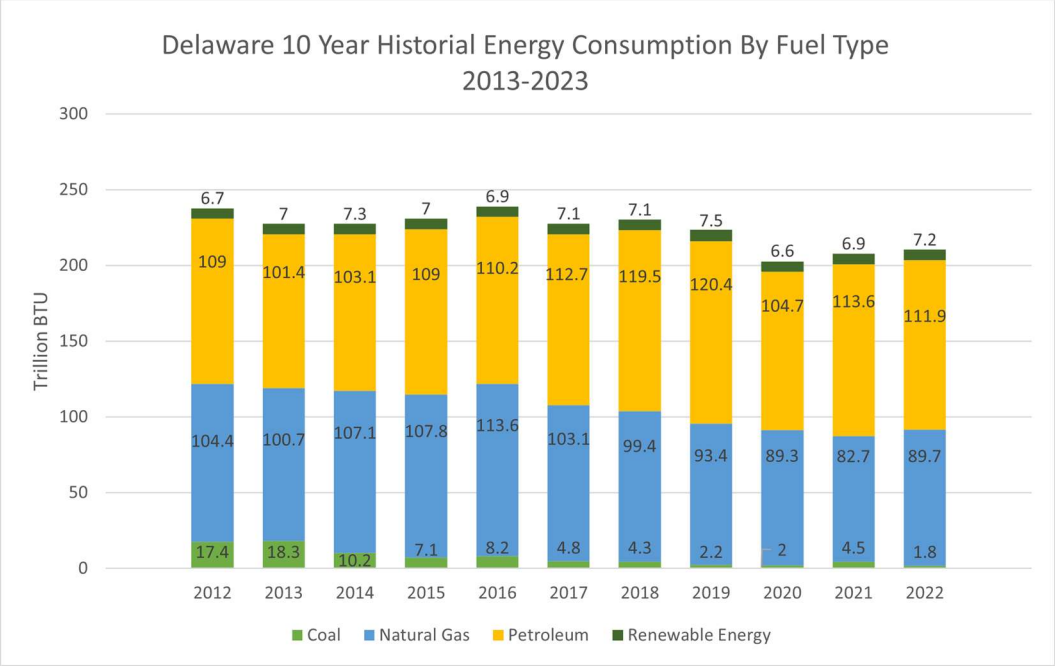

Figure 5: Delaware 10 Year Historical Primary Energy Consumption by Fuel Type, 2012 - 2022[6]

Figure 5 above shows the trends in Delaware's total primary energy consumption from 2013 to 2023.

4.3.1 Residential Sector End-Use Energy Consumption

In 2021, the residential sector accounted for 24% of the energy consumption within the state, totaling approximately 69 trillion BTU. Approximately 44% of Delaware households rely on natural gas for home heating, 35% use electricity, about 10% use propane, and 9% use fuel oil or kerosene. A small number of Delaware households use renewable resources directly for home heating—almost 1% rely on wood for heat and about 0.2% use solar thermal energy for heating.

https://www.eia.gov/state/seds/sep_use/total/pdf_cb/use_tot_DEcb.pdf

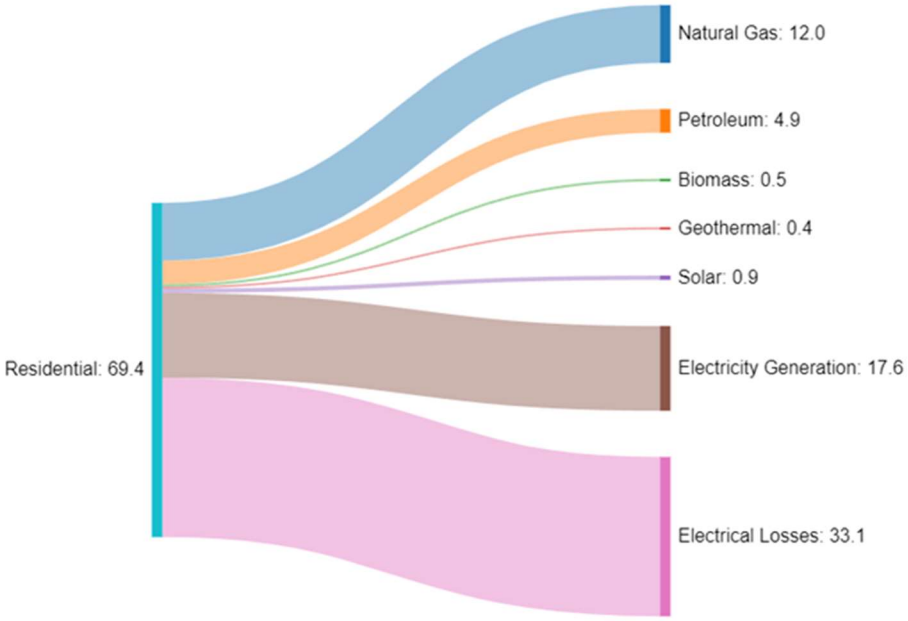

Figure 6: Residential Energy Usage per Source (Trillion BTU), 2021

4.3.2 Commercial Sector Energy End-Use Consumption

The commercial sector accounted for 20% of the energy consumption in Delaware in 2021, totaling approximately 61 trillion BTU. Similar to the Residential section, the primary fuel type used in the residential sector in 2020 was natural gas.

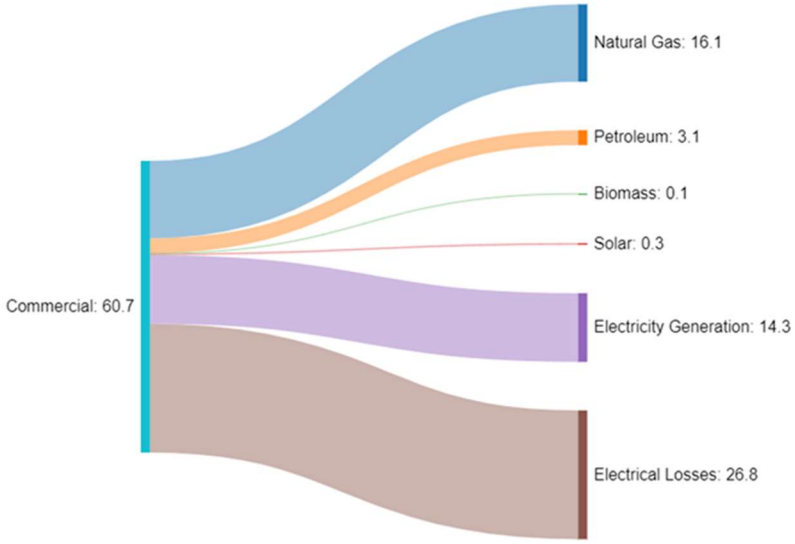

Figure 7: Commercial Energy Usage per Source (Trillion BTU), 2021

4.3.3 Industrial Sector End-Use Energy Consumption

The industrial sector was the largest consumer of energy in Delaware, accounting for 29% of the energy consumption in 2021, totaling approximately 86 trillion BTU as shown below.

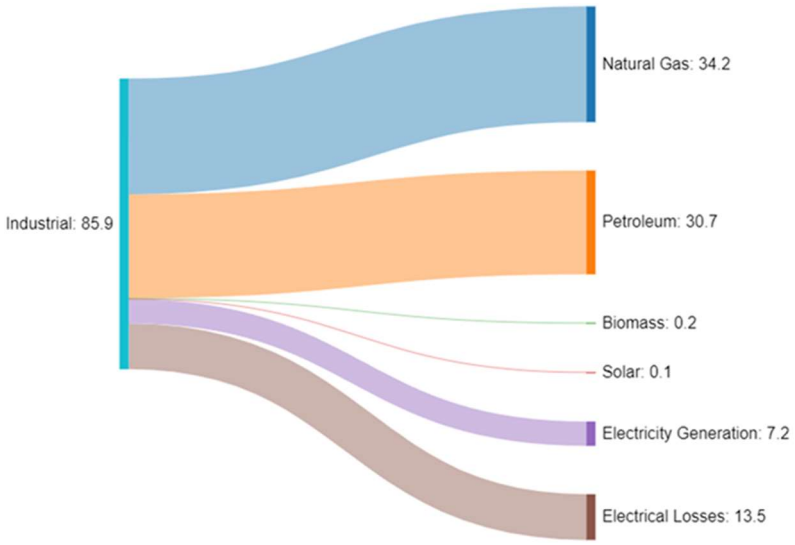

Figure 8: Industrial Energy Usage per Source (Trillion BTU), 2021

4.3.4 Transportation Sector End-Use Energy Consumption

The transportation sector accounted for 27% of the energy consumption in Delaware in 2021, totaling approximately 80 trillion BTU, primarily from gasoline motor vehicle fuel consumption.

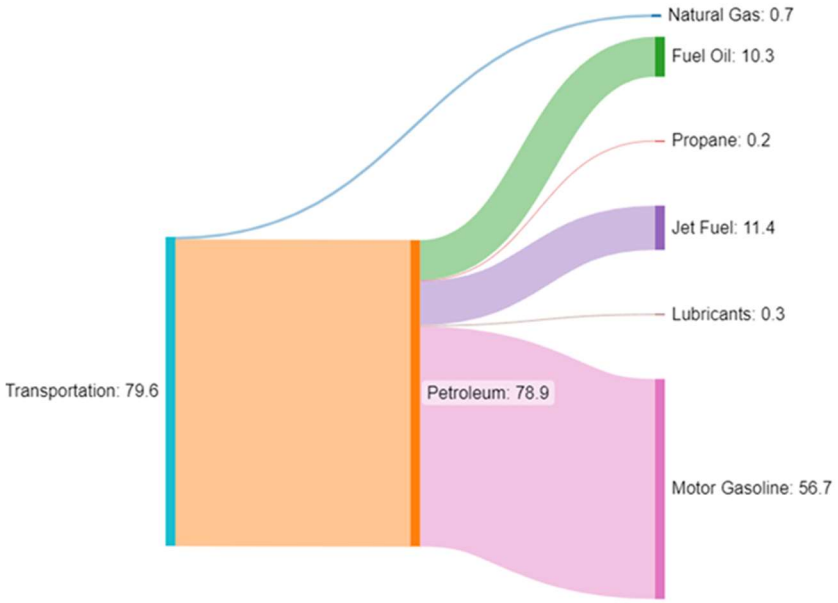

Figure 9: Transportation Energy Usage per Source (Trillion BTU), 2021

4.4 Electricity

To meet the electricity demand in Delaware, electricity is generated both in and out of the state, primarily by the combustion of fossil fuels, such as natural gas, petroleum products, and coal.

4.4.1 The Electric Grid

Delaware's electric grid is shaped by Delaware's geography and distribution of population. Delaware is located on the Delmarva peninsula and has a population of a little over 1 million. Electric load, the consumption of power or energy, is concentrated in the northern, more populous portion of the state.

Delaware is situated within the territory served by PJM Interconnection, LLC (PJM), the regional transmission organization, which manages the electric grid and wholesale power markets for roughly 65 million people through 21 power delivery utilities. The PJM territory covers 13 states and the District of Columbia, from New Jersey to North Carolina, and includes parts of Illinois.

Modernizing the electric grid, both the transmission and distribution systems, is crucial to integrating more renewable energy, improving reliability, electrifying residential and commercial buildings, and increasing adoption of electric vehicles. The transmission system, lines carrying 69 kilovolts (kV) or above, is often compared to the interstate highway system while the distribution system, primary and secondary lines carrying 34 kV and below, is likened to local streets and roads. Transmission lines move power from generators to substations, where power is stepped down to distribution level voltages that serve homes and businesses. Transmission upgrades will be needed to accommodate large new sources of renewable energy such as offshore wind, while distribution system upgrades will be needed to accommodate growth of smaller sources of renewable energy such as distributed solar. Energy storage technologies such as batteries and advanced metering and controls hold the promise of providing additional flexibility and security to the grid. Increased energy storage also helps to increase Delaware's resilience as the state faces increasing vulnerabilities from natural and human-caused outage events.

4.4.2 Delaware Retail Electricity Sales

Delaware's electric customers use roughly 11.5 million megawatt hours (MWh) of electricity a year.[7] Monthly retail electricity sales by sector for the state from 2021 through January 2022 are summarized in the graph below.

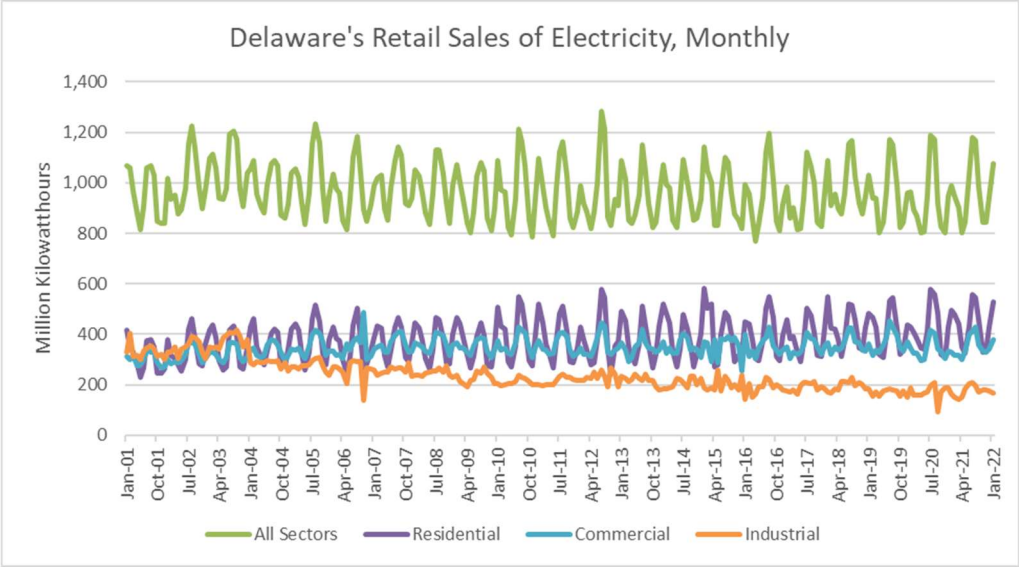

Figure 10: Delaware's Retail Sales of Electricity, 2001-2022

Delaware's retail sales of electricity, as shown above, feature a blend of regulated utilities and competitive suppliers, offering residents and businesses options for their energy needs.

4.4.3 Delaware Electric Utilities

Delmarva Power (which is regulated by the Public Service Commission) does not own generating assets, but procures electricity, including renewable energy, through markets. There are nine municipal electric companies, eight of which are managed by the Delaware Municipal Electric Corporation. Municipal electric

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companies operate under the authority of their municipal governments. The Delaware Electric Cooperative, a rural electric cooperative under Delaware law, reports to its members. Figures 11-13 provide maps of the Delaware electric utility and municipal service territories.

Figure 11: Delmarva Power's electric service territory

Figure 12: Delaware Electric Cooperative service territory

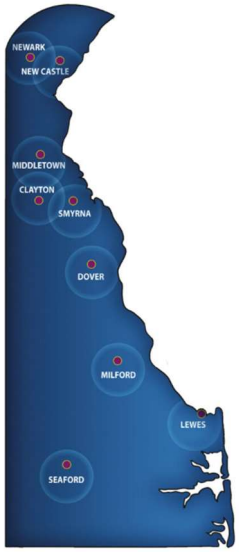

Figure 13: Delaware Municipal Electric Corporation service territory

4.4.4 Delaware Electric Utility Retail Sales

A summary of Delaware electric utilities' share of retail sales is provided below.

Utility Name	Ownership Type	Total Customer Count	Percent of State's Customers	Total Sales (MWh)
Delmarva Power	Investor Owned	296,741	53%	4,323,677
Delaware Electric Cooperative	Cooperative	113,057	20%	1,573,288
City of Dover	Municipal	24,756	4%	722,812
Town of Middletown	Municipal	9,904	2%	258,416
City of Milford	Municipal	8,320	1%	234,083
City of Newark	Municipal	13,238	2%	423,748

Table 1: Top Electric Utilities in Delaware

4.4.5 Electric Supply

Delaware is a net electricity importer (see section 4.4.8). The percentage of imports varies year-to-year due to a variety of factors, but typically ranges from 30% to 55%. Natural gas represents approximately 65.6% of the total installed capacity in the Delmarva peninsula while oil represents approximately 21.3% and coal 13%. Comparatively across PJM territory, natural gas accounts for 46.6% of the installed capacity, while oil and coal make up 3.5% and 24.0% respectively.

Renewable energy sources, such as solar and wind, also generate electricity in Delaware. In 2022, natural gas fueled 87% of Delaware's total in-state electricity generation. Delaware's Renewable Portfolio Standard (RPS) requires 40% of the state's electricity retail sales to come from renewable energy sources by 2035, with at least 10% of energy coming from solar. In 2022, about 6% of Delaware's total in-state net generation came from renewable resources, including 4% from solar energy.

In 2022, an estimated 4,305 gigawatt-hours (GWh) of electricity were generated in Delaware. Since 2010, electric generation fueled by natural gas fired power plants increased from 51% to 86% in 2021, and to 90.7% in 2022, with coal-fired plants dropping from 46% to only 7% in 2021 and 2.3% in 2022 provided by a single coal-fired power plant in southern Delaware.

4.4.6 Electric Generating Units in Delaware

Figure 14 below shows a map of major power plants and transmission lines in Delaware. The state's electric generating units consist of a mixture of natural gas, nuclear, and renewable energy sources such as solar and wind.

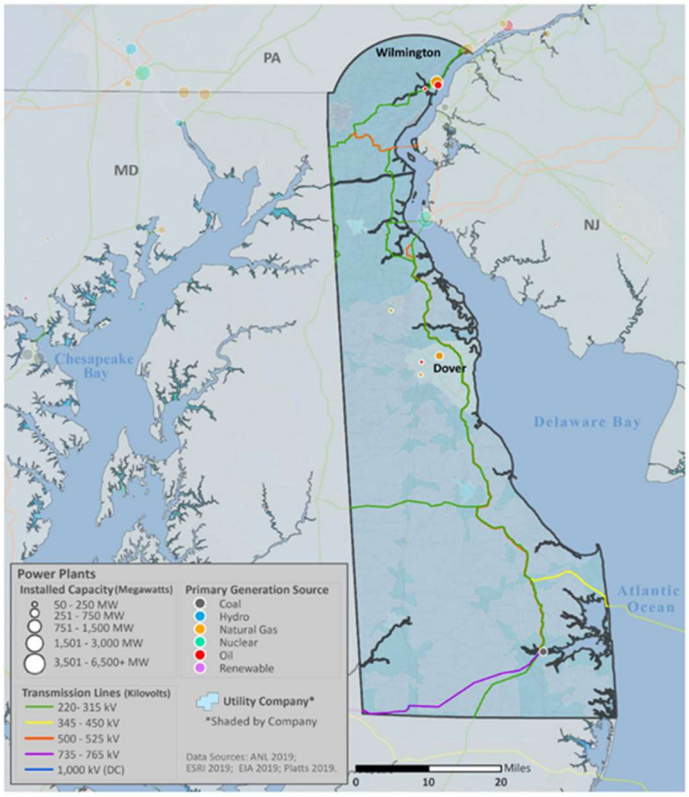

Figure 14: Delaware Electric Generating Units and Transmission Lines

Delaware had approximately 3,273 MW of installed generation capacity as of November 2022, approximately 2/3 of the electricity needed to meet the summer peak demand. Figure 15 provides a more detailed map of the location of electric generating stations across Delaware.

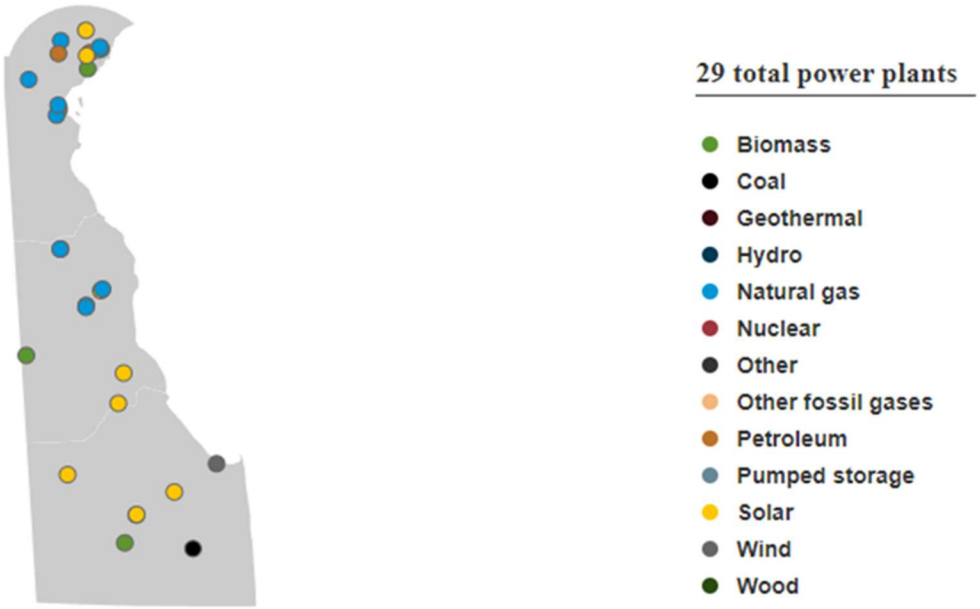

Figure 15: Delaware Electric Generating Stations Map

Delaware imports the remaining electricity needed from the PJM interconnection. Delaware has no hydroelectric, geothermal, or nuclear generating facilities in the state. The coal-fired Indian River Power Plant which is under a Reliability Must Run (RMR) contract with PJM, set to expire in the spring of 2025. Figures 16 and 17 show the generation of Delaware's power plants by fuel sources.

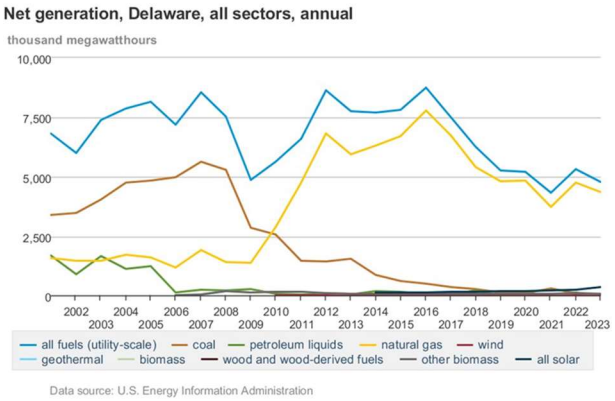

Figure 16 Delaware Net Electric Generator Fuel Sources, Historical

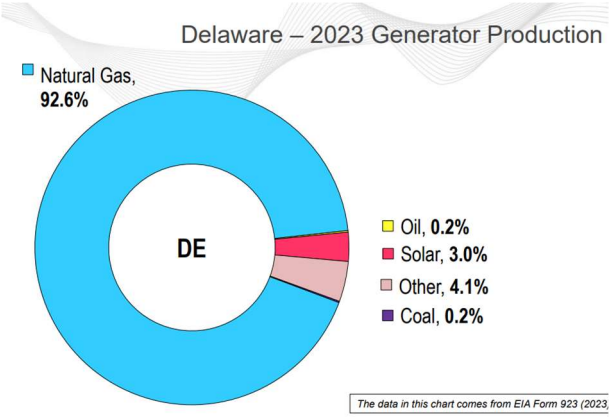

Figure 17: Delaware 2023 Electric Generator Fuel Sources

As of April 2023, Delaware had 106 MW of in-state renewable energy capacity installed. Delaware's renewable portfolio standard requires that renewable energy sources generate 40% of electricity retail sales in the state by 2035, with at least 10% coming from solar energy. In 2021, 5% of the state's total in-state net generation came from small- and large-scale solar powered facilities. The table below summarizes generation stations within the state.

Generator Name	Owner	County	Sum Cap. (MW)	Type	2022 Gen. (GWh)	% of State 2022
Hay Road	Calpine Mid-Atlantic Generation LLC	New Castle County	1,136	Natural Gas	1,947	42%
Garrison Energy Center	Garrison Energy Center LLC	Kent County	361	Natural Gas	1239	27%
Delaware City Plant	Delaware City Refining Company LLC	New Castle County	265	Natural Gas	868.1	19%
Edge Moor	Calpine Mid-Atlantic Generation LLC	New Castle County	710	Natural Gas	319.3	7%
Indian River Generating Station	Indian River Operations Inc	Sussex County	426	Coal	104.7	2%
Energy Center Dover	Energy Center Dover LLC	Kent County	118	Natural Gas	74	2%
NAES McKee Run	NAES Corporation - (DE)	Kent County	113.6	Natural Gas	NA	NA
Warren F Sam Beasley Generation Station	Delaware Municipal Electric Corp	Kent County	98	Natural Gas	50.8	1%
Christiana	Calpine Mid-Atlantic Generation LLC	New Castle County	52	Petrol	1.49	< 1%
Van Sant Station	NAES Corporation - (DE)	Kent County	45.1	Petrol	0.021	< 1%
Red Lion Energy Center	Diamond State Generation Partners, LLC	New Castle County	27	Natural Gas	NA	NA

West Station (DE)	Calpine Mid-Atlantic Generation LLC	New Castle County	20	Petrol	0	0
Delaware City 10	Delaware City Refining Company LLC	New Castle County	18.5	Petrol	0	0
Indian River Generating Station	Indian River Operations Inc	Sussex County	16.1	Petrol	0	0
Edge Moor	Calpine Mid-Atlantic Generation LLC	New Castle County	15	Petrol	0.043	< 1%
Brookside Newark	Diamond State Generation Partners, LLC	New Castle County	3.1	Natural Gas	NA	NA
AGT001 Centerville Fuel Cell	2016 ESA Project Company, LLC	New Castle County	1.3	Natural Gas	NA	NA

Table 2: Electric Generators by Capacity in 2022, sorted by percent of state generation

4.4.6.1 Generation Mix by Fuel Type

Figure 18 below demonstrates Delaware's in-state electric generation consumption by fuel type. Delaware's 2023 fuel consumption for electric generation was 100% natural gas.

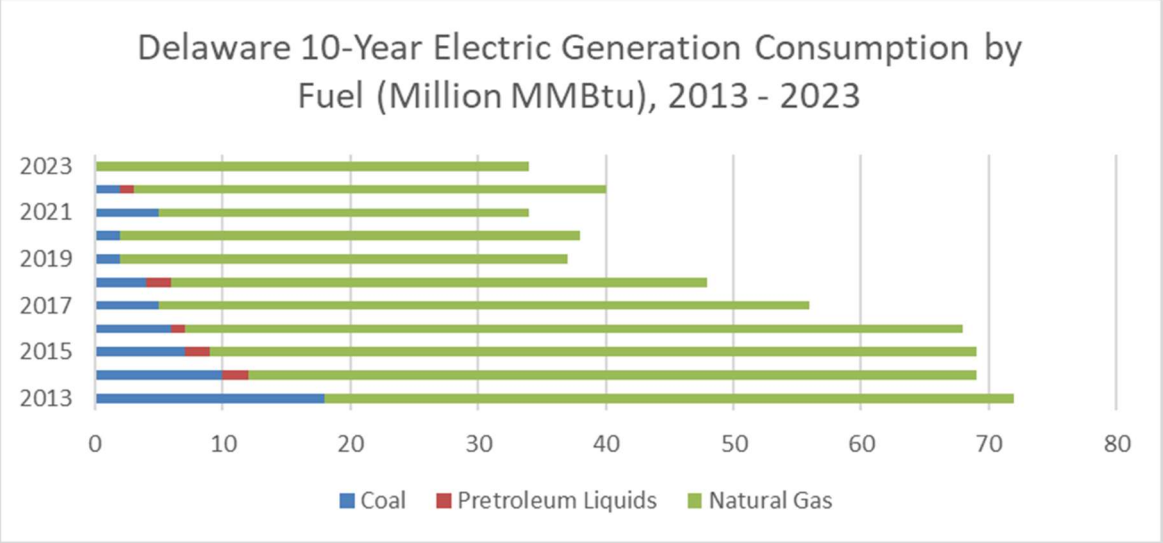

Figure 18: Delaware's Ten-Year Electric Generation Consumption by Fuel Type

4.4.7 Assessment of Delaware as a Net Importer or Exporter

Since 2000, 41 to 68 percent of Delaware's electricity has flowed into the state over transmission lines from generating units located in neighboring states. As noted earlier, most of the generating capacity located in Delaware is natural gas fired that is gas pipelines from outside the state. The net total of energy imports and exports shown in Figure 19 below indicates that Delaware is a net electricity importer.[8]

[8] https://www.pjm.com/-/media/library/reports-notices/state-specific-reports/2023/delaware.ashx

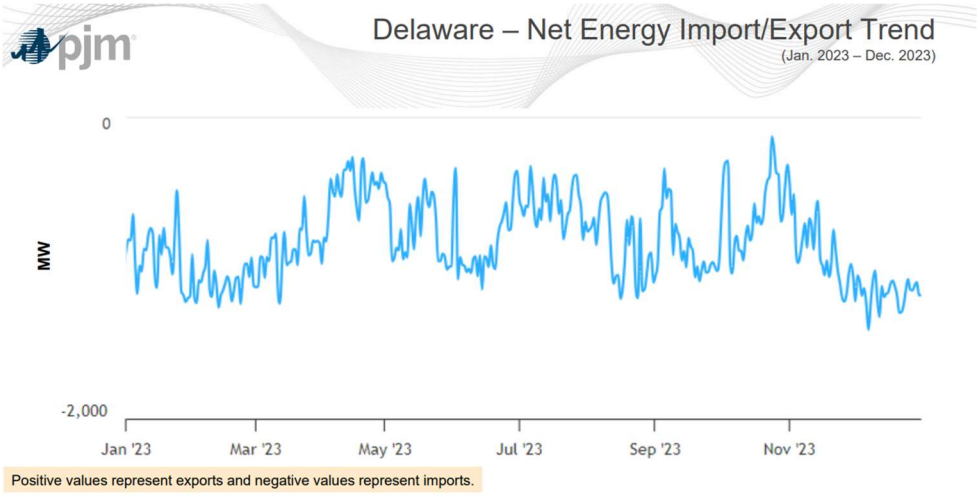

Figure 19: Net Import/Export of Electricity Generation

4.4.8 Delaware within the PJM Balancing Authority

Balancing authorities manage the operation of the electric system within a defined territory. Of the 60 different balancing authorities in the U.S., the largest areas are served by regional transmission organizations (RTOs) and independent system operators (ISOs).

> A balancing authority ensures that power system demand and supply are always balanced, which maintains safe and reliable operation of the power system. If supply falls below demand, it can cause a drop in frequency below the stable system frequency, risking significant permanent physical damage to electrical equipment and prolonged grid-wide blackouts. During such situations, balancing authorities may direct utilities to "shed load" (i.e., implement rolling blackouts) to bring supply and demand into balance. Balancing authorities also manage transfers of electricity (interchanges) with other balancing authorities and use economic dispatch to optimize the use of various generating units to minimize real-time costs. Balancing authorities are responsible for maintaining operating conditions under mandatory reliability standards issued by the North American Electric Reliability Corporation (NERC) and approved by the U.S. Federal Energy Regulatory Commission (FERC).[9]

Delaware is located within PJM, one of the largest RTOs by customers served at approximately 65 million customers. Figure 20 below outlines the PJM service territory in relation to neighboring RTOs and ISOs.

9 USDOE, Office of Cybersecurity, Energy Security, and Emergency Response, How it Works: The Role of a Balancing Authority, Factsheet, accessed August 29, 2024.

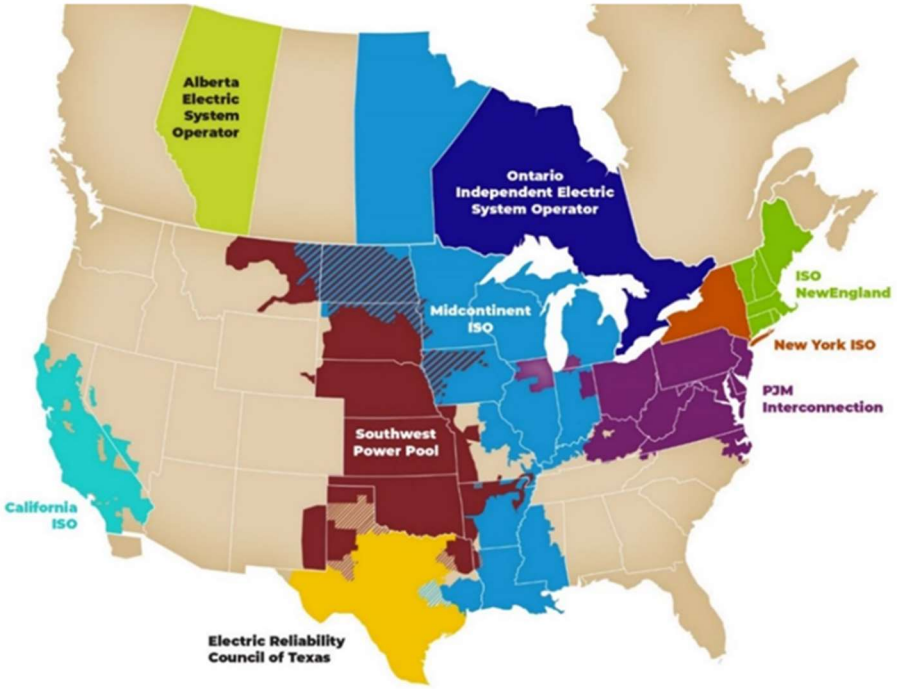

Figure 20: Map of Independent System Operators (ISO) and Regional Transmission Operators (RTO)

The 2024 PJM load forecast for Delaware[10] projected a Delaware summer peak demand of 2,634 megawatts (MW) and a winter peak demand of 2,293 MW. PJM projects incremental demand growth over the next decade. Figure 21 shows PJM's load forecast for Delaware.[11]

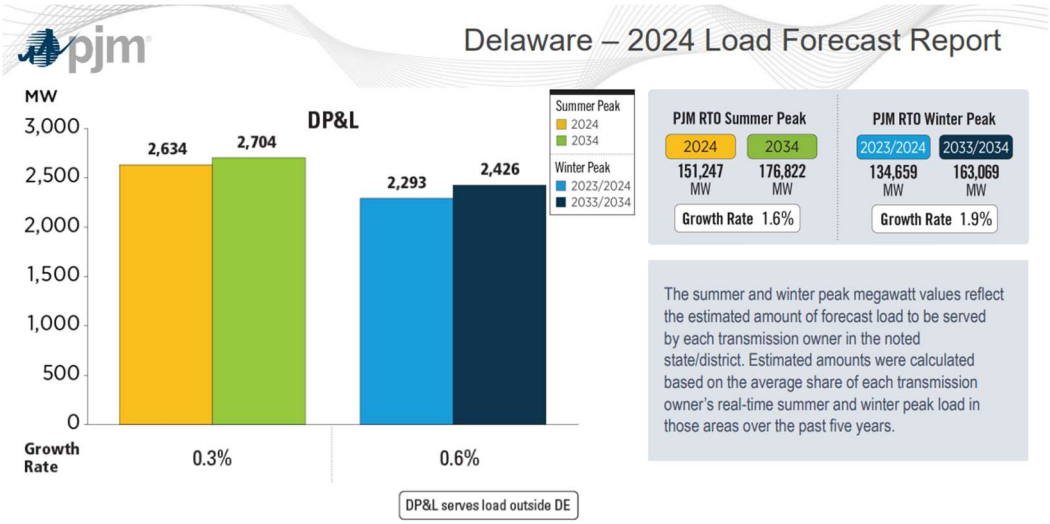

Figure 21: PJM Load Forecast for Delaware

The PJM Queued Load Capacity for Delaware is shown in Figure 22 below, including the renewable portions of PJM's generation mix.[12]

10 2022 Delaware State Infrastructure Report

[11] https://www.pjm.com/-/media/library/reports-notices/state-specific-reports/2023/delaware.ashx

[12] https://www.pjm.com/-/media/library/reports-notices/state-specific-reports/2023/delaware.ashx

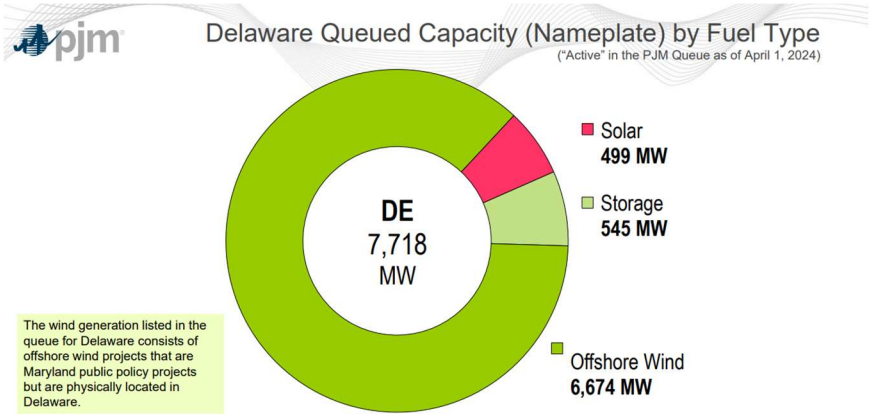

Figure 22: Delaware Queued Load Capacity (PJM)

4.4.9 Balancing Authority Electricity Graph

PJM operates one of the largest electricity grids in North America, covering a diverse region, including Delaware. The grid serves significant electric demand, driven by residential, commercial, and industrial sectors. Figure 23 below shows PJM's electricity demand, net generation, and total interchange.

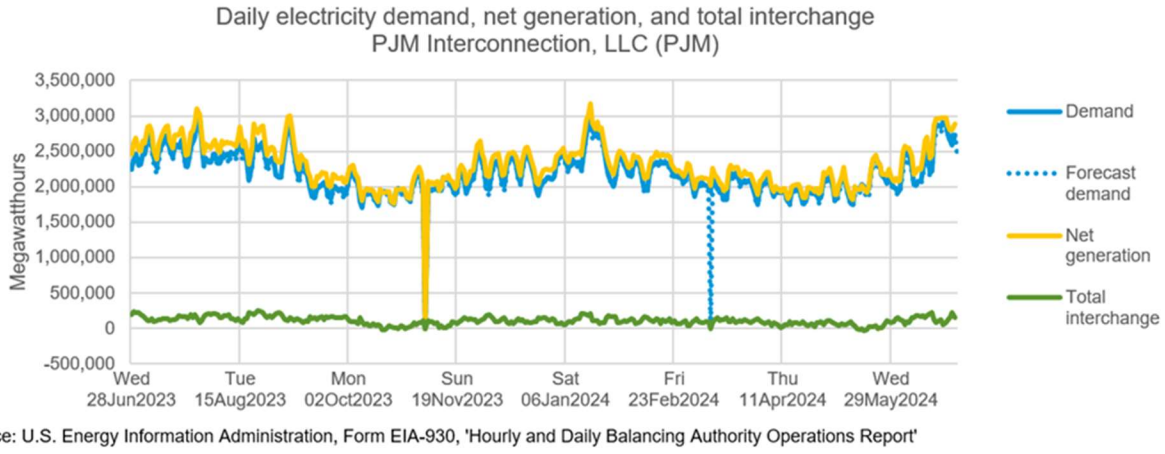

Figure 23: PJM Demand and Net Generation

4.4.10 Electricity Generation by Source within the Balancing Authority

Within the PJM Interconnection, electricity generation is diversified across several energy sources. This includes a significant portion from natural gas fired power plants. Coal fired power plants contribute a notable share, although their proportion has decreased over the last several years. Renewable energy sources, including wind, solar, and hydro, are increasingly important, as they are supported by state-level renewable energy targets and incentives. Nuclear power also has a substantive role in PJM's electricity generation mix, as it provides a reliable source of baseload power. The figure below demonstrates PJM's diverse mix of energy sources, as they ensure grid reliability.

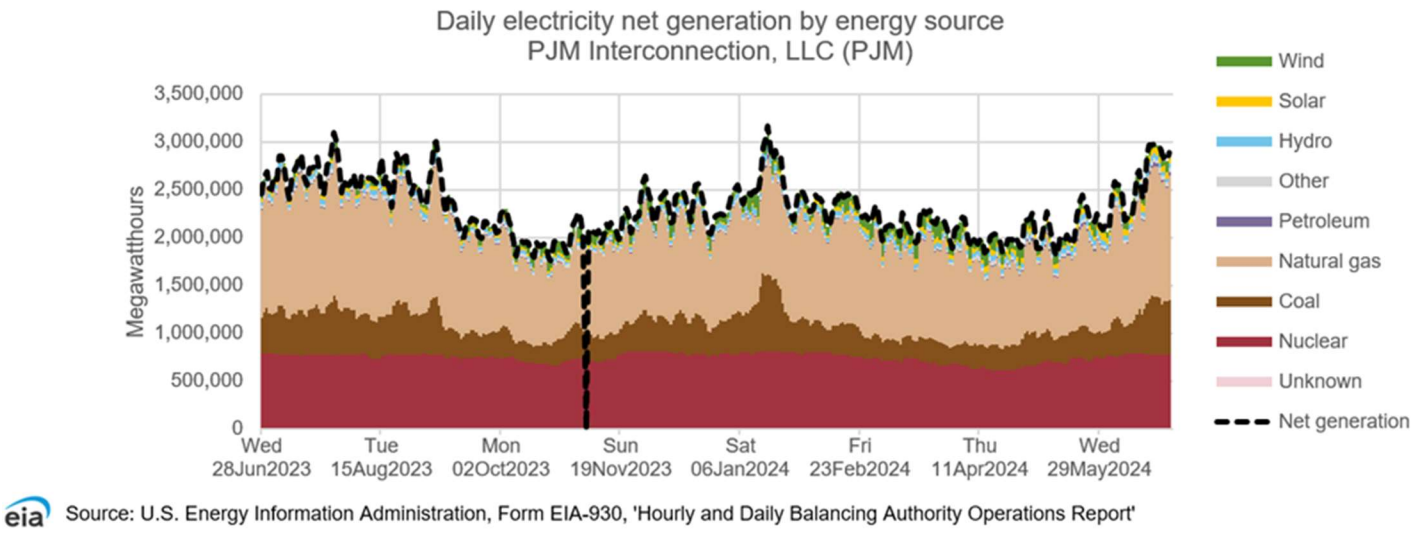

Figure 24: Graph of PJM Electricity Generation by Energy Source

4.4.11 Electricity Trends

The Renewable Energy Portfolio Standards Act (REPSA) was first adopted in 2005 and has been amended nine times starting in 2008. REPSA requires that electric utilities procure an increasing amount of energy from renewable resources every year until reaching percent (including 10 percent solar) by 2035. The percentages for the current compliance year (starting June 1, 2024) are 24 percent (including 3.25 percent solar). Utilities satisfy most of their wind requirement with out-of-state wind, while most of the solar requirement is satisfied by in-state solar facilities ranging from rooftop to utility scale installations. The State Energy Office, the Public Service Commission, the Public Advocate, and electric utilities are cooperating on transmission and distribution grid planning as the use of renewable energy grows.

Senate Bill 265, which was signed into law in September 2024, establishes a path forward for offshore wind procurement for Delaware and a regulatory process for transmission interconnections for large wind and solar facilities. The act authorizes the State Energy Office, with the approval of the Public Service Commission (PSC), to issue solicitations to procure offshore wind in aggregate amounts of up to 1,200 MW. The act provides for flexibility in procurement timing and structure to allow the procurement process to better respond to market conditions. The act recognizes the importance of Delaware cooperating with neighboring states on procurement, supply chain, and transmission planning. The act also enhances the PSC's current Certificate of Public Convenience and Necessity (CPCN) process by giving the Commission authority to issue a CPCN in connection with renewable energy interconnection facilities, such as the transmission lines from an offshore wind or utility scale solar project to a nearby substation.

4.4.12 Delaware's Long-term Electrification/Net-Zero Goals and Policies and Long-Term Impact Assessment on the Electricity Sector

The Delaware Climate Change Solutions Act (DCSA) of 2023 demonstrates a significant legislative effort to combat climate change, reduce greenhouse gas emissions, promote renewable energy, enhance energy efficiency, and build resilience to climate impacts. Delaware's Climate Action Plan serves as a roadmap for achieving climate resilience and sustainability, emphasizing mitigation measures to reduce greenhouse gas emissions and adaptation strategies to protect communities and natural resources from climate impacts.[13]

13 Delaware's Climate Action Plan

4.4.12.1 Delaware's Climate Action Plan

DCCE is updating Delaware's Climate Action Plan to guide efforts in addressing climate change and achieving its emission reduction goals. The Plan sets ambitious goals for emissions reductions, aiming for a thirty percent reduction in greenhouse gas emissions by 2030 compared to 2008 levels, and an eighty percent reduction by 2050.

The Climate Action Plan also has specific strategies for several sectors, including energy, transportation, buildings, and agriculture and natural resources. Delaware tracks progress towards its climate goals through monitoring and reporting mechanisms. This includes assessing emissions trends, evaluating the effectiveness of implemented strategies, and adjusting approaches as needed to stay on track with targets.

Delaware's Climate Action Plan identifies five action areas to minimize greenhouse gas emissions, including clean and renewable energy expansion, energy efficiency measures, transportation sector transitions, high global warming potential, and offsetting carbon emissions. The Climate Action Plan also identifies seven action areas to maximize resilience to climate change impacts, including updating or creating state regulations, supporting communities and stakeholders, creating management plans, updating facility designs and operations, promoting research and monitoring, engaging in outreach and education and providing agency support.

4.4.12.2 State Energy Plan

The State Energy Office is updating the State Energy Plan based on recommendations from the Governor's Energy Advisory Council (GEAC). The plan is set to be released in the fall of 2024. Key chapters of the plan include grid modernization, renewable energy and clean technologies, energy efficiency and beneficial electrification, workforce development, and energy justice and equity. The State Energy Plan takes into account the electrification and emissions goals of the Climate Action Plan and provides actions to ensure reliability as the state transitions to meet these goals.

4.4.13 Anticipated Generation Installations for the Next Five Years

The SEO expects to see continued growth of solar energy at all scales, from residential to utility-scale, over the next five years. In addition, Delaware is preparing for the connection of utility-scale offshore wind built to meet Maryland's requirements. Senate Bill 265, signed into law in September 2024, creates a process for Delaware to engage in procuring offshore wind which may be connected to the Delaware grid or to the PJM grid in neighboring states. Developers of battery storage solutions have submitted applications to the PJM queue to connect large-scale storage to the grid. The SEO is currently in the negotiations stage to award 40101 (d) funding to the Delaware Electric Cooperative to install a utility-scale battery, sited at their utility-scale solar farm (See section 6.6.1, 7.1.5).

4.4.14 Planned Utility-Scale Generation Retirement for the Next Five Years

Delaware is planning for the retirement of one utility-scale generation unit over the next five years as part of the effort to transition to cleaner energy sources and reduce emissions. The 445.6 MW coal-fired Indian River Generating Station will be retired in 2025. This retirement will be managed in a phased approach to ensure grid reliability while promoting the integration of renewable energy alternatives.

4.5 Natural Gas

Natural gas is the primary fuel for electricity generation in Delaware. Figure 25 below shows Delaware's natural gas consumption by end-use.

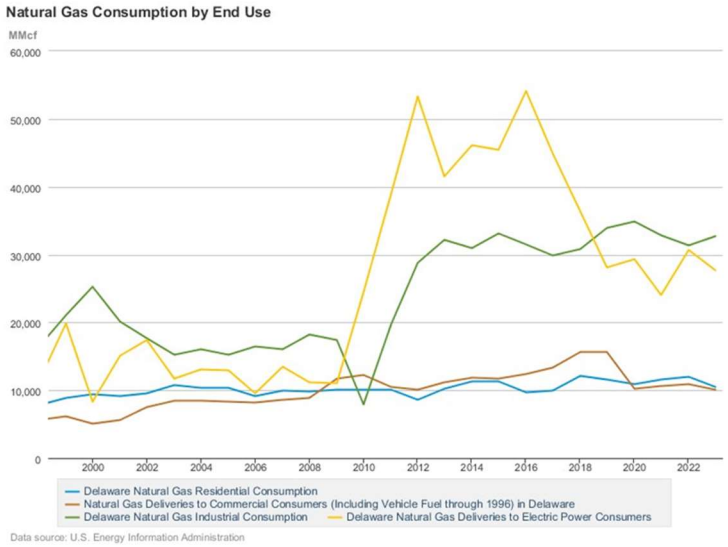

Figure 25: Natural Gas Consumption by End-Use Sector, MMcf

In 2021, Delaware's industrial sector was the largest consumer of natural gas accounting for 40% of the natural gas consumption in the state. The electric generation sector's usage decreased by 50% between 2016 and 2023.

4.5.1 Natural Gas Consumption by Sector

In 2022, an estimated 5,308 gigawatt-hours (GWh) of electricity were generated in Delaware, increasing from 4,305 GWh in 2021. Since 2010, electric generation fueled by natural gas fired power plants increased from 51% to 87% in 2022, which is down from a peak of 91% in 2019. Delaware had approximately 3,273 MW of installed generation capacity as of November 2022. An overview of the net generation from natural gas is shown in the figure below.

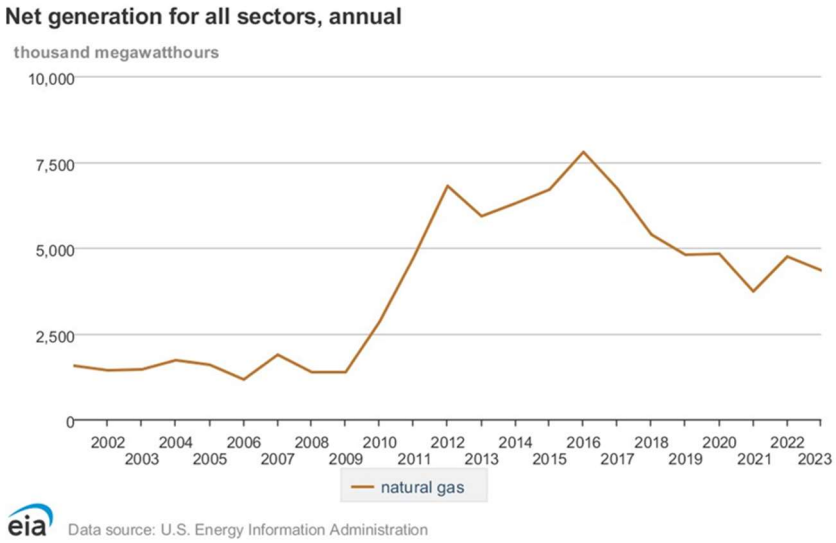

Figure 26: Natural Gas Net Generation for All Sectors

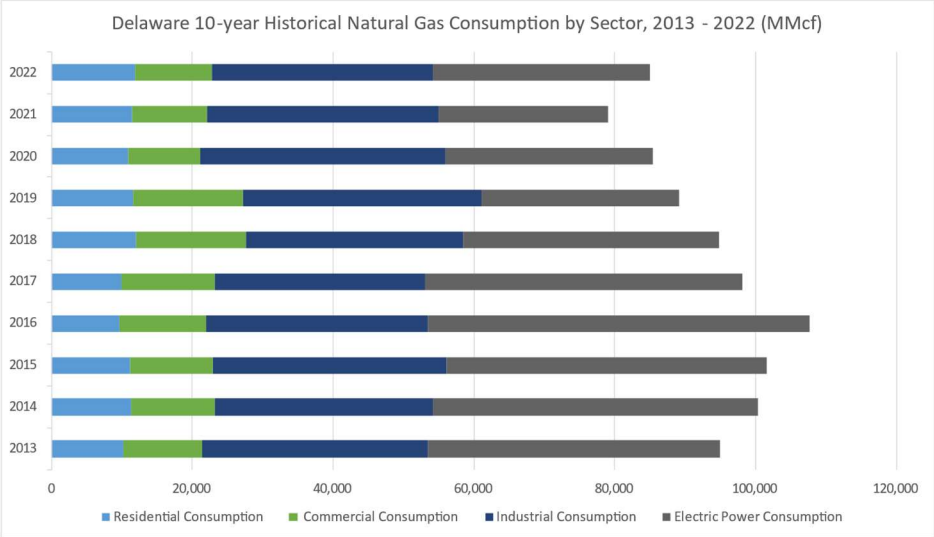

Figure 27: 10-year Historical Natural Gas Consumption by Sector

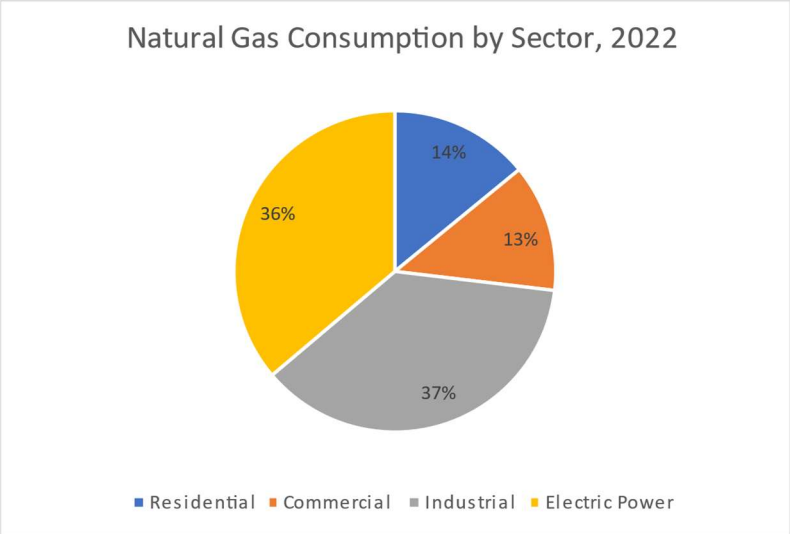

Figure 28: Natural Gas Consumption by Sector, 2022

4.5.2 Map of Natural Gas Distribution Company Territories

Delaware has two natural gas utility providers which serve the state – Chesapeake Utilities and Delmarva Power. These two utility providers serve approximately 240,000 customers with natural gas throughout the state. Figure 29 and Figure 30 demonstrate respectively the service territories of Chesapeake Utilities and Delmarva Power.

Figure 29: Chesapeake Utility Gas Service Territory

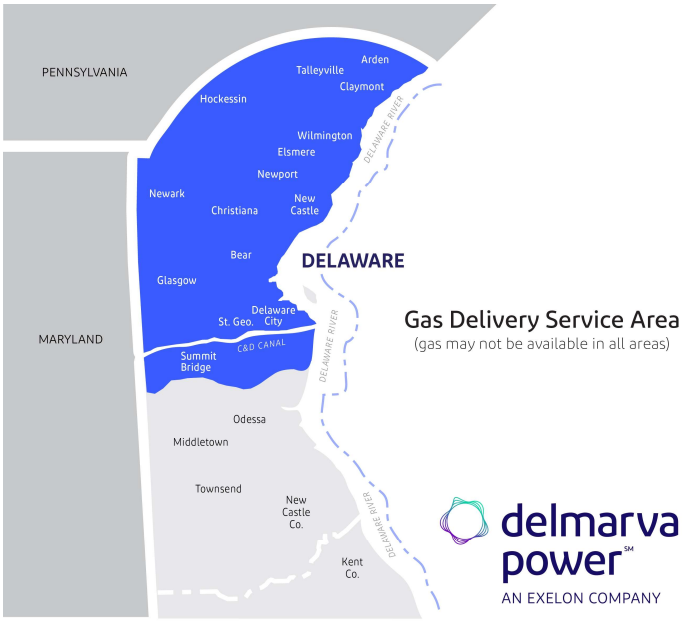

Figure 30: Delmarva Power Utility Gas Service Territory

4.5.3 Table of Natural Gas Distribution Companies, Sales by End-Use Sector

Gas Distribution Company	End-Use Sector	2020 Delivery Volume (MMcf/d)
Eastern Shore Natural Gas Co.	Industrial Volume	29,043.6
Delmarva Power and Light Co.	Electric Power Volume	17,482.8
Eastern Shore Natural Gas Co.	Electric Power Volume	11,972.0
Delmarva Power and Light Co.	Commercial Volume	7,871.8
Delmarva Power and Light Co.	Residential Volume	7,665.3
Texas Eastern Transmission LP	Electric Power Volume	6,220.4
Chesapeake Utilities Corporation	Industrial Volume	3,197.4
Chesapeake Utilities Corporation	Residential Volume	3,185.9
Delmarva Power and Light Co.	Industrial Volume	2,654.5
Chesapeake Utilities Corporation	Commercial Volume	2,377.4
Chesapeake Utilities Corporation	Vehicle Fuel Volume	2.7

Table 3: Natural Gas Distribution Companies, Sales[14]

4.5.4 Natural Gas Production and Supply

Delaware does not produce natural gas and does not have any natural gas reserves. Exploration wells drilled in the 1970s and 1980s off Delaware's Atlantic Coast found noncommercial oil and natural gas deposits.

14 Natural Gas Annual Respondent Query System (EIA-176 Data Through 2022

Delaware's natural gas supplies arrive by interstate pipeline from Pennsylvania; one-tenth of that passes through the state to reach Maryland's Eastern Shore, which occupies the western portion of the Delmarva Peninsula.

All of Delaware's natural gas supplies arrive by interstate pipeline from Pennsylvania, and about one-tenth of that natural gas is sent to Maryland's Eastern Shore on the western portion of the Delmarva Peninsula.

4.5.5 Natural Gas Map of Pipelines, Storage, Facilities, Processing Plants

As Delaware does not have any natural gas reserves or production, no storage or processing plants are available. Figure 34 below shows the natural gas pipelines throughout the state and illustrates the lack of natural gas storage or processing plants in-state.[15]

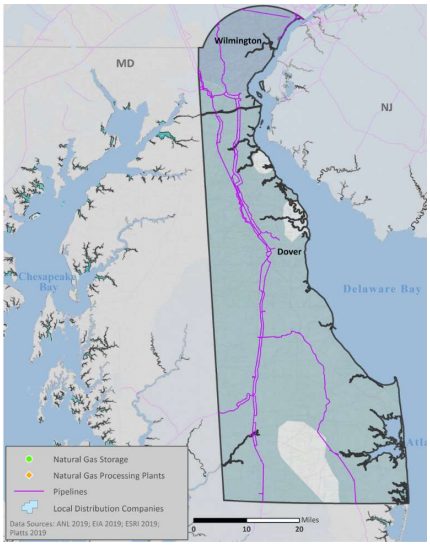

Figure 31: Local and Interstate Natural Gas Pipelines throughout Delaware

4.5.6 List of Key Natural Gas Pipelines

Delaware has limited natural gas pipelines which transit the state, with the transmission lines owned and operated by Chesapeake Utilities/Eastern Shore Natural Gas, which also serve Delmarva Power customers. Eastern Shore Natural Gas Company is Chesapeake Utilities' natural gas interstate transmission subsidiary. Eastern Shore owns and operates a 517 mile FERC regulated interstate transmission pipeline delivering gas from four upstream pipeline interconnection points in Pennsylvania and Delaware to customers along the Delmarva Peninsula, including Chesapeake's distribution systems. These lines interconnect out of state with other transmission lines in Pennsylvania owned by Transcontinental Gas. Texas Eastern Transmission LP is a transmission company connecting in northern Delaware and serving a power plant. This pipeline is part of an extensive 8,580 mile system running from the Gulf of Mexico to New York City.

4.5.7 Processing Plants

Delaware has no natural gas processing plants within state limits.

4.5.8 Natural Gas Trends

In Delaware, natural gas has been a significant part of the energy landscape, contributing to electricity generation and heating for residential and commercial sectors. Recent trends indicate a shift towards natural gas has as a preferred fuel, due to its lower emissions compared to coal and oil powered generation.

4.5.9 Description of State's Long-Term Electrification and Net-Zero Goals and

15 https://www.esng.com/about/our-pipeline-assets/#

Policies and Long-Term Impact Assessment on Natural Gas Sector

Delaware is adopting policies to promote increasing electrification in sectors such as transportation and heating to reduce greenhouse gas emissions and align with the state's climate goals. As electrification and efficiency measures increase, the demand for natural gas is predicted to decrease. Delaware has set ambitious goals to achieve long-term electrification and net-zero greenhouse gas emissions. This is driven by policies, such as the Delaware Climate Change Solutions Act of 2023 and the draft State Energy Plan, that are aimed at transitioning towards cleaner energy sources. These goals include increasing the number of electric vehicles, promoting the electrification of heating systems, and expanding the development of renewable energy sources. The demand for natural gas in the residential and commercial heating sectors could decline due to more buildings switching to heat pumps. Policies supporting these goals include incentives for renewable energy development, energy efficiency programs, and regulations that are aimed at reducing emissions from fossil fuels. Delaware's phased approach to electrification will require careful planning to ensure resource adequacy and grid stability, especially during periods of peak demand.

4.6 Liquid Fuels

4.6.1 Petroleum Products Consumption

Petroleum accounts for about 54% of the state's total energy consumption. The transportation sector is Delaware's largest petroleum consumer, accounting for 65.7% of the consumption in the state, primarily from motor vehicle gasoline usage. In 2022, the industrial sector accounted for 25.8% of petroleum usage in Delaware, with the residential and commercial sectors accounting for 4.6% and 2.8% respectively. Electric power accounts for the remaining ~1% of petroleum consumption.[16] Approximately one in five households use fuel oil or propane for heating fuel. Figure 32 shows Delaware's petroleum consumption by end-use.

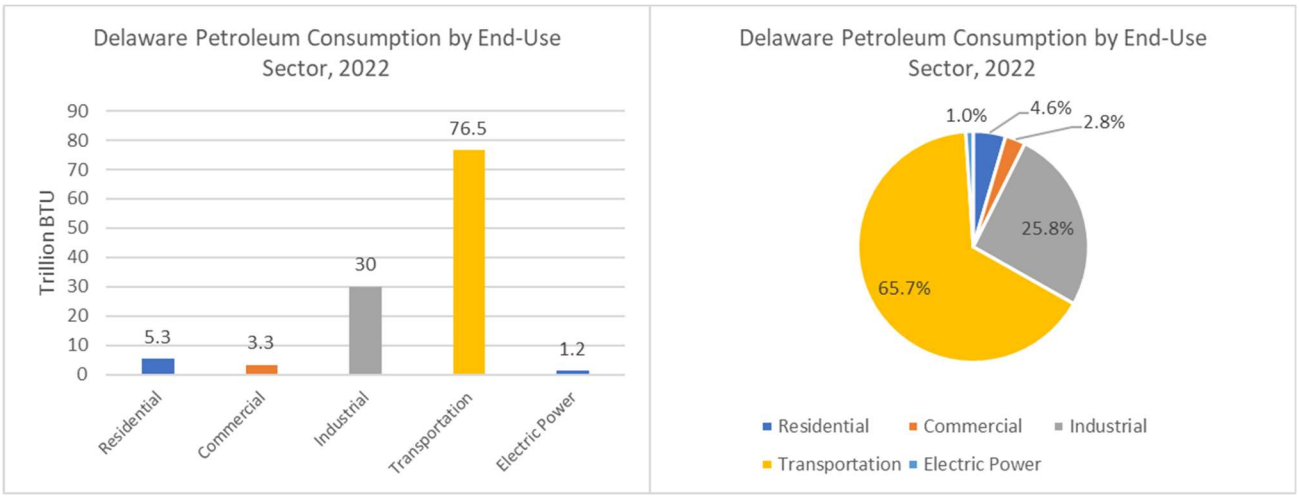

Figure 32: Petroleum Consumption by End-Use, 2022

4.6.2 Gasoline Products Consumption

Figure 33 shows the gasoline consumption across different end-use sectors in Delaware for the year 2022.

[16] https://www.eia.gov/state/analysis.php?sid=DE

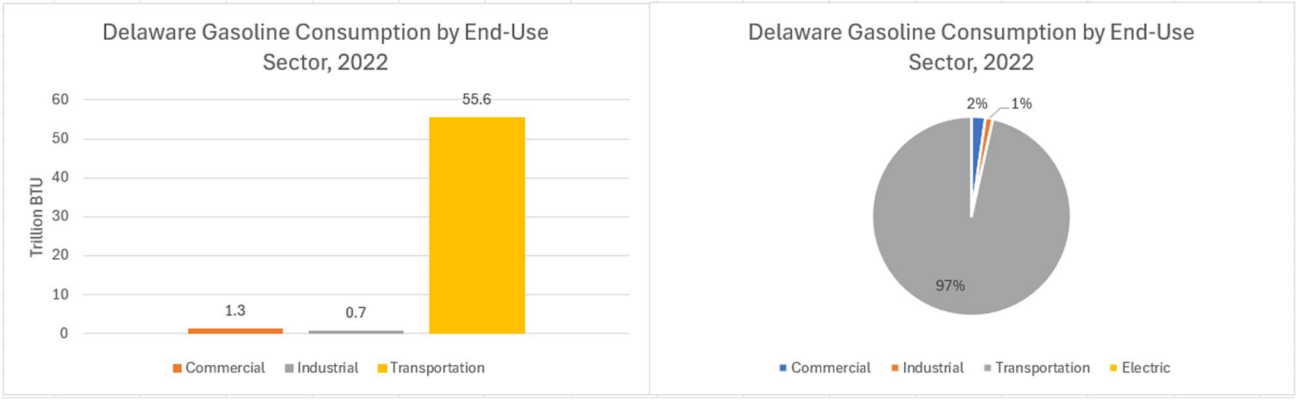

Figure 33: Gasoline Consumption by End-Use, 2022

The bar chart above illustrates the absolute consumption values in trillion BTUs for the commercial, industrial, and transportation sectors. The transportation sector dominates gasoline consumption, with a usage of 55.6 trillion BTUs, compared to 1.3 trillion BTUs for the commercial sector and 0.7 trillion BTUs for the industrial sector. The transportation sector accounts for 97% of total gasoline consumption, while the commercial and industrial sectors contribute 2% and 1%, respectively. This highlights the critical reliance of Delaware's transportation sector on gasoline, dwarfing the usage in other two sectors.

The transportation sector consists of all vehicles whose primary purpose is transporting people and/or goods from one physical location to another. Included are automobiles; trucks; buses; motorcycles; trains, subways, and other rail vehicles; aircraft; and ships, barges, and other waterborne vehicles. Vehicles whose primary purpose is not transportation (e.g., construction cranes and bulldozers, farming vehicles, and warehouse tractors and forklifts) are classified in the sector of their primary use.

4.6.3 Distillate Products Consumption

The consumption of distillate fuel across different end-use sectors in Delaware for the year 2022 are shown in Figure 34 below.

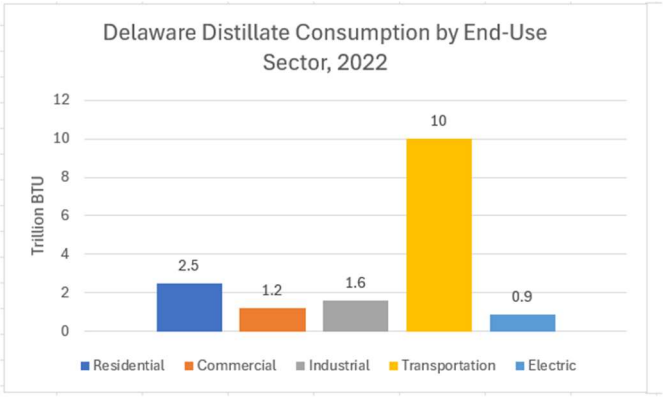

Figure 34: Distillate Consumption by End-Use, 2022

The bar chart displays the consumption values in trillion BTUs for the residential, commercial, industrial, transportation, and electric sectors. The transportation sector again emerges as the largest consumer of distillate fuel, with a consumption of 10 trillion BTUs. This is followed by the residential sector with 2.5 trillion BTUs, the industrial sector with 1.6 trillion BTUs, the commercial sector with 1.2 trillion BTUs, and the electric sector with 0.9 trillion BTUs.

4.6.4 Jet Fuel Products Consumption

Delaware is home to the Wilmington Airport (under the authority of the Delaware River and Bay Authority), Dover Air Force Base, and the Delaware Air and Army National Guards. The aviation sector in Delaware

consumed 9.8 trillion BTUs of jet fuel (1,730,000 barrels) in 2022, all of which was attributed to the transportation sector by EIA. The Dover Air Force Base consumes over 30 million gallons of jet fuel annually. The SEO does not have information regarding the Delaware Army National Guard or Delaware Air National Guard's fuel use.

4.6.5 Residual Fuel Oil Products Consumption

The consumption of residual fuel oil across different end-use sectors in Delaware for the year 2022 are shown in Figure 35.

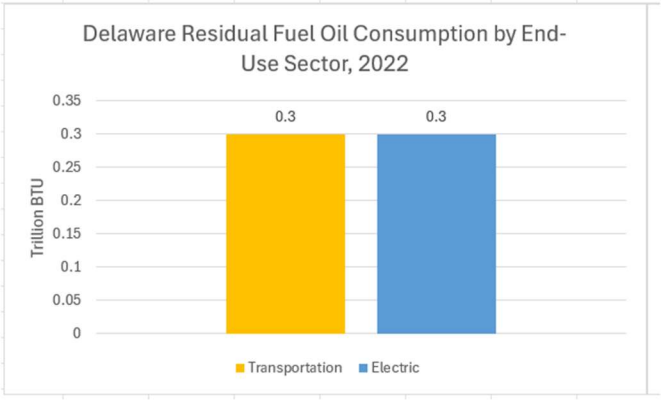

Figure 35: Residual Fuel Oil Consumption by End-Use, 2022

The bar chart shows that both the transportation and electric sectors each consumed 0.3 trillion BTUs of residual fuel oil. Residual fuel oil usage in Delaware is equally distributed between the transportation and electric sectors, indicating a balanced reliance on this fuel type for both transportation and electricity generation needs within the state.

4.6.6 Propane Products Consumption

The consumption of propane across different end-use sectors in Delaware for the year 2022 are shown in Figure 36 below.

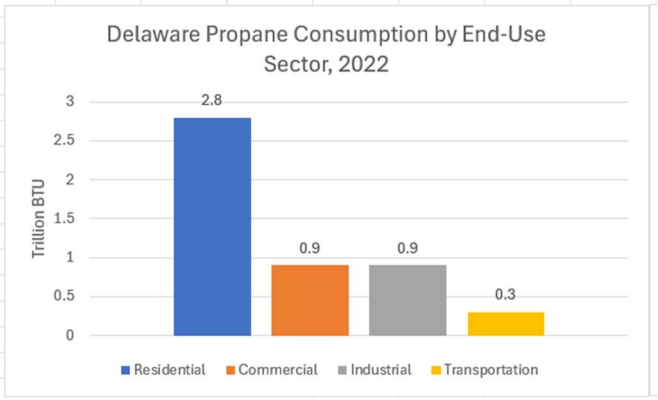

Figure 36: Propane Consumption by End-Use, 2022

The bar chart indicates that the residential sector is the largest consumer of propane, with a consumption of 2.8 trillion BTUs. The commercial and industrial sectors each consume 0.9 trillion BTUs, while the transportation sector uses 0.3 trillion BTUs. The residential sector accounts for 57% of the total propane consumption, while the commercial and industrial sectors each represent 19% of the consumption respectively, with the transportation sector accounting for 6%. These charts demonstrate that propane is primarily used for residential purposes in Delaware.

4.6.7 Petroleum Products Supply

Delaware does not produce crude oil and does not have any reserves. There is one petroleum refinery in the state as shown in figure below. The Delaware City Refinery had a 2022 delivery volume of 170,000 barrels per day. Exploratory wells were drilled off Delaware's coast to determine if economically significant deposits of oil or natural gas existed. Oil and gas deposits were found beneath the outer continental shelf 80 miles off the coast of Delaware and New Jersey; none were determined to be commercial deposits.

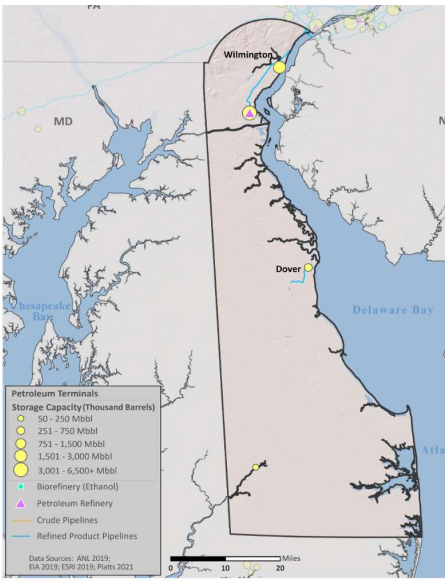

Figure 37: Petroleum Terminals in Delaware

4.6.8 EIA PADD Transportation Fuels Study Regional Infrastructure Map

Figure 38 below identifies regional petroleum and transportation fuels supply infrastructure outside of Delaware.

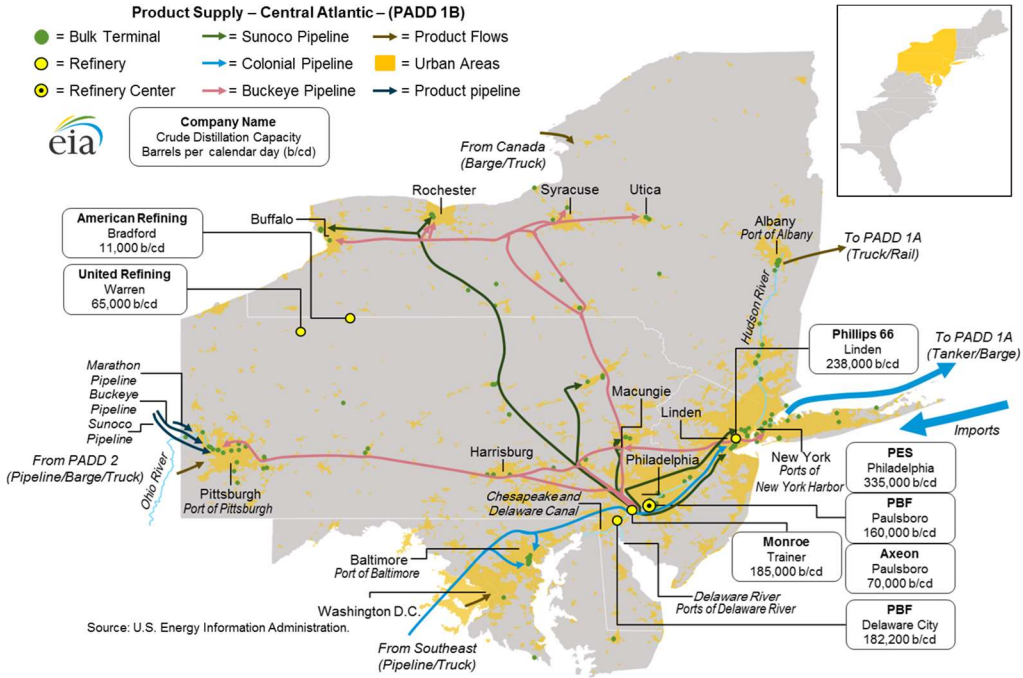

Figure 38: EIA - Petroleum and Transportation Fuels Supply, Central Atlantic Region

4.6.9 Crude Oil

The Port of Wilmington has a bulk petroleum terminal and storage depot that handles petroleum products. The Delaware City Refinery is the state's only crude oil refinery, processing approximately 170,000 barrels of oil per day, creating motor gasoline, heating oil, and other petroleum products as shown previously in Figure 41 above.

4.6.10 Petroleum Product Infrastructure

The Delaware City Refinery has a pipeline that sends refined products to Pennsylvania. Delaware has no transportation fuel pipelines within state lines. The Colonial Pipeline, which crosses through Pennsylvania is the nearest major petroleum pipeline.

The Port of Wilmington and the Delaware City Port are the ports used for crude and petroleum product delivery and shipment. The Dover Air Force Base receives fuel shipments via Port Mahon. The Buckeye Terminal in Wilmington is the only terminal in the state. Delaware does not have hydrocarbon gas liquid (HGL) pipelines crossing state limits.

4.6.11 Biofuels

There are three biofuel facilities located within Delaware as shown in Figure 15 (Section 4.4.6).

4.6.12 Liquid Fuels Trends

Delaware is adopting policies to promote increasing electrification in sectors such as transportation and heating to reduce greenhouse gas emissions and align with the state's climate goals. As electrification and efficiency measures increase, the demand for liquid fuels is expected to decrease. Delaware has set ambitious goals to achieve long-term electrification and net-zero greenhouse gas emissions. This is driven by policies, such as the Delaware Climate Change Solutions Act of 2023 and the draft State Energy Plan, that are aimed at transitioning towards cleaner energy sources. These goals include increasing the number of electric vehicles, promoting the electrification of heating systems, and expanding the development of renewable energy sources. The demand for liquid fuels in the transportation sector as well as the residential and commercial heating sectors could decline due to more individuals and organizations switching to electric vehicles and more buildings switching to heat pumps. Policies supporting these goals include incentives for renewable energy development, energy efficiency programs, and regulations that are aimed at reducing emissions from fossil fuels. Delaware's phased approach to electrification will require careful planning to ensure resource adequacy and grid stability, especially during periods of peak demand.

CHAPTER 5. RISK ASSESSMENT

5.1 Introduction

This risk assessment of Delaware's energy systems is intended to help stakeholders evaluate which system components are susceptible to disruptions and where to focus resources to reduce vulnerabilities. Delaware's energy landscape is characterized by a mix of traditional fossil fuel sources and renewable energy sources. The U.S. DOE defines risk as "the potential for loss, damage, or destruction of key resources or energy system assets resulting from exposure to a threat". Identifying risks associated with Delaware's energy landscape is crucial to ensuring energy security by evaluating and mitigating potential threats and vulnerabilities.

This section outlines the state's risk assessment of key energy infrastructure including key risks highlighted through in depth conversations with stakeholders. From this information, selected natural hazards are then assessed quantitatively, while additional threats are assessed qualitatively. By conducting risk assessments, energy providers across the state can identify potential risks to reliability, such as equipment failures, fuel supply disruptions, or extreme weather events, and take proactive measures to prevent or mitigate these risks. Discussion of energy sector interdependencies and other key considerations for Delaware are also included within this section.

5.2 Quantitative Assessment

The following quantitative risk assessment generates risk scores that are asset-specific and threat-specific for natural hazards that could impact Delaware. For example, a single electric, liquid fuel, or natural gas asset possesses separate risk scores for individual natural hazards (winter storm, flooding, extreme heat or cold, high winds, tropical cyclone, and wildfire). These risk scores are intended to be compared within a sector, such that electricity assets can be compared with other electricity assets, and likewise for natural gas and liquid fuels.

5.2.1 Methodology

The risk assessment is built on the following three components:

- **Exposure Score**: The exposure score estimates the probability or frequency of a specific disruptive event occurring at a specific location. This score is determined by overlaying hazard layers and energy infrastructure layers to determine an expected frequency of occurrence.
- **Vulnerability/Sensitivity Score**: This factor represents the susceptibility of the energy asset or system to be disrupted by the given hazard. Recognizing that a given event can have varying impacts, this score takes a range of outcomes and estimates the susceptibility for impact leveraging subject matter expertise.
- **Consequence Score**: This factor estimates the relative importance of the asset to energy supply and customers in Delaware and therefore the consequence to the state if the asset were to be offline due to a hazard.

For natural hazards, the risk score was calculated by multiplying the expected frequency of occurrence by the vulnerability score by the consequence score. The general function is expressed below:

$$Risk_{Asset} = Threat_{Asset\ Location} \times Vulnerability_{Asset\ Type} \times Consequence_{Asset}$$

The final risk scores can be used to assign energy assets a priority level. Threats that are not natural hazards (e.g., pandemic, cyberattack, equipment malfunction, etc.) have not been assessed using this quantitative

method. Instead, they are discussed qualitatively, informed by the State Energy Office (SEO)'s discussions with energy providers and subject matter experts across the state.

5.2.2 Overview of Natural Hazard Risks

The Delaware energy sector faces numerous natural hazards that could potentially disrupt operations, impact supply chains, and limit the system's ability to meet consumer demand. These threats include, but are not limited to storms, extreme heat waves, and flooding. The 2023 Delaware Hazard Mitigation Plan from the Delaware Emergency Management Agency (DEMA) informed the following list of natural hazard risks.[17]

1. **Flooding (Coastal)**: A coastal flood occurs because of a rise in sea level due to high tides, onshore winds, and/or atmospheric pressure. Coastal flooding can damage components and systems across electrical networks.
2. **Hurricane/Tropical Storm**: Hurricanes and tropical storms are rotating low-pressure storms with violent surface winds. Hurricanes and tropical storms can damage transportation infrastructure, such as highways, bridges, or vehicles, and impair energy networks.
3. **Flooding (Riverine)**: Riverine flooding occurs when rivers exceed their natural capacity and water spills out onto dry land. Riverine flooding can damage components and systems across electrical networks.
4. **Winter Storm (Snowstorm, Nor'easter, Blizzard)**: Winter storms, are storms that contain significant amounts of snow with strong winds. Delaware experiences winter storms, nor'easters, and blizzards that could impact energy distribution and demand.
5. **Ice Storm**: Ice storms are storms of freezing rain that leave a coating of ice. Ice storms can cause physical damage to energy infrastructure.
6. **Strong Winds**: Strong winds consist of damaging high-speed winds, often from thunderstorms. Strong winds can cause blackouts and more localized electricity supply disruptions when vegetation falls on wires and poles. Strong winds combined with wet snow or ice is also a common threat to electricity distribution in the Northeast.
7. **Lightning**: Lightning is a high voltage, electrostatic discharge of electricity in the atmosphere during storms. Lightning strikes can disrupt energy systems and cause damage, though usually not widespread.
8. **Tornado**: A tornado is a mobile, destructive vortex of violently rotating winds. Tornadoes can impact the electricity grid infrastructure, particularly power lines, as structures may be damaged due to the high wind speeds.
9. **Hail**: Hail occurs when pellets of frozen rain fall in showers from cumulonimbus clouds. Hail can cause physical damage to infrastructure, which can cause potential disruptions.
10. **Solar Radiation Storm**: Solar radiation storms occur when large quantities of charged particles are accelerated by processes at or near the sun. Solar radiation storms can cause damage to electrical components of energy systems and infrastructure.
11. **Extreme Cold (Cold Wave)**: Extreme cold, or cold waves, are periods of temperatures below freezing. Extreme cold can strain the energy sector with increased heating demands and potential operational difficulties experienced by fossil-fueled power plants – a heightened vulnerability with increased electrification efforts.
12. **Extreme Heat (Heat Wave)**: Extreme heat, or heat waves, are periods of high heat over a prolonged period. Heat waves are increasingly common and can greatly increase energy demand which may

[17] https://dema.delaware.gov/contentFolder/pdfs/HazardMitigationPlan.pdf

stress the power grid and lead to outages. Extreme heat for extended periods of time also pose a threat to vulnerable residents of urban areas with greater densities of heat absorbing buildings and roads referred to as the urban heat island effect.

13. **Drought**: Droughts are the deficiency of precipitation over a prolonged period. Droughts can have an indirect effect on energy production, especially for systems dependent on water resources.
14. **Dam Failure:** Dam failure is an uncontrolled release of water due to structural failures or damage to the dam itself. Dam failures are the result of accidental or unintentional collapse which can lead to catastrophic flooding downstream and damage to infrastructure.
15. **Wildfire and Smoldering Fire**: Wildfires are large destructive fires that spread quickly over woodland or brush. Smoldering fires are slow, low-temperature, flameless combustion, typically caused by wood coal and peat. Wildfires can cause physical damage to energy infrastructure and disrupt power services to customers.
16. **Local Earth Movement**: Local earth movement includes land subsidence, the gradual or sudden sinking of the earth; sinkhole, a depression in the ground with no natural drainage; and landslide, the movement of a mass of earth, debris, or rock down a slope. Local earth movement can cause structural damage to buildings or bridges and highways, impacting the ability to distribute energy effectively.
17. **Earthquake**: Shaking of the earth caused by seismic activity. Earthquakes can cause structural damage to buildings, bridges and highways impacting the ability to distribute energy effectively.

> DEMA is currently undertaking a threat hazard identification risk assessment for Delaware to evaluate several possible scenarios over the next three years through a stakeholder process.

5.2.3 Exposure Score

The exposure score indicates the likelihood of a natural hazard occurring in the same location as an energy asset. The criteria for scoring exposure were customized for each climate hazard. Geospatial Information Systems (GIS) were used to estimate the level of exposure that energy infrastructure is expected to have from natural hazards by overlaying hazard maps based on historical data onto energy infrastructure maps where available. A hazard exposure score was assigned to each energy asset by intersecting infrastructure asset locations with spatially distributed hazard data. For this analysis, we chose to normalize exposure using a scale of 0 to 5, representing low to high exposure, with "0" representing no exposure and "5" representing high exposure. The criteria for scoring exposure were customized for each natural hazard.

Hazard Layers			
Hazard	**Variable**	**Scoring Criteria**	**Data Source**
Coastal Flooding and Erosion	Inundation under different sea level rise scenarios	0 = [not used for this hazard] 1 = not inundated 2 = inundated in 2100 (3.2') 3 = inundated in 2075 (2') 4 = inundated in 2050 (1.1') 5 = inundated in 2035 (0.5')	FEMA NFHL (downloaded 2024) FEMA Flood Map Service Center
Tropical Cyclones (Hurricanes & Tropical Storms)	Peak gust wind speed during event equal to category 3 hurricane (0.2% annual chance, 500 years between landfall)	0 = [not used for this hazard] 1 = < 90 mph 2 = < 130 mph 3 = < 140 mph 4 = < 155 mph 5 = ≥ 155 mph	FEMA's Hazus Program v 6.0 https://www.fema.gov/flood-maps/productstools/hazus

Inland Flooding (Riverine, Storm, Flash)	A flood hazard zones map layer was downloaded from the FEMA National Flood Hazard Layer (NFHL) database. The flood zones were reclassified to "Flood Zone 100 Yr", "Flood Zone 500 Yr", or "N/A" for the hazards assessment	0 = [not used for this hazard] 1 = not in flood zone or not mapped 2 = only in 500- year zone only 3 = not applicable for this hazard 4 = not applicable for this hazard 5 = in 100- year zone	FEMA NFHL (downloaded 2024) FEMA Flood Map Service Center
Severe Winter Weather (Blizzard, Ice Storm, etc.)	The FEMA National Risk Index (NRI) Winter Weather layer measures Weather alerts from the NWS in annualized frequency of events with values ranging from 0 to 10.79026. Dataset is for the entire United States and includes winter weather/storm advisories for blizzard, heavy snow, lake effect snow and blowing snow, winter storm, and winter weather	0 = [not used for this hazard] 1 = not in risk zone 2 = low risk 3 = medium risk 4 = relatively high risk 5 = very high risk	FEMA NRI National Risk Index Annualized Frequency - Winter Weather
Severe Thunderstorms & Tornadoes	The FEMA National Risk Index (NRI) Lightning and Tornado layers measures the risk by looking at Expected Annual Loss, Social Vulnerability, and Community Resilience.	0 = [not used for this hazard] 1 = not in risk zone 2 = low risk 3 = medium risk 4 = relatively high risk 5 = very high risk	FEMA NRI National Risk Index Annualized Frequency - Lightning and Tornado
Extreme Temperatures (Heat & Cold)	The FEMA National Risk Index (NRI) Cold Wave layer measures the risk by looking at Expected Annual Loss, Social Vulnerability, and Community Resilience. The FEMA National Risk Index (NRI) Heat Wave layer measures the risk by looking at Expected Annual Loss, Social Vulnerability, and Community Resilience	0 = [not used for this hazard] 1 = not in risk zone 2 = low risk 3 = medium risk 4 = relatively high risk 5 = very high risk	FEMA NRI National Risk Index – Cold Wave FEMA NRI National Risk Index – Heat Wave
Drought	If in a drought risk zone, degree of risk	0 = [not used for this hazard] 1 = not in risk zone 2 = low risk 3 = medium risk 4 = relatively high risk 5 = very high risk	FEMA NRI National Risk Index – Drought
Dam/Levee Failure Flooding	If in a flood risk zone, degree of risk	0 = not inundated 1 = < 5 feet 2 = < 10 feet 3 = < 15 feet 4 = < 20 feet 4 = ≥ 20 feet	FEMA's Hazus Program v 6.0 https://www.fema.gov/flood-maps/productstools/hazus
Wildfire & Smoldering Fires	The FEMA National Risk Index (NRI) Wildfire layer measures the risk by looking at Expected Annual Loss, Social Vulnerability, and Community Resilience.	0 = [not used for this hazard] 1 = not in risk zone 2 = low risk 3 = medium risk 4 = relatively high risk 5 = very high risk	FEMA NRI National Risk Index – Wildfire
Local Earth Movement (Sinkholes & Landslides)	If in a landslide risk zone, degree of risk	0 = [not used for this hazard] 1 = not in risk zone 2 = low risk 3 = medium risk 4 = relatively high risk 5 = very high risk	USGS Landslide susceptibility maps
Earthquakes	Peak ground acceleration in 6.8 magnitude event	0 = [not used for this hazard] 1 = not in risk zone 2 = low risk 3 = medium risk 4 = relatively high risk 5 = very high risk	HAZUS Earthquake

The following infrastructure layers were identified based on the state's energy profile.

Infrastructure Layers		
Hazard	**Variable**	**Data Source**
Electricity Map		
Electric Power Transmission Lines	Transmission Lines are the system of structures, wires, insulators, and associated hardware that carry electric energy from one point to another in an electric power system. Lines are operated at voltages varying from 69 kV to 765 kV and can transmit electricity over long distances. Underground transmission lines are included where sources were available.	Geospatial Energy Mapper
Power Plants	Operable electric generating plants in the United States by energy source. This includes all plants that are operating on standby, or short- or long-term out of service with a combined nameplate capacity of 1 MW (Mega Watts) or more.	EIA Energy Atlas
Substations	Electricity substations filtered to the state.	Geospatial Energy Mapper
Natural Gas Map		
Natural Gas Interstate and Intrastate Pipelines	Natural gas interstate and intrastate pipelines in the United States. Based on various sources with varying scales and levels of accuracy. This layer is not visible if zoomed in beyond 1:1,000,000 scale.	Layer Information for Interactive State Maps (eia.gov)
Above Ground LNG Storage	Above ground LNG storage facilities by operator name.	HIFLD Above Ground LNG Storage
Gas Compressor Station	Locations of natural gas compressor stations by pipeline company	HIFLD - Natural Gas Compressor Stations
Liquid Fuels Map		
Product Pipelines	Petroleum pipelines in the state and their operators	Petroleum Product Pipelines | U.S. Energy Atlas (eia.gov)
Terminals	Petroleum terminals by company and city name	HIFLD – Terminal Map

5.2.4 Vulnerability/Sensitivity Score

The vulnerability score represents the sensitivity of Delaware's energy infrastructure to a given hazard, estimating the degree to which infrastructure may be impacted based on specific characteristics. For example, above-ground transmission lines are typically vulnerable to high winds and accompanying debris. However, underground assets, such as pipelines, are not likely to be directly impacted by high winds. As a result, even though a given transmission line and pipeline may be equally exposed to high winds, these two assets would receive different vulnerability scores (high and low, respectively).

The vulnerability score for each critical energy infrastructure asset was informed by information gathered from engagement with energy providers, available literature, and subject matter expertise. The tables below evaluate electricity, liquid fuel, and natural gas infrastructure categories against the environmental hazards. The vulnerability score is categorized as low, medium, or high according to the following sensitivities:

Rating	Sensitivities
Low (1)	Asset, operation, or system faces minimal potential adverse impact from this hazard
Low-Med (2)	Risk of complete failure is extremely unlikely; capacity/efficiency reductions are unlikely to occur or will be relatively minor
Medium (3)	Asset, operation, or system may be adversely affected by this hazard
Med-High (4)	Impacts are moderated by one or more factors, such as likely occurring as chronic/controlled rather than sudden/acute (e.g. accelerated degradation rather than catastrophic failure), or only being likely to occur at a high threshold of exposure (e.g. very high temperature or water level)
High (5)	Asset, operation, or system may be subject to increased risk of major and/or sudden failure in the event of hazard exposure.
	Asset has limited existing tolerance for exposure to this hazard

Error! Reference source not found.igures 2-3 summarize the energy infrastructure sensitivity matrix combining hazard layers and infrastructure layers.

Electricity	Coastal Flooding and Erosion		Tropical Cyclones (Hurricanes & Tropical Storms)		Inland Flooding (Riverine, Storm, Flash)		Severe Winter Weather (Blizzard, Ice Storm, etc.)		Severe Thunderstorms & Tornadoes		Extreme Temperatures (Heat & Cold)		Drought		Dam/Levee Failure Flooding		Wildfire & Smoldering Fires		Local Earth Movement (Sinkholes & Landslides)		Earthquakes	
	Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification
Solar Generation	2	Panels are generally positioned on elevated bases that raise them several feet above ground. Thus the panels themselves may not be sensitive to shallow flooding. However, solar arrays may experience direct damage to electrical equipment near ground level or sea erosion to module support structures due to flooding and erosion.	3	Commercial PV systems are typically designed to withstand wind <140mph, though extreme winds may damage PV panels or cause them to dissemble in very extreme cases. Damage to solar panels from high winds is rare. Additionally, flying debris may damage solar panels, though repair times are often faster compared to repairs for other energy infrastructure.	2	Panels are generally positioned on elevated bases that raise them several feet above ground. Thus the panels themselves may not be sensitive to shallow flooding. However, solar arrays may experience direct damage to electrical equipment near ground level or sea erosion to module support structures due to flooding and erosion.	3	Heavy accumulation of ice and snow can inhibit generation if panels remain covered. Accumulation of snow and ice can also stress a panel's support structure.	4	See Tropical Cyclones. Hailstones can crack or shatter solar panels, reducing their efficiency or rendering them inoperable.	2	Solar PV systems exposed to extreme heat and cold situations typically result in degraded efficiency and overall equipment lifetime. Extreme heat can lower the efficiency of solar cells and the capacity of conductors. The efficiency of crystalline silicon PV cells can fall 0.8% for every 1.8°F increase in ambient temperatures above 77°F.	1	Solar generation equipment is not typically sensitive to drought conditions	2	See Inland Flooding. Additionally, a dam or levee failure may result in a much faster and larger initial wave height impacting with the solar panel equipment bases, potentially resulting in panels being dislodged from their positions or even disconnecting completely and being swept away by the water.	4	Solar arrays are susceptible to damage from wildfires, as their construction is not typically fire resistant.	3	Solar panel mounts and supporting structures can be damaged by ground shifts. Landslides can damage panels and support structures. Sinkholes can cause immediate structural damage to solar panel mounts and supporting electrical infrastructure.	3	Earthquakes can cause physical damage to solar panels, including cracking, dislodging, or breaking of the panels. Inverters are sensitive to vibrations and mechanical shocks.
Wind Generation	2	Repeated flooding of the base of a turbine may cause corrosion over time.	5	Wind turbines are susceptible to damage from winds associated with extreme storms. Turbines shut off when wind speeds are greater than 55 mph and tend to have an upper threshold of 140 mph.	2	Onshore wind turbines are typically designed to withstand high loading and thus have low sensitivity to damage from floodwater movement. Repeated flooding of the turbine base may cause corrosion over time.	5	See Severe Thunderstorms & Tornadoes. Ice storms and winter events can cause icing to occur on turbine blades and subsequent shutdowns. In areas with more regular winter temperatures, turbines may be adapted to generate under extreme conditions.	5	Wind turbines are susceptible to damage from winds associated with extreme storms. Turbines shut off in winds greater than 55 mph and tend to have an upper threshold of 140 mph.	4	Turbines located in areas susceptible to colder temperatures are weatherized (equipped with cold weather gear making them less susceptible). Electrical components and machinery within a turbine are at risk of damage during extreme heat events. Lubrication oil in the gearbox can change viscosity in the heat and cause grinding of gears.	1	Wind turbines are not sensitive to drought conditions	2	See Inland Flooding. Additionally, a dam or levee failure may result in a much faster and larger initial wave height impacting with the equipment, potentially resulting in structual damage due to high shear loads.	4	Fires can damage wind turbines. Smoke and ash from fires can impair the funtioning of wind turbines by accumulating on blades and other components, which can lead to mechanical issues due to decreased aerodynamic efficiency.	3	Instability, caused by sinkholes, can undermine the foundation of wind turbines. Landslides can cause deformation or damage to wind turbines, affecting its ability to operate safely.	3	Wind turbines are susceptible to seismic activity due to their height and loads experienced during operation. Earthquakes can cause structural damage to the turbine towers and blades, resulting in misalignment, cracking, or collapse.
Batteries	4	Batteries exposed and/or inundated with sea water may be damaged. Rising seas and groundwater levels may also affect soil water content and soil stability. Destabilized or eroded soil could destabilize the foundation of a transformer or other battery equipment. However, batteries are often housed within facilities that limit exposure to potential flood waters.	2	See Coastal Flooding and Erosion for water impacts. Batteries typically have very low sensitivity to high winds, or are housed within facilities that limit exposure. Batteries are also often located within fences and components are housed within walls.	4	See Coastal Flooding and Erosion. Batteries contain equipment that can be very sensitive to water damage. Exposure to flood water can lead to corrosion, and both immediate and prolonged equipment damage.	2	Cold temperatures can reduce the efficiency and capacity of batteries. Ice accumulation and heavy snow can physically damage battery enclosures and associated infrastructure, potentially leading to system malfunctions or failures. However, batteries are typically installed in facilities that are protected from weather.	2	Batteries typically have very low sensitivity to high winds, or are housed within facilities that limit exposure. Batteries are also often located within fences and components are housed within walls, protecting assets from flying debris.	2	Cold temperatures can reduce the efficiency and capacity of batteries. High temperatures can accelerate the chemical reactions within batteries, leading to thermal degradation and a reduction in energy storage capacity. Overheating can cause battery cells to swell, leak, or even pose fire hazards, especially in lithium-ion batteries.	2	Batteries are not typically sensitive to drought conditions. Utility scale batteries that rely on water-source cooling systems, could overheat and shut down without sufficient water supply.	3	Flooding resulting from dam and levee failure may move at a faster speed and cause greater structural impacts compared to other storm-related floodwaters. Dam failure floodwaters may displace or damage assets that are typically designed to withstand other storm-related floodwaters.	4	Batteries in energy storage systems can suffer from thermal damage when exposed to high temperatures. Wildfires can cause temperatures to rise significantly, which could lead to overheating in batteries. Direct exposure to fires can damage the battery casing and internal components, which leads to the leakage of hazardous materials, reduced performance, or complete failure of the battery system.	3	Damage to the area around a battery storage systems can disrupt electrical connections and cabling. This can lead to short circuits, power outages, or damage to critical components.	3	Earthquakes can cause structural damage to battery storage systems and facilities. Seismic activity could disrupt electrical wiring and connections within battery systems.
All Other Generation	3	Flooding can result in water entry into electrical equipment, with potential to cause electrical faults or corrosion, resulting in significant damage.	2	Power plant structures are generally designed to withstand high winds and are unlikely to sustain significant damage. Some components, such as transformers and transmission lines on the plant site, may be damaged directly by extreme winds or wind-driven debris.	3	Flooding can result in water damage to electrical equipment, with potential to cause electrical faults or corrosion. Storm surge may also physically displace equipment, causing damage.	2	Equipment and instrumentation may freeze under extreme conditions, causing operational failures. Accumulation of ice may impede transportation to and from the facility.	2	See Inland Flooding for storm water impacts. Power plant structures are generally designed to withstand high winds and are unlikely to sustain significant damage. Some power plants components, such as transformers and transmission lines on the plant site, may be damaged directly by extreme winds or wind-driven debris.	1	Equipment may freeze under extreme conditions and fail. Substation transformers are the most vulnerable units to heat waves. Prolonged exposure to extreme heat and increased peak load due to customer cooling needs can marginally increase the risk of failure and reduce a transformer's lifespan.	1	Generation equipment is typically not sensitive to drought conditions. Cooling ponds maybe impacted in prolonged droughts that may impact power plant operations.	2	In addition to the impacts described in the flooding column, dam failures can create a stronger hydrodynamic force upon impact, threatening the structural integrity of generation assets and facilities	4	Electrical components in generation equipment is vulnerable to fires and significant heat. Transformers, wiring, and control systems can be damaged by fires.	2	Ground collapse or shifting around a generator can impact the mechanical components and electrical connections. Operational failures and electrical shortages can happen as a result.	2	Generation equipment can experience mechanical failures and reduced performance as a result of earthquakes. Internal damage to engine components could lead to operational disruptions.
Substations	4	Frequent or permanant flooding of substations may result in damage, corrosion from salt water, accelerated aging, and/or equipment de-energizing. It is unlikely that a substation would be able to continue to function if permanantly flooded. Rising seas and groundwater levels may also affect soil water content and soil stability. Destabilized or eroded soil could destabilize the foundation of a transformer or other substation equipment. Soil with higher water and salt concentrations could cause corrosion of underground equipment such as grounding grids, cables, and conduits.	3	Flooding of electrical equipment may cause electrical faults or corrosion, resulting in significant damage. Storm surge may also physically displace equipment, causing damage. Substations often experience low wind load or are housed in cabinets that limit wind exposure, resulting in low sensitivity to high winds.	4	Substations contain equipment sensitive to water exposure and flood-related debris. Water damage can cause corrosion as well as equipment damage. Since transformer tanks are hermetically sealed, flooding is unlikely to impact the transformer windings and other interior components. However, flooding may impact the transformer's control cabinet, radiators, fans, pumps, external wiring connections, and other accessories. Control rooms are particularly sensitive to flooding. Flooding of a substation is a significant enough threat that utilities may consider de-energizing equipment to limit damage.	2	Substation equipment may freeze under extreme conditions. Downed powerlines may also inhibit a plant's operations.	2	Substations often experience low wind load or are housed in cabinets that limit wind exposure, resulting in low sensitivity to high winds. Unprotected equipment, such as the bus system, may be damaged by flying debris, although substations are protected by fences or walls.	1	Substation equipment may freeze under extreme conditions. Transformers are the most vulnerable units to heat waves within a substation. Prolonged exposure to extreme heat and increased peak load due to customer cooling needs can marginally increase the risk of failure and reduce a transformer's lifespan.	1	Substations are not sensitive to drought conditions	2	Dam and Levee Failure flooding may move at a faster speed and cause greater structural impacts compared to other storm-related floodwaters; for example, dam failure floodwaters may displace or damage assets that are typically designed to withstand other storm-related floodwaters.	4	Extreme temperatures from wildfires can damage electrical components, such as transformers and circuit breakers, which can lead to failures or fires.	2	Landslides can expose substations to physical damage and hazardous conditions. Ground shifts can also block or damage access routes, increasing the difficulty of transporting repair equipment and personnel, which can hinder maintenance.	2	Earthquakes can cause structural damage to substations. Transformers can experience mechanical failures, oil leaks, or foundational issues.
Transmission Lines (Overhead)	4	Erosion and scouring of the ground near pole bases may lead to damage. If structures are not designed to be inundated, long-term saline inundation is likely to result in corrosion, and access for maintenance or repairs could be restricted.	5	Although transmission towers and conductors are typically designed to withstand high-speed winds, very intense wind speeds, such as those in hurricane categories 3-5, can damage towers and potentially lead to tower failure. Debris from high-speed winds can damage lower voltage transmission lines.	2	Overhead lines typically have low sensitivity to flooding unless floodwaters compromise the structural integrity of a tower. Structural impacts could be greater from moving water.	3	Ice can accumulate on power lines, increasing their vulnerability to high winds and breakage. Snow and ice can also cause tree branches to break, damaging lines.	3	Overhead lines typically have low sensitivity to storm waters unless floodwaters compromise the structural integrity of a tower. Structural impacts could be greater from moving water. While transmission towers and conductors are designed to withstand high winds, extreme high winds, such as tornadoes of EF-1 and above, can damage towers. Debris from high winds can also damage transmission lines.	2	Cold temperatures in themselves do not cause power line failures. Heat waves most significantly impact overhead transmission lines due to line sag when operating at peak load and under higher ambient temperatures. Sagging lines may contact vegetation causing short circuits. Higher ambient temperatures can also reduce the capacity of lines.	1	Overhead equipment is not sensitive to drought conditions	2	While flooding from dam and levee may move at a faster speed and cause greater structural impacts compared to other storm-related floodwaters, transmission towers are designed to withstand this type of water movement.	4	Transmission lines can spark and ignite fires if they come into contact with burning vegetation or damage from high winds. Equipment failure from damaged components can lead to power outages and further fire risks if the system fails or lines fall to the ground.	3	Land movements can cause issues to the ground beneath transmission towers, which can lead to tilting, collapse, or power failure. This instability can result in downed lines or disruptions of power supply.	3	Transmission lines can shift or sag, increasing the risk of line faults or outages due to potential contact with trees, structures, or other obstacles.
Transmission Lines (Underground)	2	Underground transmission lines along coastlines could be subject to increased saline water exposure. Over time, this increased saltwater exposure can corrode underground systems, resulting in decreased asset reliability and lifespan. Permanent submersion of underground transmission conductors due to flooding may impede access for maintenance or restoration activities. Additionally, if the ground around an underground line erodes or soil shifts due to sea level rise and coastal erosion, it could destabilize or cause the line to move, potentially causing damage.	1	Underground equipment is not typically sensitive to direct impacts from severe hurricane or storm events.	1	Underground transmission systems are typically designed to withstand surface flooding. However, in extreme flood events, heavily inundated soil can have reduced load-bearing capacity, which may cause damage to underground transmission assets.	1	Underground equipment is not typically sensitive to direct impacts from severe winter weather events.	1	See Inland Flooding for storm water impacts. Underground conductors are typically protected from wind and thunderstorm strikes.	1	Underground equipment is not sensitive to extreme temperature events	1	Underground equipment is not sensitive to drought conditions	1	Underground lines are typically not sensitive to dam failure conditions unless severe erosion scouring occurs.	2	Wildfires can alter soil conditions and expose underground cables and infrastructure.	2	Shifting soil can crush or sever underground cables, leading to power outages and safety hazards.	2	Earthquakes can crush or sever underground cables, leading to power outages and safety hazards.
Distribution Lines (Overhead)	4	Pole rot from saltwater exposure may compromise the structural integrity of distribution lines. Additionally, erosion and scouring of the ground near pole bases may lead to damage. If structures are not designed to be inundated, long-term saline inundation is likely to result in corrosion, and access for maintenance or repairs could be restricted.	5	Although distribution poles and conductors are typically designed to withstand high-speed winds, very intense wind speeds, such as those in hurricane categories 3-5, can damage towers and potentially lead to tower failure. Debris from high-speed winds can damage lower voltage transmission lines.	3	Overhead lines typically have low sensitivity to flooding unless floodwaters compromise the structural integrity of a pole. Structural impacts could be greater from moving water.	5	Ice can accumulate on power lines, increasing their vulnerability to high winds and breakage. Snow and ice can also cause tree branches to break, damaging lines.	5	Overhead lines typically have low sensitivity to storm waters unless floodwaters compromise the structural integrity of a pole. Structural impacts could be greater from moving water. While distribution equipment is designed to withstand high winds, extreme high winds, such as tornadoes of EF-1 and above, can damage towers. Debris from high winds can also damage distribution systems.	3	Cold temperatures in themselves do not cause power line failures. Heat waves most significantly impact overhead distribution lines due to line sag when operating at peak load and under higher ambient temperatures. Sagging lines may contact vegetation causing short circuits. Higher ambient temperatures can also reduce the capacity of lines.	1	Overhead equipment is not sensitive to drought conditions	3	Flooding from dam and levee failure may move at a faster speed and cause greater structural impacts compared to other storm-related floodwaters. Dam failure floodwaters may displace or damage assets that are typically designed to withstand other storm-related floodwaters.	5	Distribution lines can spark and ignite fires if they come into contact with burning vegetation or damage from high winds. Wooden poles can also burn in a fire. Equipment failure from damaged components can lead to power outages and further fire risks if the system fails or lines fall to the ground.	4	Land movements can cause issues to the ground beneath distribution poles, which can lead to tilting, collapse, or power failure. This instability can result in downed lines or disruptions of power supply.	4	Distribution lines can shift or sag, increasing the risk of line faults or outages due to potential contact with trees, structures, or other obstacles.
Distribution Lines (Underground)	2	Underground distribution lines along coastlines could be subject to increased saline water exposure. Over time, this increased saltwater exposure can corrode underground systems, resulting in decreased asset reliability and lifespan. Permanent submersion of underground distribution conductors due to flooding may impede access for maintenance or restoration activities. Additionally, if the ground around an underground line erodes or soil shifts due to sea level rise and coastal erosion, it could destabilize or cause the line to move, potentially causing damage.	1	Underground equipment is not typically sensitive to direct impacts from severe hurricane or storm events.	1	Underground distribution systems are typically designed to withstand surface flooding. However, in extreme flood events, heavily inundated soil can have reduced load-bearing capacity, which may cause damage to underground distribution assets.	1	Underground equipment is not typically sensitive to direct impacts from severe winter weather events.	1	See Inland Flooding for storm water impacts. Underground conductors are typically protected from wind and thunderstorm strikes.	1	Underground equipment is not sensitive to extreme temperature events	1	Underground equipment is not sensitive to drought conditions	1	Underground lines are typically not sensitive to dam failure conditions unless severe erosion scouring occurs.	3	Wildfires and smoldering can alter soil conditions and expose underground wires and infrastructure.	3	Shifting soil can crush or sever underground wires, leading to power outages and safety hazards.	3	Earthquakes can crush or sever underground wires, leading to power outages and safety hazards.

Figure 1: Electricity Infrastructure Sensitivity Matrix

Natural Gas	Coastal Flooding and Erosion		Tropical Cyclones (Hurricanes & Tropical Storms)		Inland Flooding (Riverine, Storm, Flash)		Severe Winter Weather (Blizzard, Ice Storm, etc.)		Severe Thunderstorms & Tornadoes		Extreme Temperatures (Heat & Cold)		Drought		Dam/Levee Failure Flooding		Wildfire & Smoldering Fires		Local Earth Movement (Sinkholes & Landslides)		Earthquakes	
	Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification
Gas Production Facilities	4	Flooding can result in water entry into electrical components, causing electrical faults and/or displacing equipment. External power loss can halt operations for electric-driven compressors.	4	Flooding can result in water entry into electrical components, causing electrical faults and/or displacing equipment. External power loss can halt operations for electric-driven compressors.	4	Flooding can result in water entry into electrical components, causing electrical faults and/or displacing equipment. External power loss can halt operations for electric-driven compressors.	4	Ice and snow may inhibit operations at stations or even damage equipment. Freezing of entrained water can damage pipes, leading to leakage and shutdown. Additionally, ice and snow can block access for inspecting pipes and making repairs. External power loss can halt operations for electric-driven compressors.	4	High wind speeds and debris may damage buildings and structures that could cause damage to unprotected equipment by toppling processing units.	2	Equipment may freeze under extreme conditions. Refineries are unlikely to be impacted by extreme heat conditions. Winterizing is a regular part of refinery operations.	1	Production equipment is typically not sensitive to drought conditions except for water-sourced cooling requirements.	3	See Inland Flooding. Damage from dam failures is more likely to be caused by debris impacting the facility carried in the flood waters.	5	Wildfires can ignite equipment or structures, leading to explosions or fires.	3	Ground shifts and movement can lead to structural failure of storage tanks and processing units. Misalignment and structural damage can also occur.	3	Earthquakes can cause structural damage to buildings and infrastructure, including cracking or collapsing of walls, roofs, and support structures.
Pipelines	3	Pipelines are typically designed to withstand water inundation. However, rising seas and groundwater levels may affect soil water content, soil stability, and the distribution of soil over a pipeline, which could destabilize or damage pipes.	2	Pipelines are typically designed to be resilient to flooding or water inundation and thus have low sensitivity to flood-related impacts. Most pipelines are located underground and protected from high winds	2	Pipelines are typically constructed to withstand water inundation. Some low-pressure distribution piping can have an elevated risk of water intrusion, but this is less of a concern in transmission pipelines. Heavy precipitation can cause soil to shift, leading to pipeline ruptures.	2	Often, pipelines are buried well below frozen ground. However, pipeline operation is likely stalled due to cold-related failures at supporting pump stations and plants.	1	Most pipelines are located underground and protected from high winds and rain.	2	Pipeline capacity can be constrained during the coldest winter months. Heat waves typically have very little impact on pipelines	1	Pipelines are not sensitive to drought conditions.	2	Pipelines are typically constructed to withstand water inundation. Some low-pressure distribution piping can have an elevated risk of water intrusion, but this is less of a concern in the transmission pipelines. Heavy precipitation can cause soil to shift, leading to pipeline ruptures.	2	The heat and flames from a wildfire can damage or weaken facility structures, including pipelines, storage tanks, and control systems.	3	The formation of sinkholes can expose and damage underground pipelines used for transporting gas from production sites. The sudden movement can cause pipelines to rupture or collapse, leading to leaks, spills, or explosions.	3	Seismic activity can cause ruptures or leaks in pipelines. Leaks pose significant safety risks, including explosions or fires.
Transportation	2	Roads are sensitive to coastal flooding and erosion and trucks are limited in the types of roads they are allowed to drive on.	2	Roads are sensitive to coastal flooding and erosion and trucks are limited in the types of roads they are allowed to drive on.	2	Roads are sensitive to inland flooding and trucks are limited in the types of roads they are allowed to drive on.	2	Roads may be shut down in the case of extreme weather. If a statewide emergency is declared, fuel waivers may be available although road conditions may not be favorable.	2	Most trucks and storage tanks are designed to withstand thunderstorm conditions. In extreme cases, trucks may be lifted by high winds in a tornado.	1	Trucks and storage tanks are typically designed to withstand extreme temperatures.	1	Trucks and storage tanks are not sensitive to drought conditions.	2	Roads are sensitive to inland flooding and trucks are limited in the types of roads they are allowed to drive on.	2	Wildfires and smoldering fires may cause road closures. Trucks are limited in the types of roads they are allowed to drive on.	2	Landslides and sinkholes may cause road closures. Trucks are limited in the types of roads they are allowed to drive on.	2	Seismic activity may cause road closures. Trucks are limited in the types of roads they are allowed to drive on.

Figure 2: Natural Gas Infrastructure Sensitivity Matrix

Petroleum	Coastal Flooding and Erosion		Tropical Cyclones (Hurricanes & Tropical Storms)		Inland Flooding (Riverine, Storm, Flash)		Severe Winter Weather (Blizzard, Ice Storm, etc.)		Severe Thunderstorms & Tornadoes		Extreme Temperatures (Heat & Cold)		Drought		Dam/Levee Failure Flooding		Wildfire & Smoldering Fires		Local Earth Movement (Sinkholes & Landslides)		Earthquakes	
	Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification	Score	Justification
Refinery	4	Flooding can result in water entry into electrical equipment, with potential to cause electrical faults or corrosion, resulting in significant damage. Flooding can also cause water composition to change in dangerous ways. If the ground underneath a refinery facility shifts or erodes due to coastal erosion and sea level rise, it could destabilize the structure.	5	Hurricanes can cause flooding, which can result in water entry into electrical components, causing electrical faults, and displacing equipment, potentially forcing the refinery to stop operations. Hurricane wind speeds and flying debris may damage buildings and structures in a refinery, causing damage to unprotected equipment by toppling processing or storage units.	4	Flooding can result in water entry into electrical components, which may cause electrical faults and displace equipment, potentially forcing the refinery to stop operations. Fast-moving floodwaters may move with force that can damage equipment. Flooding can also cause water composition to change in dangerous ways.	3	Equipment and instrumentation may freeze under extreme conditions, causing operational failures. Most refineries in cold climates have seasonal winterization processes to avoid these disturbances. Accumulation of ice and snow can limit access to facilities, feedstocks, and storage equipment, as well as impair rail movements to markets.	3	High wind speeds may damage buildings and structures in a refinery. They could cause damage to unprotected equipment by toppling processing or storage units, or from debris carried by high winds.	1	Equipment may freeze under extreme conditions; however, regular winterization processes help to lessen the chances of equipment freezing. Refineries are unlikely to be impacted by extreme heat conditions	1	Refinery equipment is typically not sensitive to drought conditions except for water-sourced cooling requirements.	4	See Inland Flooding. Damage from dam failures is more likely to be caused by debris impacting the facility carried in the flood waters.	5	Wildfires can ignite equipment or structures, leading to explosions or fires.	3	Ground shifts and movement can lead to structural failure of storage tanks and processing units. Misalignment and structural damage can also occur.	3	Earthquakes can cause structural damage to buildings and infrastructure, including cracking or collapsing of walls, roofs, and support structures.
Pipelines	3	If the ground around a section of pipeline shifts or erodes due to coastal erosion and sea level rise, it could destabilize and/or cause a rupture in the pipeline.	2	Petroleum pipelines are typically designed to be resilient to flooding or water inundation and thus have low sensitivity to flood-related impacts. Most petroleum pipelines are located underground and protected from high winds	1	Petroleum pipelines are typically designed to be resilient to flooding or water inundation, and thus have low sensitivity to flood-related impacts	1	Most petroleum pipelines are located underground and protected from winter weather.	1	Most petroleum pipelines are located underground and protected from high winds	2	Pipelines may experience freezing, disrupting product flow and potentially cracking pipes. Likely, pipeline operation is stalled due to cold-related failures at supporting pump stations and plants. Heat waves typically have very little impact on pipelines	1	Pipelines are not sensitive to drought conditions.	1	Dam and levee failure are unlikely to affect pipelines.	2	The heat and flames from a wildfire can damage or weaken facility structures, including pipelines, storage tanks, and control systems.	3	The formation of sinkholes can expose and damage underground pipelines used for transporting fuels from production sites. The sudden movement can cause pipelines to rupture or collapse, leading to leaks, spills, or explosions.	3	Seismic activity can cause ruptures or leaks in pipelines. Leaks pose significant safety risks, including explosions or fires.
Ports	4	Coastal ports could be rendered unusable due to severe structural and equipment damage from sea level rise-related flooding. Additionally, coastal erosion can cause the displacement of the soil underneath the port structure.	5	Hurricanes can cause flooding, which can result in water entry into electrical components, causing electrical faults, and displacing equipment, potentially forcing the refinery to stop operations. High winds and associated debris may damage dock facilities, buildings, and unprotected equipment such as cranes and trailers.	1	Petroleum ports are commonly reinforced with concrete foundations and can generally withstand large shear loads. In addition, floors are raised above road level and can withstand some tsunami-like inundation.	4	Ice or heavy snowfall can cause ports to close or operate at lower capacity which can create congestion, delay voyages, and cause operational disruption.	3	See Tropical Cyclones. High winds and associated debris may damage dock facilities and unprotected equipment.	2	Equipment and port access may freeze under extreme conditions. Terminals are unlikely to be impacted by extreme heat conditions	1	Ports are typically not sensitive to drought conditions.	1	Petroleum ports are commonly reinforced with concrete foundations and can generally withstand large shear loads. In addition, floors are raised above road level and can withstand some tsunami-like inundation. Damage from dam failures is more likely to be caused by debris impacting the facility carried in the flood waters.	5	Ports handle fuels, chemicals, and cargo. Direct exposure to wildfire flames can ignite these materials, leading to fires or explosions. Intense heat from wildfires can damage port infrastructure, including loading docks, warehouses, and storage tanks.	3	Earth movements, such as sinkholes and landslides, can impact the ground in and around port facilities. This can undermine critical infrastructure such as docks, cranes, and storage areas.	3	Buildings and infrastructure at ports may suffer from structural damage, leading to operational disruptions. Damage to ports can hinder the movement of fuels and impact the overall efficiency of the port.
Terminals	4	Flooding can result in water entry into electrical equipment, with potential to cause electrical faults or corrosion, resulting in significant damage. Additionally, soil displacement from coastal erosion can destabilize structures.	3	High winds and associated debris may damage terminal facilities and unprotected equipment. Generally, terminals are less vulnerable than refineries.	4	Flooding can result in water entry into electrical equipment, with potential to cause electrical faults or corrosion, resulting in significant damage.	3	Equipment and instrumentation may freeze under extreme conditions, causing operational failures. Accumulation of ice and snow may impede transportation to and from the facility.	3	High winds and associated debris may damage terminal facilities and unprotected equipment. Generally, terminals are less vulnerable than refineries.	2	Equipment may freeze under extreme conditions. Terminals are unlikely to be impacted by extreme heat conditions	1	Terminals are typically not sensitive to drought conditions.	2	Dam and Levee Failure flooding may move at a faster speed and cause greater structural impacts compared to other storm-related floodwaters; for example, dam failure floodwaters may displace or damage assets that are typically designed to withstand other storm-related floodwaters.	5	Direct exposure to wildfire flames can ignite fuels, leading to fires or explosions. Intense heat from wildfires can damage terminal infrastructure, including equipment, buildings, and loading docks.	2	Sinkholes and landslides can impact the land beneath terminal infrastructure.	2	Buildings and infrastructure at terminals may suffer from structural damage, leading to operational disruptions. Damage to terminals can hinder the movement of fuels and impact the overall efficiency of the terminal.

Figure 3: Liquid Fuels Infrastructure Sensitivity Matrix

5.2.5 Consequence Score

Consequence is defined as the magnitude of impact experienced in the event of a hazard negatively affecting an asset. To identify the highest consequence assets within Delaware, this risk assessment uses publicly available data, data collected by state agencies, and a high-level quantitative screening that considers the overall market share served in the state and the number and size of supply alternatives within a specific region. Elements of system assets not captured by the quantitative approach were assessed by subject matter experts based on review of available utility planning documents, discussions with energy providers, and other relevant materials. Energy utilities and system operators regularly assess the ability of their assets to provide energy services under peak-day and peak-hour conditions, and under various contingency scenarios.

Different types of energy (electricity, petroleum, or natural gas) serve different sectors of society and will have different secondary consequences.

- **Electricity**: Because electricity is essential for the operation of most lifeline sectors, such as healthcare, emergency services, and water; electricity outages typically have the largest overall secondary consequences. Widespread electricity outages may also have cascading impacts on the petroleum and natural gas sectors, since pipeline infrastructure, including pumping stations, distribution terminals, and retail fuel stations all rely on electricity for operations.
- **Petroleum**: Petroleum outages primarily impact the transportation sector.
- **Natural Gas**: Natural gas outages primarily impact cooking, heating, electricity generation, and industrial processes.

Electricity is the dominant source of energy across the state. This risk assessment analysis will solely focus on the electric sector. Electricity assets were given a consequence score following the criteria laid out below for generators.

A list of generators was derived utilizing EIA's Form 860 and Form 923 data. The annual generation of each plant was then used to estimate the relative importance of the generators.

"High" consequence scores were given to generators with over 5% of the state's generation, with the scoring determined as follows:

- Generators with over 20% of the state's generation was given a score of 100
- Generators with over 10% of the state's generation was given a score of 90
- Generators with over 5% of the state's generation was given a score of 80

"Medium" consequence scores were given to generators with over 2% of the state's generation, with the scoring determined as follows:

- Generators with over 4% of the state's generation was given a score of 70
- Generators with over 3% of the state's generation was given a score of 60
- Generators with over 2% of the state's generation was given a score of 50

"Low" consequence scores were given to generators with under 2% of a given state's generation, with the scoring determined as follows:

- Generators with over 1% of the state's generation was given a score of 40
- Generators with over 0.5% of the state's generation was given a score of 30

- Generators with over 0.1% of the state's generation was given a score of 20
- All other generators were given a score of 10

Consequence Score	Generators	Other Infrastructure Types
	Amount of Generation	Priority Score
100	> 20%	High
90	> 10%	
80	> 5%	
70	> 4%	Medium
60	> 3%	
50	> 2%	
40	> 1%	Low
30	> 0.5%	
20	> 0.1%	
10	0%	

Table 1: Generator Consequences Scoring Table

Plant Name	Net Generation (MWh)	Consequence Score
Hay Road	504,015	100
Delaware City Plant	443,443	100
Garrison Energy Center LLC	265,041	90
ENGIE Solidago Solar Project - Hybrid	35,994	50
Indian River Generating Station	29,492	40
Energy Center Dover	22,384	40
Warren F Sam Beasley Generation Station	8,081	30
Milford Solar Farm	6,450	10
Dover Sun Park	4,679	10
University of Delaware Wind Turbine	777	10

Table 2: Consequence Score for Generators

Utilities use GIS to map transmission lines and substations. Through our conversations with these energy providers, and by using the DOE Delaware Critical Infrastructure Study as a base when speaking to the Delaware Information Analysis Center, the SEO was able to identify high consequence transmission lines and substations across the state.

The SEO is considering using Homeland Infrastructure Foundation-Level Data and PJM's mapping tools to conduct more detailed research, particularly as it moves more seriously into offshore wind planning. DEMA is currently in the process of digitizing the locations of critical infrastructure across the state with the goal of using the information to inform and identify future risks to Delaware infrastructure. Once this effort is complete, the data will be shared with the SEO to aid in planning efforts.

5.3 Qualitative Assessment

This section describes qualitative analysis of the impact likelihoods, asset vulnerabilities, and considerations for Delaware's electricity, natural gas, and liquid fuels sectors specifically due to man-made hazards and excluding natural hazards.

5.3.1 Methodology

To thoroughly assess the risks to the energy sector, the State Energy Office (SEO) conducted qualitative research designed to explore the risks faced by energy providers across Delaware and the strategies they employ to mitigate these risks. The SEO conducted interviews with the state's energy providers, including Chesapeake Utilities Corporation, Delaware City Refinery (PBF Energy), Delaware Electric Cooperative (DEC), Delmarva Power and Light, PJM, the Mid-Atlantic Petroleum Distributors Association (MAPDA), the Delaware Municipal Electric Corporation (DEMEC), as well as the Delaware Energy Management Agency (DEMA) and the Delaware Information and Analysis Center (DIAC). Appendix P contains the list of SEO's questions to energy providers. The SEO has an ongoing dialogue with the energy providers across the state to better understand the everchanging risk landscape in the state.

This plan builds upon the Delaware Emergency Management Agency (DEMA)'s risk and vulnerability assessment within the 2023 Delaware Hazard Mitigation Plan to identify threats, hazards, probabilities, and consequence severity.[18] The SEO also considered threats from the U.S. Department of Energy (DOE)'s Office of Cybersecurity, Energy Security, and Emergency Response (CESER)'s Energy Emergency Response Playbook. The SEO used these identified threats, hazards, vulnerabilities, and consequence severities to calculate risk scores, relating to the consequences of these threats and hazards on the energy sector in Delaware. These risk scores help inform the SEO's risk mitigation strategy by guiding the prioritization of mitigation measures. This risk assessment methodology was also informed by the DOE CESER's Risk Assessment Essentials for State Energy Security Plans.

5.3.2 Descriptions of Energy Providers

The SEO interviewed the seven energy providers and key stakeholders who provide energy services across Delaware, including the transmission and distribution of electricity, natural gas, and propane. The SEO conducted additional interviews with the State Fusion Center, the Delaware Information and Analysis Center (DIAC), and the Delaware Emergency Management Agency (DEMA), the primary agency responsible for emergency response, recovery, and mitigation in the State of Delaware.

Chesapeake Utilities Corporation, headquartered in Dover, Delaware, provides natural gas and propane transmission and distribution to residential, commercial, and industrial customers.[19] Across Delaware and Maryland, Chesapeake Utilities Corporation distributes natural gas to approximately 101,000 customers.

The Delaware City Refinery, a subsidiary of PBF Energy, is an oil refinery located on the Delaware River.[20] The Delaware City Refinery processes crude oil into gasoline, diesel, jet fuel, and other refined products. The Delaware City Refinery provides electricity to the grid as needed. The refinery does not provide gasoline services directly to customers. The refinery's operations primarily focus on refining oil into petroleum products for wholesale distribution and bulk market sales, such as gas stations, airports, and industrial customers.

Delaware Municipal Electric Corporation (DEMEC) represents and serves all of Delaware's municipal electric

[18] 2023 Delaware Hazard Mitigation Plan
[19] Chesapeake Utilities Corporation
[20] Delaware City Refinery

distribution utilities.[21] Its members serve over 140,000 residents and businesses with a peak load over 307 MW. DEMEC owns generation and operates as a Load Serving Entity in PJM.

Delaware Electric Cooperative (DEC) is a member-owned electric utility that serves rural areas of Delaware. As a not-for-profit cooperative, Delaware Electric Cooperative (DEC)'s customers are also its owners.[22] This structure allows members to provide input into how the cooperative is run and ensures that profits are reinvested or returned to members. DEC serves approximately 84,000 customers across Kent and Sussex Counties in Delaware.

Delmarva Power and Light (DPL), a subsidiary of Exelon Corporation, is an energy provider that serves customers in Delaware and Maryland.[23] DPL provides electric service to residential, commercial, and industrial customers across its service territory. DPL also provides natural gas services across northern Delaware. Across Delaware and eastern Maryland, DPL serves approximately 532,000 electric customers. 136,000 natural gas customers are served across northern Delaware.

PJM Interconnection (PJM), is a regional transmission organization that manages the electric grid and wholesale electricity markets across several states in the Mid-Atlantic and Midwestern regions of the United States, including Delaware.[24] PJM coordinates the movement of electricity across the transmission network, ensuring reliable and efficient operation of the electric grid. While PJM does not serve individual customers, its operations impact the availability, reliability, and cost of electricity for consumers in Delaware. PJM also facilitates the delivery of electricity from generators to distribution utilities, which serve customers across the state.

The Mid-Atlantic Petroleum Distributors' Association (MAPDA) is a trade association representing convenience stores and energy distributors across Delaware, Maryland, and Washington D.C.[25] MAPDA members include convenience store operators, petroleum marketers, and fuel distributors. In Delaware, MAPDA works to address issues that are relevant to convenience stores and energy distributors operating within the state.

[21] Delaware Municipal Electric Corporation
[22] Delaware Electric Cooperative
[23] Delmarva Power and Light
[24] PJM Interconnection
[25] Mid-Atlantic Petroleum Distributors' Association

5.3.3 Selected Scenarios

The tables below provide a qualitative analysis of selected man-made threats.

Cyberattacks	
Likelihood	Delaware does not have a publicly available archived history of cyberattacks on energy infrastructure within the state. The Delaware Public Service Commission conducts annual reviews of regulated utilities and their cybersecurity efforts.[26] Automated technologies, such as those included in grid modernization and network-based technologies, increase the vulnerability level of Delaware to cyberattacks due to reliance on connected systems. In response to the growing risk cyberattacks pose to state energy security, the Delaware Information and Analysis Center (DIAC) has developed a close working relationship with the Cybersecurity and Infrastructure Security Agency (CISA) as well as the Delaware Governor's Cybersecurity Council to identify vulnerable facilities and critical infrastructure.
Vulnerability	Energy systems are becoming increasingly more reliant on digital infrastructure, which makes them susceptible to a wide range of cybersecurity threats. These threats jeopardize the availability of the energy system and supply. Additionally, cybersecurity threats can disrupt operations, compromise data integrity, and impact Delaware's security and economy. Delaware's energy infrastructure, including power plants, substations, and distribution networks, are vulnerable to cyber-physical attacks. Malicious actors could infiltrate these systems to disrupt operations and manipulate equipment, leading to power outages and infrastructure damage across the state. Delaware's energy systems also rely on a complex network of suppliers and vendors for various equipment, software, and services. Vulnerabilities in the supply chain can be exploited by adversaries to gain access to critical systems or compromise sensitive data. Protecting the state from these cybersecurity threats requires collaboration among key stakeholders to enhance the resilience of Delaware's energy systems and mitigate the impact of cyberattacks. There are a variety of electricity, liquid fuels, and natural gas sector assets vulnerable to cyberthreats. **Electricity**: Breakers, transformers, switches, and sensors at substations and other transmission-level assets and power plant generation equipment can all be targeted by cyberattacks and damaged or disrupted. Distributed generators, battery storage, and smart meters typically use software to communicate with grid networks and remotely monitor grid performance, which can provide an entry point for threat actors. **Liquid Fuels**: Compromised refinery sensors could damage equipment, causing leaks, creation of out-of-specification products, unit shutdowns, or other issues. Pipeline pump stations may be damaged or disrupted, causing leaks, or affecting product flow rates. At terminals, SCADA systems may be manipulated, changing product specifications, affecting the ability of trucks to load product, or otherwise disrupting operations. **Natural Gas**: Processing plant equipment could be manipulated or damaged, disrupting gas volumes or quality. Compressor station equipment could be targeted, affecting the rate of gas flow in transmission lines, or even causing ruptures or explosions.

Table 3: Qualitative Risk Assessment for Cyberattacks

[26] https://depsc.delaware.gov/cybersecurity/

Physical Attack/Sabotage	
Likelihood	While the likelihood of physical attacks on energy infrastructure is difficult to predict, the likelihood of future or projected attacks is generally accepted to be increasing. Physical attacks may include sabotage and terrorism, theft resulting in equipment damage, vandalism, or disruption from political protest, activists, or disgruntled employees. The Delaware Information Analysis Center offers free, confidential physical security assessments to facilities at their request. **Electricity**: Several high-profile attacks in 2022 on substations in North Carolina and Washington state highlighted the vulnerability to attack on electricity infrastructure. Archives from U.S. Department of Energy (DOE) OE-417 contain increased reports of physical events in 2022, including significant gaps in event descriptions due to a lack of comprehensive reporting requirements and security concerns.[27] **Liquid Fuels**: Liquid fuel assets may be the target of physical attacks. The likelihood of an attack may increase in conjunction with political unrest and subsequent copycats from media coverage of attacks on petroleum project construction and assets. **Natural Gas**: Natural Gas assets may also be the target of physical attacks. However, these assets have historically proven to be less of a target compared to electricity and liquid fuel assets, as more of the infrastructure is underground and less visible.
Vulnerability	Assets that do not have robust security measures or deterrents in place may be more vulnerable to attacks. Deterrents of physical attacks include perimeter fencing, alarm systems, locks, security cameras, security guards, etc. However, those deterrents may not be feasible to protect some infrastructure, including transmission lines and gas and liquid fuel pipelines which are expansive. **Electricity**: These assets are arguably more vulnerable to physical attack than liquid fuel and natural gas assets because they are located aboveground and are readily identifiable. Substations are attractive targets, because they are relatively easy to disrupt, typically unmanned, and are often unsecured beyond simple fencing. Some may not have cameras. Control rooms are locked but can be broken into. It is possible to attack substations from outside the asset perimeter without entering the premise (via gunshot, materials thrown over the fence, drone, etc.). Remote substations may be attractive targets due to their isolation but are likely only identifiable by knowledgeable perpetrators. Damage at remote substations that does not cause operational impacts may go unnoticed for some time. Substations in populated areas are more obvious targets to less experienced individuals, although their location may also deter more elaborate attacks. Transmission infrastructure can and has been attacked, such as by attempting to bring down a transmission tower. However, this is generally an uncommon occurrence, because it is relatively difficult and more dangerous to the perpetrator. Power plants typically are better secured, and the presence of personnel makes them a less attractive target, although renewable energy generation typically does not have personnel and is less secured. Equipment supporting power-related construction and maintenance projects is also a possible target for vandalism in these communities. **Liquid Fuels**: Liquid fuels infrastructure is generally less exposed than electricity infrastructure and is thus less susceptible to physical attack. Liquid fuel pipelines are generally buried underground, but fuel pump stations are aboveground and more exposed. Terminals and refineries are somewhat more exposed than buried pipelines, but terminal operators typically secure access to the facilities, employ security guards, and have cameras onsite. Service stations and tanker trucks are vulnerable but have not historically been the target of attacks. **Natural Gas**: Like liquid fuel assets, natural gas transmission lines are typically underground and thus less vulnerable to attack. Remote energy infrastructure may face increased risk of physical attack.

[27] https://www.oe.netl.doe.gov/oe417.aspx

Table 4: Qualitative Risk Assessment for Physical Attacks/Sabotage

Human Error or Accident	
Likelihood	Human error includes infrastructure operators and passersby that may inadvertently damage or disrupt infrastructure, such as third-party strikes of buried pipelines. Third-party damages occur, although primarily at the distribution level. Third party strikes on underground pipelines are possible, although relatively uncommon, for major natural gas and petroleum product lines due to the buried depth of these pipelines and marking procedures. The July 2024 CloudStrike software "Blue Screen of Death" episode resulted in millions of computer system worldwide locking up and refusing to boot. This incident was a high-profile example of human error, resulting in potentially billions of dollars in damages and multiple losses of critical infrastructure due to software errors.
Vulnerability	It is also difficult to assess the vulnerability of infrastructure to human error or accident. **Electricity**: Electric infrastructure is relatively less vulnerable to error and accidents than liquid fuels and natural gas, due to the distributed nature of systems and higher levels of redundancy in infrastructure. **Liquid Fuels**: Buried transmission pipelines are located deep underground and are unlikely to be hit accidentally. Processing facilities such as ethanol plants and refiners are vulnerable to these incidents, particularly during maintenance activities and annual turnarounds. Transmission lines are less vulnerable to third-party strikes due to depth of burial and their more remote locations. **Natural Gas**: Natural gas pipelines and other facilities are vulnerable to accidents, and the product's extremely combustible nature together with its proximity to inhabited areas means that incidents can have catastrophic and dangerous effects.

Table 5: Qualitative Risk Assessment for Human Errors or Accidents

Equipment Malfunction/Maintenance Issues	
Likelihood	Equipment malfunctions are a cause of energy infrastructure disruption. It is difficult to predict where and when equipment malfunctions will occur, although the likelihood can be drastically reduced with frequent inspections, routine maintenance, and other steps. While maintenance procedures often require spare pumps and components, breakdowns can still occur. Construction activities around electricity, liquid fuels and natural gas infrastructure can be dangerous to personnel and a threat to operations without proper mark-out of facility locations conducted by experienced personnel.
Vulnerability	Virtually all energy infrastructure is vulnerable to equipment malfunctions, including renewable generation components. One cause is equipment age. The DIAC has identified aging infrastructure, particularly in Sussex County, to be one of the top risks to the regional energy grid. Routine inspections, maintenance, testing, and equipment upgrades are all preventative measures that can be taken to minimize equipment malfunction.

Table 6: Qualitative Risk Assessment for Equipment Malfunctions/Maintenance Issues

Pandemic	
Likelihood	The COVID-19 pandemic highlighted the potential impact of global pandemics to disrupt personnel supply and supply chains. It is difficult to predict when the next pandemic will affect energy systems.

Vulnerability	Although specific infrastructure assets are not susceptible to pandemic, energy supply chains broadly may be disrupted due to impacts on personnel. The potential impact on energy infrastructure and demands may vary significantly based on global scope and required protocols to mitigate the health risks. Stay-at-home orders, social distancing requirements, staff unable to work due to illness, and equipment shortages may all impact energy markets. The COVID-19 pandemic exemplified the potential of these events to have an extended duration impact. **Electricity**: The electricity sector is most vulnerable to a pandemic from a workforce perspective. Staff working in control rooms and bucket trucks may be hindered by social distancing requirements and/or illnesses. Communal housing of crews during large-scale restoration activities may be inadvisable, necessitating hotels or other private lodgings. Demand patterns changed dramatically with the shift in stay-at-home orders, the work-from-home movement, and the drop-off of tourism, which caused challenges for balancing authorities to forecast and manage the balance of supply and demand. Electricity equipment supply chains may experience shortages, such as with transformers. **Liquid Fuels**: Fuel demand dropped off considerably during the initial months of the COVID-19 pandemic, as people stayed home, and tourism decreased. Fuel demand decreases had ripple effects in the refining sector (where refineries ramped down or closed entirely, creating long-term consequences for markets) and for fuel storage (where states received EPA waivers to continue to sell winter-grade gasoline into the summer months, due to reduced demand). **Natural Gas**: The natural gas industry may have both workforce and supply chain impacts due to a pandemic. For example, natural gas crews often need access to residential homes to check meters and fix problems, which may be inadvisable or dangerous during a pandemic.

Table 7: Qualitative Risk Assessment for Pandemics

5.4 Cross-Sector Interdependencies

In Delaware, the cross-sector interdependencies between electricity, natural gas, and liquid fuels play a critical role in shaping the state's energy landscape and ensuring stability and resilience. Electricity generation relies significantly on natural gas as a fuel source, while the state's electricity infrastructure supports a portfolio of liquid and gaseous fuels supplied for transportation and heating in residential, commercial and industrial end uses. These sectors are intricately connected, with fluctuations in one sector often impacting other sectors through supply disruptions, regulatory changes, or shifts in demand.

5.4.1 Electricity Cross-Sector Interdependencies

Virtually all industries rely on electric power, creating cross-sector interdependencies that impact resilience and functionality. Figure 4 shows DOE's diagram of electricity cross-sector interdependencies that are applicable to Delaware.

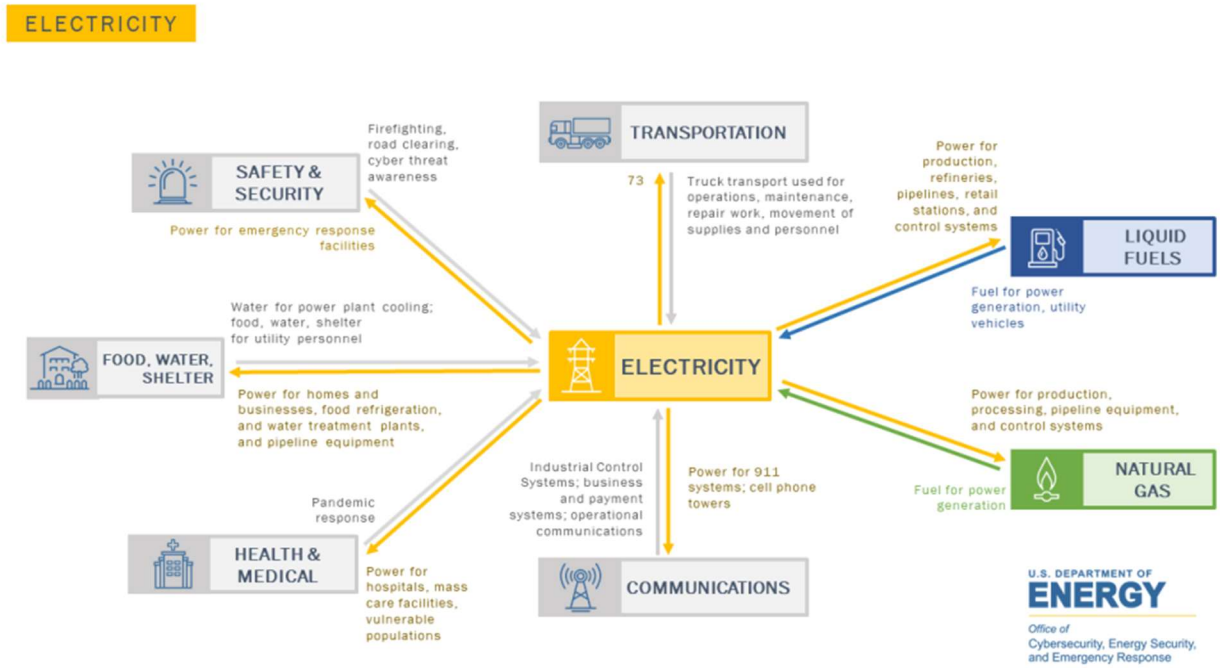

Figure 4: DOE CESER's Electricity Cross-Sector Interdependencies

The following paragraphs detail the interdependencies of electricity and other sectors.

Transportation

Delaware's highways and roadways, including major routes such as I-95 and Route 1, use electricity for traffic lights, electronic message boards, and toll collection systems. In the event of a power outage, traffic lights and electronic signage might fail, leading to confusion, increased traffic accidents, and significant travel delays. Real-time traffic management systems, which rely on electricity to monitor and control traffic flow, would also be impacted. Disruptions in electricity could cause delays and impact commuters, particularly during peak travel times or major events. DART First State, managed by the Delaware Transit Corporation within the Delaware Department of Transportation, operates bus routes throughout Delaware. DART is increasingly integrating electric buses and real-time tracking systems into its operations. A power outage could halt bus operations, disrupt schedules, and prevent the use of real-time tracking apps that keep passengers and commuters informed. This can leave many residents, particularly those who rely on public transit for commuting or accessing essential services, stranded and unable to travel.

Liquid Fuels

Delaware's refineries, such as the Delaware City Refinery, are energy-intensive facilities that require electricity to operate refining processes, control systems, and safety mechanisms. An interruption in power can stop or slow down production, resulting in a decrease in the availability of gasoline and diesel. Power outages can disrupt fuel production and distribution, potentially leading to shortages and increased prices at gas stations. This can affect not only local consumers but also regional supply chains dependent on Delaware's refined products. Gas stations across Delaware rely on electricity to operate fuel pumps and electronic payment systems. Power outages can prevent customers from refueling their vehicles, disrupting

daily activities and emergency response operations. Long-term outages can affect the supply chain, as refineries and distribution hubs may struggle to deliver fuel to stations. Outages can prevent drivers from refueling, affecting transportation and logistics across the state.

Natural Gas

The natural gas infrastructure in Delaware, including pipelines and compressor stations, requires electricity to function. Electricity is needed to operate valves, monitoring systems, and communication equipment critical to the flow of gas. Conversely, natural gas is needed to generate electricity at natural gas fired generators. An electricity outage can disrupt the flow of natural gas, leading to heating issues in homes and businesses, and potentially impacting industrial processes that depend on a continuous supply of natural gas. Many industrial processes in Delaware use natural gas for heating or energy. A power outage can disrupt natural gas supply and the availability of combined heat and power systems that generate electricity and heat for industrial and large commercial operations. Residential heating systems that depend on natural gas could also be affected, a particular burden during cold weather. Additionally, the DIAC reports that the majority of facilities they have assessed depend on electricity yet only a small number of them maintain generator backups. Chesapeake Utilities can operate solely on natural gas in the event of grid failure. Delmarva Power and Light has battery or natural gas backups at all critical stations so in the event of a grid failure, they could work for days and maintain minimum pressure.

Communications

Delaware's telecommunications networks, including cell towers and internet service rely on electricity to maintain operations. Power outages can lead to the loss of phone service and internet access, which can disrupt daily life and make it difficult to contact emergency services. Data centers in Delaware house critical information infrastructure. These facilities require continuous electricity to provide communications services and to maintain data security. Power disruptions can result in data loss, service outages, and economic impacts on businesses that rely on these data centers for their operations. DEMA, and many of the energy providers the SEO spoke with, has landline and satellite phone backups to keep communication lines open during times of emergency.

Health and Medical

Major healthcare facilities such as Christiana Care Health Services and Bayhealth Medical Center in Delaware rely on electricity to power medical devices and life-support equipment. During a power outage, diesel and gas backup generators are typically used. However, these generators are not always sufficient for prolonged outages. Disruptions in power can delay surgeries, impact patient care, and hinder emergency medical response services. Vaccines and other temperature-sensitive and regulated medications must be stored within specific temperature ranges to remain effective. Electricity is crucial for refrigeration units at pharmacies and healthcare facilities. Power outages can comprise the storage conditions of these critical supplies, leading to potential health risks if they are ineffective. Medical centers are prioritized for restoration services.

Food, Water, and Shelter

Supermarkets, restaurants, and food warehouses in Delaware use refrigeration to preserve perishable goods. Power outages can cause food spoilage, leading to waste and potential shortages. This can impact local food supplies and disrupt grocery shopping for customers and residents. Food distribution centers, which manage the flow of food products from suppliers to retail outlets, rely on electricity for sorting, packing, and logistics. Power disruption can delay deliveries, affecting inventory levels in grocery stores and

leading to shortages of essential food items.

Delaware's water and wastewater treatment plants use electricity for processes including filtration, chemical treatment, and pumping. An outage can disrupt these processes, potentially leading to unsafe drinking water and difficulties in wastewater management, impacting public health and sanitation. Electricity powers the pumping stations that maintain water pressure and distribution throughout the state. DEMA notes that many of Delaware's wastewater treatment plants are at or below sea level, which means that electric pumps are required to move wastewater. Power outages can reduce water pressure or halt distribution, leading to potential shortages or disruptions in services for residents and businesses.

In Delaware, many homes rely on electricity for heating during the winter and cooling during the summer. Power outages can leave residents without essential climate control, which is particularly concerning during extreme weather conditions. A disruption in service can lead to discomfort, health risks, and increased dependence on emergency shelters. Temporary shelters set up during emergencies or disasters require electricity for lighting, heating, cooling, and essential services. Disruptions can make it challenging to provide safe and comfortable accommodations for displaced individuals, affecting the overall effectiveness of disaster response efforts.

Safety and Security

Delaware's police, fire, and emergency medical services rely on electricity for communication systems, dispatch centers, and operational equipment. Power outages can impede their ability to respond to emergencies promptly, affecting public health and safety. Public buildings, transportation hubs, and critical infrastructure use security systems that rely on electricity for surveillance cameras, alarm systems, and access control. Power disruptions can compromise security, making these facilities more vulnerable to theft, vandalism, or other security threats.

5.4.2 Natural Gas Cross-Sector Interdependencies

Natural gas plays a pivotal role in Delaware's infrastructure and daily operations, underpinning multiple critical sectors within the state. Many businesses and homes rely on natural gas for heating. Its versatility and efficiency make it essential not only for powering homes and businesses, but also for maintaining the functionality of transportation, electricity generation and emergency services. The interdependencies of natural gas with other energy sectors highlight its importance in ensuring seamless operation and resilience. Disruptions in natural gas supply can have cascading effects, impacting public transportation, communication networks, health services, food production, and more. Figure 5 demonstrates DOE's diagram of natural gas cross-sector interdependencies.

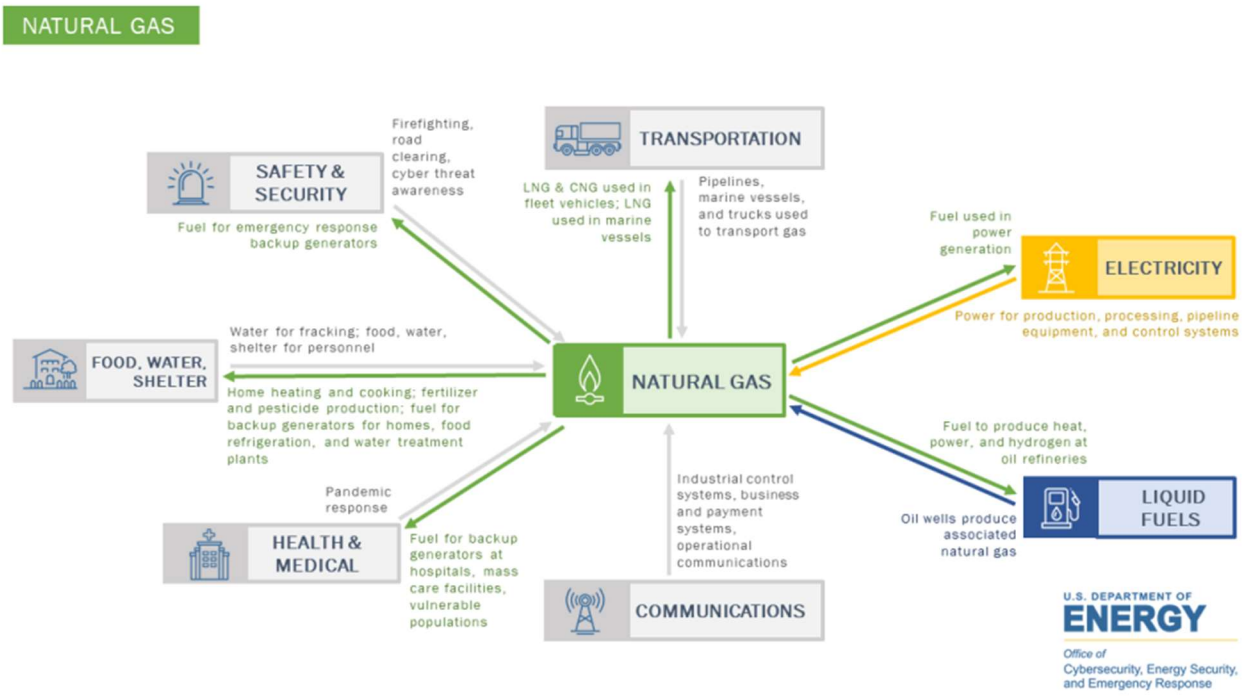

Figure 5: DOE CESER's Natural Gas Cross-Sector Interdependencies

The following paragraphs detail the interdependencies of natural gas and other sectors.

Transportation

Delaware has a number of compressed natural gas (CNG) vehicles used for commercial transportation. Disruptions in natural gas supply could lead to reduced availability of CNG and affect fuel transportation. Delaware has CNG fueling stations, such as those in Wilmington and Dover. A disruption in natural gas supply could lead to closures of these stations, impacting commercial vehicle operations.

Liquid Fuels

Natural gas has an indirect role in the liquid fuels sector through its use in refining processes. Delaware has one large refinery within state boundaries, the Delaware City Refinery operated by PBF energy. The refinery relies on a natural gas pipeline from Pennsylvania to operate the power plant on site. Disruptions to the Delaware City Refinery or other Mid-Atlantic refineries' natural gas supply could impact fuel availability and pricing in the state and region.

Electricity

Delaware's in-state electricity generation heavily relies on natural gas. A disruption to natural gas supplies in the state would greatly affect in-state generation. As of 2022, the three largest stations in terms of state generation were the Hay Road plant in New Castle County, Garrison Energy Center in Kent County, and the Delaware City Plant in New Castle County. All three plants are powered by natural gas and were responsible for approximately 88% of Delaware's generator production in 2022.

Communications

Wilmington, as a major economic hub, houses several data centers and communication facilities that use natural gas for backup power. Disruptions could impact data integrity and communications reliability in the region. Natural gas-powered generators at cell towers provide backup during outages. A disruption in natural gas supply could lead to communication failures during emergencies.

Health and Medical

Major hospitals rely on natural gas for heating and backup power. Interruptions could impact patient care and operational capabilities. Public health facilities across the state use natural gas for heating and power. Interruptions could compromise their ability to provide continuous care and maintain proper living conditions for patients.

Food, Water, and Shelter

Delaware has local food processing facilities that utilize natural gas for cooking and processing food products. Disruption could impact the production and distribution of food, potentially leading to shortages and increased prices. Companies involved in the production of prepared foods, baked goods, and dairy products often use natural gas for high-temperature processes as baking and pasteurization. A disruption in natural gas supply could lead to halted production lines, reduced output, and potential food shortages. Although Delaware's agriculture is not heavily reliant on natural gas compared to other sectors, certain agricultural operations, such as greenhouse heating, may use natural gas. Greenhouses that produce vegetables, flowers, or seedlings may face challenges in maintaining optimal growing conditions if natural gas supply is interrupted. Many food distribution centers and warehouses use natural gas to power cooling systems or with backup generators. A disruption in natural gas supply could affect refrigeration units, leading to a spoilage of perishable goods and a potential disruption in the food supply chain. Delaware's restaurants use natural gas for cooking and heating. An outage in natural gas would disrupt their operations, leading to temporary closures or limited service, which impacts local dining options and could potentially cause food waste.

Water treatment plants like the Wilmington Water Treatment Plant rely on natural gas for heating and powering backup generators. Natural gas disruptions could impair water treatment operations potentially affecting water quality and availability for residents. Natural gas is also used within wastewater treatment plants for heating and backup power. Disruptions in the natural gas supply could impact facilities' ability to process wastewater effectively, which can lead to potential environmental hazards and public health concerns. Many homes and businesses in Delaware use natural gas for water heating. Disruptions could affect hot water availability for residential use, which affects and impacts daily activities and comfort for residents.

Natural gas is a primary source of heating for many Delaware homes. During colder moths, reliable heating is crucial for maintaining indoor comfort and safety. Interruptions in natural gas supply could leave homes without heat, which is critical for vulnerable populations including the elderly, children, and those with underlying health conditions. In emergency situations, such as severe weather events or disasters, temporary shelters are set up by organizations such as the American Red Cross. These shelters often rely on natural gas for heating and cooking. Natural gas disruptions could impact the ability of these shelters to provide adequate warmth and food for displaced individuals. Public buildings, such as schools and community centers, often use natural gas for heating and cooking, particularly in facilities that serve as community hubs during emergencies. A natural gas supply disruption could affect these services, which

could impact community support functions and educational activities for students.

Safety and Security

Fire stations, such as the Wilmington Fire Department use natural gas-powered generators to ensure continuous operation during power outages. Interruptions in natural gas could impact their ability to respond effectively to emergencies, which can affect public safety. Police stations also rely on backup power sources fueled by natural gas to maintain communication and operational capabilities during power disruptions. Any issues with natural gas supply could hinder their response to emergencies and routine policing duties.

5.4.3 Liquid Fuel Cross-Sector Interdependencies

The interconnected nature of critical infrastructure sectors underscores the role of liquid fuels in maintaining Delaware's operational stability and resilience. Transportation networks, power generation, emergency services, and healthcare facilities, among others, utilize liquid fuels to support essential services. Disruptions in the supply of liquid fuels can have cascading effects, which can impact the delivery of goods and transportation as well as the emergency services and public safety. Figure 6 demonstrates DOE's diagram of natural gas cross-sector interdependencies.

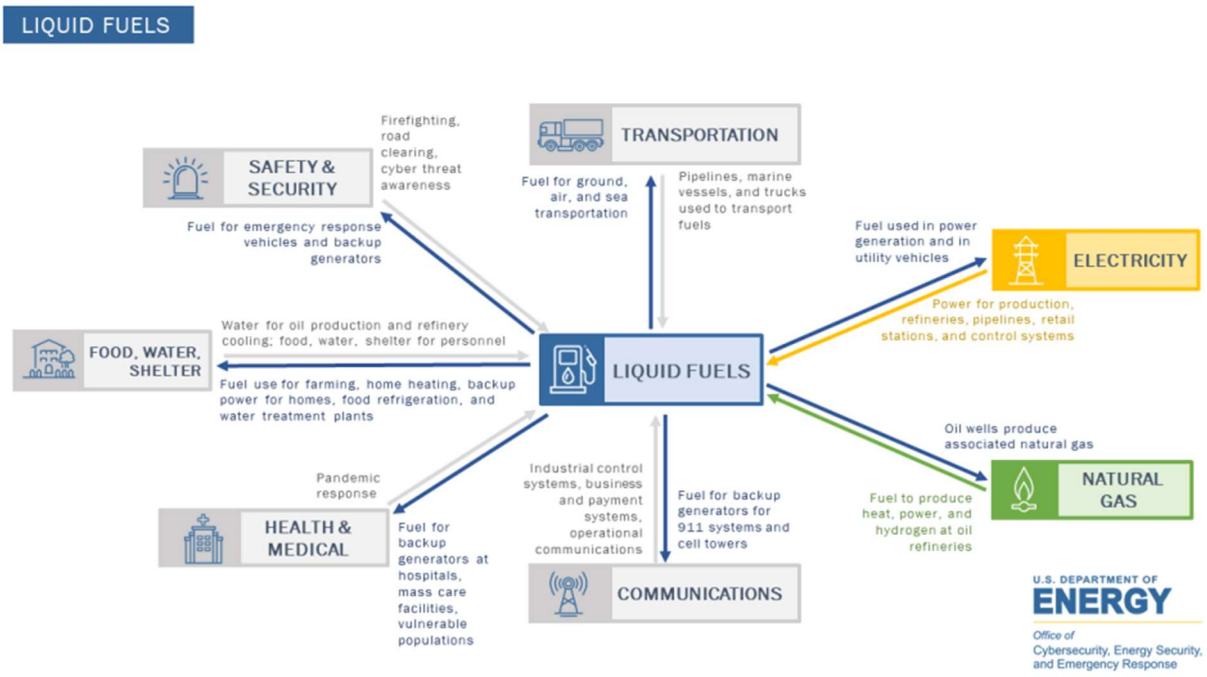

Figure 6: DOE CESER's Liquid Fuel Cross-Sector Interdependencies

The following paragraphs detail the interdependencies of liquid fuels and other sectors.

Transportation

Delaware's transportation network, including I-95 and the Delaware Turnpike, is vital for commuters and moving goods. Diesel fuel powers the trucks that transport goods to and from the Port of Wilmington, a major cargo hub. If there is a disruption in the fuel supply, it could delay the transportation of imports and exports, which affects local businesses and the state's economy.

Electricity

Some power plants in Delaware, such as the Beasley Plant in Smyrna, run on fuel oil in winter months. A disruption in the supply of these inputs could result in a decrease in the amount of electricity supplied to municipalities and the grid. In the event of power outages or peak demand periods, utilities across the state may rely on diesel generators to provide emergency power. If a hurricane or severe storm damages the grid, these generators can ensure that power is maintained for critical infrastructure, including hospitals and emergency services. A disruption in diesel fuel supply could impact the ability of these generators to operate, which could lead to extended power outages, therefore affecting essential services.

Natural Gas

Natural gas infrastructure, such as pipelines and processing facilities, often rely on diesel-powered vehicles for maintenance and emergency response. Maintenance crews use diesel-powered trucks and equipment to perform repairs to pipelines or respond to gas leaks. A shortage of diesel fuel could delay these critical repairs, which could impact and affect the delivery of natural gas to homes and businesses. This could result in heating issues during the winter months.

Communications

Communications infrastructure in Wilmington, including cell towers and data centers, rely on backup diesel generators to remain operational during power outages. If a severe storm causes widespread electrical outages, these generators must keep communication lines open for emergency services and ensure that data centers continue to function to preserve critical information. A fuel shortage could lead to communication blackouts, which impacts emergency response coordination and everyday communication needs.

Health and Medical

Hospitals and healthcare providers in Delaware may utilize diesel generators to ensure continuous power for critical medical equipment and facilities during power outages. In emergency situations, such as severe storms or grid failure, these generators support life-saving equipment including ventilators and monitors. If a disruption occurs, the loss of diesel fuel supply could compromise the hospital or healthcare provider's ability to provide uninterrupted care, which, in turn, could potentially endanger the health and safety of patients.

Food, Water, and Shelter

The Delaware Department of Health and Social Services manages the distribution of food and water to shelters and affected communities during emergency situations. Diesel-powered trucks are used to transport these supplies from distribution centers to emergency shelters. If there is a shortage of diesel fuel, the distribution of necessary supplies including food and clean water, could be delayed. This can affect residents across the state who depend on these services.

Safety and Security

The Delaware State Police and local fire departments use diesel-powered vehicles and equipment for emergency response. Fire trucks and police vehicles are essential for responding to fires, accidents, and other emergencies. Disruptions in the diesel fuel supply could impact emergency responders by presenting challenges in reaching affected areas and performing their duties. This could detrimentally impact public

safety and the effectiveness of emergency response efforts across Delaware.

5.5 Risk to State Assets from Outside of Delaware

The risks to energy infrastructure, businesses, and citizens within Delaware are not limited to impacts within the state. The risk to state assets from outside of Delaware can encompass several factors. Assets maintained digitally, such as databases, financial records, power plants, and sensitive information, are vulnerable to cyberattacks originating from anywhere in the world. Additionally, data breaches or ransomware attacks can target sensitive information and operational systems.

Fluctuations in prices of natural gas or oil can impact local business revenue streams and profitability. Delaware could face disruptions in the delivery of goods or services essential to state operations resulting from supply chain issues. Issues in states or countries that are major energy producers with oil and gas resources and issues with electricity grids can affect energy supply chain and prices nationwide. Delaware, as a consumer of energy, could experience increased costs or shortages if production or transmission in other states is disrupted. Energy market dynamics, such as changes in oil prices or shifts in natural gas markets, can affect Delaware's energy costs. Major fluctuations in oil prices in states that are significant oil producers can impact fuel prices and, consequently, the cost of energy in Delaware.

The state receives a significant portion of its electricity from Pennsylvania, which is a major producer of electricity due to its coal, natural gas, and nuclear power plants. Pennsylvania is also part of the PJM Interconnection, which operates the electricity grid serving Delaware. New Jersey also contributes to Delaware's electricity supply through the PJM grid. New Jersey has a diverse energy mix, including nuclear, natural gas, and renewable sources, which help balance the energy supply in the region. As a neighboring state with its own resources and infrastructure, Maryland plays a role in Delaware's electricity supply. Maryland contributes to the PJM Interconnection and has a mix of energy sources, including natural gas, nuclear, coal, and renewable resources. Energy grids are interconnected, which means that issues with the electricity transmission infrastructure in neighboring states or regions can lead to power outages or instability in Delaware. Issues in the PJM Interconnection region can directly impact Delaware's electricity reliability.

Changes in energy policies, environmental regulations, or legal disputes can affect operations and project viability. Changes in federal policies or regulations can influence funding, support, or operations of state-owned projects that receive federal assistance. New energy policies or regulations implemented in other states can create ripple effects. If neighboring states impose stricter emissions regulations or adopt renewable energy mandates, Delaware may face economic and regulatory pressures to adopt and adapt new mandates and energy strategies. Natural disasters, such as hurricanes, earthquakes, or floods can impact physical infrastructure and its dependent entities' operational continuity. Properties and infrastructure within Delaware could be impacted by natural disasters, which have implications for state-owned buildings, roads, and utilities. Transmission lines are susceptible to physical damage from natural disasters, such as storms, which impact electricity distribution. Environmental disasters in other states can disrupt energy infrastructure such as refineries, pipelines, and power plants. These disruptions can lead to regional energy shortages or increased prices that affect Delaware's energy supply. Appendices C to J describe Delaware's response procedures to select threat scenarios.

CHAPTER 6. RISK MITIGATION

6.1 Introduction

Risk mitigation is crucial to ensuring energy security in Delaware by proactively safeguarding against potential disruptions in the energy supply. Risk mitigation identifies existing and future possible measures that various agencies and stakeholders may implement in the State. It is vital for the State and its partners to continue working to reduce vulnerabilities and enhance reliability across the state's energy system. Delaware's risk mitigation approach also includes ensuring the resilience of energy infrastructure to withstand extreme weather events and cyber and physical attacks.

6.2 Risk Mitigation Goals

In accordance with DOE's interpretation of Bipartisan Infrastructure Law (BIL) Section 40108, the State has prepared a risk mitigation approach, including the development of energy sector-specific goals and potential mitigation measures. Throughout the planning process, DNREC and Delaware energy sector stakeholders provided input to ensure goals support long-term sustainability and resiliency, changes in mitigation capabilities, and other state-level priorities.

The development of the Delaware SESP involved partner engagement among multiple energy providers, state agencies, and other stakeholders representing the electric, natural gas, and liquid fuels sectors.

Delaware Energy Security Goals:

1. Enhance energy sector reliability for end users.
2. Enhance supply chain resilience for the Delaware energy sector.
3. Enhance the response to and recovery from energy disruptions and emergencies.
4. Secure critical infrastructure against natural hazards and man-made threats.

6.3 Mitigation Actions

Regularly inspecting and maintaining power plants, terminals, and transmission lines reduces the risk of unexpected failures or unplanned outages and disruptions. Backup power sources or alternative transmission routes enhance reliability by ensuring that energy supply can be maintained regardless of system failures. The mitigation actions identified in this plan aim to look beyond these regular activities for opportunities to improve resilience.

6.3.1 Risk Mitigation Approach

The SEO's risk assessment, DEMA's State Hazard Mitigation Plan, and DEMA's Emergency Operations Plan identified mitigation actions categorized and prioritized in the Delaware Energy Hazard Mitigation table below.

Number	Action	Risk Reduced	Primary Responsible Entities	Advances the following goals				Priority
				Reliability	Supply Chain Resilience	Response and Recovery	Secure Critical Infrastructure	
Strengthen Against and Resist Potential Hazards								
1	Protect and secure critical infrastructure & community lifelines to mitigate impacts from natural and manmade threats and make more resilient.	Loss of infrastructure from hazard	DEMA, DelDOT, Facility Managers	x			x	High
2	Prepare the power grid and energy infrastructure to accommodate the growth of electrical vehicles and the possible charging impacts during an evacuation.	Weakening grid leading to outages	DEMA, DelDOT, DNREC, OMB, Private Sector	x			x	High
3	Support efforts to promote efficient mitigation measures for critical assets in order to better utilize resources.	Ineffective use of resources	DelDOT, DEMA	x			x	High
4	Install alternative power supplies where applicable (wind power, generators, solar options, battery storage, etc.) to alleviate pressure on power grid.	Fluctuations due to load increase	DelDOT, DSHS, UD, OMB (Facilities Management)	x			x	High
5	Identify and assess appropriate measures to mitigate risks to below-grade facilities using methods deemed appropriate.	Critical facilities at risk for inundation due to grade	DOS, DelDOT, DNREC	x		x	x	High
6	Create microgrids for bus infrastructure in order to support mass charging capabilities and enhance transportation security	Utility disruptions due to increased load; disruptions to transportation sector	DelDOT, DEMA	x			x	Moderate
7	Review preparedness and emergency response measures with water and wastewater sanitation plant owners and operators.	Water / wastewater contamination or breakdown	DHSS, DNREC, DEMA, UD				x	Moderate
8	Evaluate cost-effective flood protection measures for protecting substations in the current and future floodplain to account for sea level rise, including flood walls; installing monitoring equipment; and elevating equipment, flood enclosures, and pumps	Flooding and grid outages in unexpected / unprepared areas	Utilities, PSC, DEMA	x			x	Moderate
9	Reinforce or relocate towers, poles, conductors, and associated hardware to strengthen transmission and distribution feeders and circuits against high winds, wildfire, erosion, and damage from large vegetation. For example, wood poles can be reinforced or replaced with concrete or fiberglass.	Weak transmission hardware	Utilities, PSC	x			x	Moderate
10	Evaluate potential options for natural gas and petroleum pipeline retrofits and/or relocation for erosion, sea level rise, and earthquake protection. Retrofits may include reinforcing moorings and surrounding soil, flexible joint connectors, encasing pipelines in culverts, and rerouting pipelines.	Strain on unreinforced pipeline system	Utilities, PSC, DNREC				x	Moderate

11	Install and acquire quick connect generators and portable storage for primary shelters.	Prolonged outages resulting in increased discomfort for vulnerable populations	DEMA, Shelter Managers, DSHS, DHSS	x			x	Low
12	Work with infrastructure owners to conduct physical security threat and vulnerability assessments to identify which energy infrastructure should be prioritized for protective measures. This will support identifying appropriate standards (e.g., Chemical Facility Anti-Terrorism Standards) and allocating resources to protect infrastructure whose loss or outage would have the greatest impact on energy reliability and resiliency.	Gaps in physical infrastructure security	Asset Owners, DSHS, PSC, PJM	x			x	Low
13	Work with infrastructure owners to inventory their cyber assets and assess vulnerabilities using a standardized methodology (e.g., Energy Subsector Cybersecurity Capability Maturity Model). This will inform the prioritization of future actions and investments to improve cybersecurity across the state's energy infrastructure.	Gaps in network security	Asset Owners, DSHS, PSC, PJM, DNREC	x			x	Low
Absorb Impacts when Hazards Strike								
14	Continue the installation of smart switches, fuses, reclosers, and feeder ties within the distribution system to reduce the scope of outages and improve restoration time	Prolonged and extensive outages	Utilities, PSC	x		x		High
15	Explore installing battery energy storage systems focused on continuity of service for loss of transmission supply to high-consequence substations.	Disruption in transmission	Utilities, DNREC, PSC	x		x		High
16	Develop and implement a grid modernization strategy which may include support for advanced sensors and monitoring, smart fault current indicators, Advanced Distribution Management Systems (ADMS), Distributed Energy Resource Management Systems (DERMS), advanced simulations, and performance models.	Added stress to grid from distributed energy resources (DERs)	DNREC, PSC, Utilities	x	x	x		High
17	Identify gaps and evaluate the need for redundant power (including but not limited to a microgrid or battery storage) at the Port of Wilmington to address power outages that may affect Delaware's access to imports and fuel.	Disruptions to the liquid fuels supply chain	Delaware River and Bay Authority	x	x	x		Moderate
18	Engage Critical Lifelines and Key Customers (CLKC) with no or outdated backup power generation to implement energy redundancy.	Disruptions to critical and life-sustaining services	DNREC & Private Entities		x	x		Moderate
19	Conduct a study to identify a long-term strategy and potential geography for a mobile critical customer hub.	Disruptions to critical and life-sustaining services	DEMA, DNREC			x		Moderate
20	Conduct a statewide microgrid and energy resilience feasibility study, conceptual design, and implementation at airports.	Increased vulnerability to grid disturbances.	Delaware River and Bay Authority, DelDOT, Utilities, DNREC	x	x			Moderate

21	Evaluate the merits of breakaway connectors for overhead transmission lines as a coordinated failure control device for towers	Weakened supporting transmission structures	Utilities	x		x		Low
Advance Resilience through Planning and Policy								
22	Incorporate energy security into Long Term Regional Transmission Planning	Major gaps in long term regional plans	DNREC, PSC, PJM, Utilities	x	x		x	High
23	Review state and county zoning processes for utility scale solar and battery installation for opportunities to streamline projects that support grid resilience.	Unnecessary interconnection backlogs	DNREC	x	x			High
24	Explore policies, frameworks, and processes to support equitable siting of energy infrastructure such as microgrids, battery power storage, and energy resilience hubs to support communities.	Inequitable distribution of energy infrastructure / resiliency investments	DNREC, PSC,DEMA, Private Entities	x				High
25	Monitor new climate change modeling to understand future risks to the energy system, including implications to load forecasting, equipment rating, asset management, and emergency management processes.	Major gaps in planning due to unidentified potential climate-related risks	DNREC, Utilities			x		Moderate
26	Develop resilience metrics to gauge improvement in energy resilience, distinct from reliability improvements, as well as targets for such metrics.	Reliance on outdated metrics	DNREC, PSC, DEMA, Utilities	x				Medium

Table 8: Delaware Energy Hazard Mitigation Measures

6.4 Mitigation Measure Prioritization

The State Energy Office recognizes that recommended mitigation measures must be evaluated and prioritized to support implementation to achieve the desired impact and goals within a meaningful timeframe. For each measure, DNREC established an action priority of high, moderate, or low based on the following evaluation criteria:

- High Priority: Evaluation score of 7-10
- Moderate Priority: Evaluation score of 4-6
- Low Priority: Evaluation score of 1-3

The resulting prioritization criteria is reflected in Table 9 below. Evaluation criteria can also be used as a benchmark to assess the performance and suitability of actions for future grant funding opportunities.

Criteria	Scoring Rationale	Criteria Source
Does the measure meet more than one goal?	1 – 4, relative to the number of goals the project aligns with	Industry best practice. Most funding sources require documentation that actions provide co-benefits and align with long-term strategies.
Does the measure address multiple threats/hazards?	0 – Does not address a specific threat or natural hazard 1 – Addresses one threat or hazard 2 – Addresses multiple threats/hazards	Industry best practice. Addressing multiple threats/hazards is an indicator that resiliency and cost-effectiveness is being maximized.
Does the measure promote equity or protect energy service for disadvantaged communities (DACs)?	0 – Measure benefit is broad and does not specifically benefit DACs 1 – Measure can be tailored to specifically benefit DACs	This is a priority objective for the State Energy Office as detailed in the State Energy Plan.
Is the measure technically feasible?	0 – Measure is new and may face unknown complexities 1 – Measure has been adopted in a limited capacity 2 - Measure is mature and well tested	Prioritizing measures that can be readily implemented will result in successful mitigation of risks to the energy system.
Is the measure cost effective?	0 – Avoided costs and societal benefits are less than the cost of the measure 1 – Avoided costs and societal benefits are roughly equal to the cost of the measure 2 - Avoided costs and societal benefits are greater than the cost of the measure	Prioritizing measures that are cost effective will result in successful mitigation of risks to the energy system.

Table 9: Hazard Mitigation Measure Prioritization Criteria

6.5 Climate Adaptation and Risk Mitigation Strategies for Physical Threats

Delaware's location along the coast requires significant consideration for climate adaptation strategies, since the state has an extensive coastline and low-lying topography that is susceptible to flooding, a risk exacerbated by climate change and rising sea levels. As climate change impacts increase, so does the need for climate risk mitigation strategies, particularly when considering energy systems and transmission. Enhancing infrastructure resilience against extreme weather events, increasing energy efficiency measures, and transitioning to renewable energy sources reduces reliance on fossil fuels and mitigates the impacts of climate-related disruptions and increases our energy infrastructure's durability and persistence. DEMA's Hazard Mitigation Plan includes a range of action items, including plans and regulations, structural and infrastructure projects, natural systems protection, and education and awareness programs.[28] DNREC is working with stakeholders to elevate awareness of climate risks and develop strategies to mitigate and adapt to those risks.

6.5.1 Identified Mitigation Strategies from Energy Providers

Mitigating climate risks will strengthen the resilience of energy systems by increasing the ability to withstand and recover from climate-related disruptions. Infrastructure that can withstand floods, or other extreme weather events, can reduce damage and energy outages or disruptions. Bolstering resilience and reliability ensures that energy systems are more adept at adapting to constantly changing environmental conditions.

The state has taken proactive measures to address these challenges by developing resources like the DNREC Delaware Flood Planning Tool[29]. This tool includes a 50-year flooding map which projects potential flood zones across the state over the next half-century. Utilizing advanced hydrological models and climate projections, this map serves as a vital resource for planners, policymakers, and residents. It helps them understand and prepare for the risks associated with increased flooding frequency and intensity. This preparation is essential for guiding development, improving infrastructure resilience, and ensuring the safety and sustainability of communities throughout Delaware.

Delmarva Power and Light: While Delmarva Power and Light does not have a mitigation plan for current infrastructure related to climate change impacts, such as sea level rise and flooding, as they build new infrastructure considerations are made for the environmental impacts of climate change and decisions are made to avoid the worst of the adverse effects associated with these impacts.

Delaware Electric Cooperative (DEC): DEC has an Emergency Operations Plan, which they are currently updating, which details how they respond to disruptions due to severe weather or other types of outages. The DEC has begun to raise their transformers an additional 18 inches off the ground and onto vaults along low lying areas of the state that are prone to flooding. They are also looking towards increasing their AI and SCADA capabilities to improve resiliency in times of load increase and extreme heat.

Delaware City Refinery: The Delaware City Refinery, operated by PBF Energy and PBF Logistics operate the Delaware City Sales Terminal, which provides motor vehicle fuels, such as gasoline and diesel fuel, and

[28] 2023 Delaware Hazard Mitigation Plan
[29] https://floodplanning.dnrec.delaware.gov/

propane. PBF Logistics also operates a 23.4-mile pipeline from a terminal in Pennsylvania to Delaware City that carries various grades of gasoline, distillates, and fuels. The refinery does not have a comprehensive energy security plan. However, it has a suite of plans to comply with different regulators which define its security strategy. PBF Energy has a plan in place with the North American Electric Reliability Corporation (NERC) that pertains to the operations of the facility on a daily, normal, conditional, and emergency basis. The Delaware City Refinery is also regulated by the US Coast Guard and is subject to the US Coast Guard Maritime Coastline Security Plan. The facility also has an Integrated Contingency and Emergency Response Plan that is reviewed periodically by the Coast Guard and the Environmental Protection Agency. DNREC's Accidental Release Prevention group checks rotating elements annually and DNREC's Division of Waste and Hazardous Substances plans for corrective action and cleanup in the event of a spill under the Resource Conservation and Recovery Act.

> Delaware City Refinery regularly conducts tabletop exercises to practice scenarios as part of its emergency response plan. In addition, the company notes that it conducts daily morning meetings to ensure constant communications within the organization.

MAPDA: The Mid-Atlantic Petroleum Distributors' Association has fencing and other protection measures as part of their physical security for bulk suppliers. MAPDA has a number of redundancies in place within their supply chain policy and their distribution of regulatory relief. This policy of redundancy allows MAPDA to pivot in times of emergencies mitigating any disruptions in the supply chain and their ability to meet their members' demands.

Delaware Municipal Electric Corporation (DEMEC): DEMEC maintains a confidential energy security plan that pertains to critical energy infrastructure as well as peninsula restoration plans in the event the Delmarva Peninsula suffers a large-scale grid outage. DEMEC also coordinates with their members to conduct 20-year load forecasts to determine load changes due to changing weather patterns and other climate related variables.

Chesapeake Utilities Corporation: Chesapeake does not have a single energy security document but rather a number of individual plans that contribute to a greater whole. Chesapeake Utilities Corporation's has replaced their cast-iron system with modern plastic piping and has installed all equipment above the 100-year flood level.

All of the providers contacted have plans to harden maintaining and restoring their physical infrastructure in preparation for extreme weather events. All providers also have plans to restore their physical infrastructure in case of disruption due to extreme weather events.

6.6 Energy Security Diversification and Renewable Energy Integration

Delaware imports roughly half of the electricity it uses and most instate generation relies on natural gas. This presents a major vulnerability as the state relies on other states for electricity which travels through transmission lines or is generated from gas arriving through pipelines. Increased energy efficiency and use of renewable energy has enabled Delaware to lessen its overall reliance on outside sources of energy. Renewables also present opportunities for supply diversification which can lessen vulnerabilities from supply chain disruptions.

Delaware has legislation allowing for and encouraging the increased use and integration of solar and wind. The Renewable Energy Portfolio Standards Act, 26 Del.C. § 351-364 (REPSA) requires an increasing percentage of electricity to come from renewable energy sources. REPSA also established the Delaware Renewable Energy Taskforce which works to assess the state of the renewables market in Delaware and makes recommendations to improve the market. House Bill 65 prohibits homeowner's associations from

restricting the installation of solar systems on privately owned residences. Senate Bill 2 authorizes community-owned energy generating facilities and eliminates barriers to community-based solar photovoltaic systems in Delaware. Senate Bill 265 allows for the State Energy Office's procurement of up to 1.2 GW of offshore wind energy, encourages regional coordination with other state's procurement efforts, and increases the options available for interconnecting renewable energy resources to the transmission grid.

Incorporating renewable energy resources into the electricity transmission and distribution system can enhance reliability by diversifying the sources of energy generation and offering decentralized and distributed generation capabilities. Energy systems that integrate renewable energy can effectively adapt to changing conditions, recover faster from disruptions and outages, and ensure continued and reliable access to energy.

The process for interconnection of a new renewable electric generation facility depends on whether the proposed point of interconnection occurs on an electric circuit that serves wholesale electricity transactions or solely retail customers. Developers seeking to interconnect to a transmission or distribution circuit that hosts wholesale transactions must apply to PJM for the ability to interconnect their proposed generation resource. Developers seeking to interconnect to a distribution circuit where only retail transactions occur must apply to the local electric distribution company. Each pathway to interconnect new generation has its potential challenges depending largely on size and location of the proposed project.

A significant backlog has been building over the past five years of new generation requests from developers seeking to interconnect to the PJM-managed, wholesale transmission and distribution circuits under the jurisdiction of FERC. The interconnection queues of the nation's regional transmission organizations currently have over 2,500 gigawatts of projects at various stages of development in a process that now averages five years to complete. In response to the backlog, in November 2023 FERC issued Order 2023 which adopted reforms designed to streamline and speed the process of new generation resources interconnecting with the bulk power grid. These reforms are anticipated to expedite the oldest projects and reduce the backlog by processing clusters of newer projects in a first ready first served approach.

The process to interconnect relatively smaller generation resources to the retail distribution system is characterized by a different challenge. The capacity of a distribution circuit to accommodate the interconnection of a renewable energy generation facility is commonly referred to as its "hosting capacity". A general rule of thumb used by electric distribution companies (EDC) estimates the hosting capacity of a distribution circuit as twenty five percent of the circuit's peak load rating. For example, a 12 kV distribution circuit could in theory accommodate the interconnection of three megawatts of solar. The actual, real-world capacity of a given distribution circuit is determined by power flow modeling conducted by an EDC. The EDCs post hosting capacity maps on their websites to inform their customers and developers when a distribution circuit is at or near the limits of its ability to accommodate new requests to interconnect. As the pace of development of distributed generation resources increases, the constraints on interconnecting new generation to distribution circuits increases.

Incorporating renewable energy resources can enhance reliability by diversifying the sources of energy generation and offering decentralized and distributed generation capabilities. Energy systems that integrate renewable energy can effectively adapt to changing conditions, recover faster from disruptions and outages, and ensure continued and reliable access to energy.

6.6.1 Identified Mitigation Strategies from Energy Providers

Chesapeake Utilities Corporation: Chesapeake Utilities Corporation has interconnections with three upstream pipelines in Pennsylvania, with some onsite reserves and propane available as backup power supply at its operations in Delaware. Currently, Chesapeake Utilities Corporation has vehicle fleets that run on gasoline and natural gas. To mitigate risks, they are working to find renewable natural gas alternatives to reduce dependencies on gas coming from Pennsylvania. Chesapeake Utilities Corporation is also looking at deploying hydrogen to mitigate risk. Chesapeake Utilities Corporation also has natural gas tank trailers that can hold natural gas in a compressed state in case regional emergencies occur. For example, if supply is constrained, they can use these trailers to provide an alternative source of energy.

Delaware Municipal Electric Corporation: DEMEC and its members produce nearly 29 megawatts of solar generation in-state and continue to develop additional renewable generation in local communities throughout Delaware. They are committed to a diverse power supply portfolio to manage risk and cost, and they actively manage and are working to incorporate multiple transmission feeds to their communities for redundancy and reliability. DEMEC also coordinates with its members quarterly to receive load forecasting data to include a wide array of variables that pertain to the unique characteristics of each community. This data is then used in partnership with their energy services provider to perform analytics with up to 20-year forecasts to determine potential load changes that may arise from changing weather patterns.

DEMEC has applied and is in the negotiation stages for a 40101(d) grant to obtain funding for advanced modeling technology to help analyze distribution system distributed energy resources hosting capacity and resiliency in support of grid modernization.

PJM Interconnection: PJM, as a FERC-jurisdictional regional transmission provider, prioritizes reliability and market efficiency in their long-term regional transmission and resource adequacy planning processes. They conduct forecasts, modeling and analysis of regional electricity demand and power flow over existing generation and transmission assets toward ensuring that capacity reserve requirements and other operating and resource procurement rules are sufficient to meet future electricity needs reliably. As discussed earlier, PJM follows the industry guidelines and standards for reliability established by the North American Electric Reliability Corporation and its regional affiliate, ReliabilityFirst.

This effort has become increasingly challenging over the last five years as the result of a confluence of factors including a precipitous increase in the demand for electricity primarily from the proliferation of data centers, a building backlog of proposed new generation resources in the interconnection queue, and a significant number of retirements of older generation that has become uneconomic to operate. In May 2024, FERC issued Order 1920 which requires additional reform to the long-term regional transmission planning processes required of the nation's Transmission Providers (TPs) such as PJM. TPs must increase their long-term transmission planning horizon to cover a twenty-year timeframe and include the development of plausible and diverse scenarios with sensitivities for how the bulk power grid might change based on specific factors like electric fuel mix, laws, technology trends, and planned power plant retirements, etc. TPs must now do this longer-range planning with stakeholder input taking into consideration the energy policy goals of the states they serve.

Delaware Electric Cooperative: DEC has a mobile substation and mobile transformer which can be deployed when a transformer fails. DEC has also applied and is in the negotiation stages for 40101(d) grid resilience funding to design and install a battery storage system at the coop's 4 MW Bruce A Henry Solar Farm in Georgetown, a disadvantaged community.

6.7 Mitigating Cybersecurity Risks

Annual Cybersecurity Questionnaire

The Delaware Public Service Commission (DE PSC) requires public utility companies provide an annual update to a set of questions regarding cybersecurity. These questions are grouped into three categories: Planning/Risk Management; Personnel and Policies; and Standards and Guidelines for Reporting. The DE PSC has periodically updated the questions as cybersecurity threats have evolved. The public reports are available on the DE PSC website under Docket 16-0659.

Energy providers across the state implement and enforce cybersecurity standards. With these strategies, the energy providers demonstrate their commitment to mitigating cybersecurity risks for energy systems and safeguarding the reliability, security, and resilience of critical infrastructure against cyber threats.

Mitigating cybersecurity risks helps to reduce the number of cyberattacks capable of disrupting energy operations, minimizing the occurrence of unplanned outages. The resilience of energy systems increase as cyber threats are mitigated. Having contingency plans, response protocols, and safety briefings in place allow energy providers to navigate and address the effects of cyber incidents, ensuring faster restoration of services. With fewer interruptions in their service lines, energy providers in Delaware are better able to maintain a consistent source of electricity or fuel to meet the needs of their customers.

6.7.1 Identified Mitigation Strategies from Energy Providers

The following identifies some illustrative cybersecurity mitigation strategies shared by Delaware energy providers. All of the energy providers surveyed by the SEO indicated they isolate their control systems (SCADA) so they cannot be attacked remotely.

Chesapeake Utilities Corporation: Chesapeake Utilities Corporation has a 2022 Sustainability Report that provides details about their cybersecurity plan and how they address risk and safety issues.[30] As members of the American Gas Association (AGA), Chesapeake Utilities Corporation ensures resilient natural gas pipeline infrastructure when facing cyber and physical security risks.

Chesapeake Utilities indicates that it engages in weekly cybersecurity testing. The utility's cybersecurity program is structured to include the following elements:

- Vulnerability Management
- Adversary Emulation
- Digital Forensics and Incident Response
- Security Awareness
- Third Party Risk
- Threat Identification
- Control systems
- Threat Intelligence

Delaware City Refinery: Part of the Delaware City Refinery's (PBF Energy) facility security plan addresses facility security and how the facility security posture would change in response to MARSEC levels, with 1 as a default level, 2 indicates heightened risk of a security incident, and 3 demonstrates that a security incident is probable or imminent. The Delaware City Refinery assesses cyber threats using tools and processes used to identify and remediate threats. NERC compliance requires cybersecurity inclusions. Employees also receive annual cybersecurity training with periodic tests throughout the year.

Delmarva Power and Light: Delmarva Power and Light has a confidential cybersecurity plan that is referenced in general terms in the utility's response to the DE PSC's annual cybersecurity questionnaire.

Delaware Municipal Electric Corporation (DEMEC): DEMEC has a confidential cybersecurity plan.

6.8 Policy and Regulatory Mitigation Measures

[30] 2022 Chesapeake Utilities Corporation Sustainability Report

There have been many state-driven initiatives to increase the percentage of renewable energy sources in Delaware's energy mix and to increase beneficial electrification. Delaware is preparing for a cleaner and more resilient grid through the State Energy Office efforts to advance grid hardening and resilience projects and to plan for transmission projects which can accommodate offshore wind energy.

Local land use authorities in Delaware incorporate environmental and climate considerations into land use development codes and comprehensive planning. Counties have required setbacks from wetlands, streams, and other environmental features prone to flooding. These codes also apply to energy infrastructure projects such as substations and solar facilities, lowering the vulnerability of these critical energy assets. For instance, Kent County prevents solar facilities from siting too close to specified natural areas such as woodlands which are vulnerable to wildfires. Legislation was recently enacted amending provisions of the Delaware Code related to the comprehensive planning required of each county to now incorporate climate change and resilience considerations.

The State Energy Office (SEO) is encouraging utilities to build microgrid projects using 40101(d) Grid Resilience State and Tribal Formula Grant funds. Similarly, the Delaware Emergency Management Agency (DEMA) is encouraging municipalities to build microgrid projects using FEMA Building Resilient Infrastructure and Communities (BRIC) funds. A microgrid is a group of interconnected energy-consuming loads and distributed energy resources within a clearly defined electrical boundary which acts as a single controllable entity with respect to the utility grid. Using smart controls, microgrids can disconnect from the conventional utility grid to operate autonomously. In addition to providing resilience during disruptions to the larger grid, microgrids can be used to stabilize portions of the grid with problematic loads or energy supplies creating voltage and frequency issues. Microgrids can also be used as a demand response tool to rectify imbalances between supply and demand on the larger grid with electricity supplied from the microgrid's distributed energy resources paired with storage.

The SEO and DEMA are also working to create resilience hubs, community-based facilities where people can gather in times of emergency. Resilience hubs also serve as a place to strengthen community awareness and coordination, making communities better prepared for emergency response and more self-sufficient.

6.9 Existing State Resources and Mitigation Measures

6.9.1 Delaware Information and Analysis Center (DIAC)

The Delaware Information and Analysis Center offers voluntary Safety Assessment at First Entry (SAFE) service designed to rapidly evaluate a facility's current security posture and identify options for facility owners and operators to mitigate relevant threats. Although it is not intended to be an in-depth security assessment, a SAFE visit may be the first step in adopting a comprehensive and effective security program. SAFE was developed by the Cybersecurity and Infrastructure Security Agency (CISA) and any findings from these assessments are protected from prosecution or litigation by the Critical Infrastructure Security Act of 2002. Additionally, as the state's fusion center and information hub, the DIAC prioritizes public communication in all their mitigation efforts. DIAC sends out weekly emails, special bulletins, and invites their partners to attend workshops discussing upcoming projects ensuring they stay connected with their community partners in the private and public sectors. Identified threats will be communicated to stakeholders and service providers through mass emails, or if the threat is specified to a single entity, DIAC will communicate with them directly. Threats identified by the public may be communicated to DIAC through their Homeland Security and Anti-Terrorism Tip Line at 1-800-FORCE-12.

6.9.2 Delaware Emergency Management Agency (DEMA)

Delaware's newly adopted Hazard Mitigation Plan identified any deficiency in energy resiliency as a

potential hazard to the state and its people which would warrant granting DEMA the ability to access federal funding to address emerging threats such as solar flares and electromagnetic pulses To combat cybersecurity risks, DEMA offers Mitigation Grants to allow cybersecurity elements to be added to any existing projects. DEMA is also in the process of developing a GIS hub through the ESRI Advantage Program to assist the agency and its partners in identifying future risks and opportunities for mitigation strategies. Through this hub they intend to quantify potential gaps in state infrastructure and develop proposals for FEMA funding to address them. Additionally, DEMA has a mass distribution list for town managers and municipalities to advertise mitigation opportunities and potential funding options. To notify the public in the face of oncoming threats the Delaware Emergency Notification System (DENS) uses email and text platforms to issue alerts while DEMA's Public Information Officer passes information to the media.

6.10 Existing Mitigation Funding Mechanisms

Mitigating physical infrastructure risks in energy systems is crucial for ensuring uninterrupted power supply and safeguarding against potential disruptions. By implementing various strategies, such as the regular inspection of power plants, transmission lines, and substations, energy providers can minimize the risks and impacts of outages. DNREC, from discussions with energy providers, learned of the diversity of methods employed to mitigate risks to physical infrastructure.

Toward strengthening its resilience, Delaware has secured substantial funding for additional hazard mitigation initiatives. Securing this funding demonstrates the state's aggregate commitment to proactively assess and prepare for risks to and vulnerabilities in its energy systems. This funding represents an opportunity for Delaware to increase resilience by bolstering its ability to withstand and recover from various hazards and threats to the safe, adequate and reliable supply of energy.

6.10.1 DOE Infrastructure Investment and Jobs Act (IIJA)

The Bipartisan Infrastructure Law (BIL) Section 40101(d) provides non-competitive funding to states and tribes to improve the resilience of their electric grids.[31] These grants are for activities, technologies, equipment, and hardening measures to reduce the impacts and likelihoods of energy disruptions. Delaware was allocated $1,467,476 annually for five years. DNREC followed a public stakeholder process to develop a fair, transparent, and efficient means to equitably distribute funds to utilities across the state for grid hardening and modernizing investments.[32] The State Energy Office is currently in the negotiation stage with the Delaware Electric Cooperative which proposed a project for the installation of a battery storage system at its 4 MW solar farm. The SEO is also in the negotiation stage with the Delaware Municipal Electric Corporation which plans to use funding to deploy advanced modeling technology to inform new customer-sited generation projects. The SEO is also in the negotiation stage with Delmarva Power and Light regarding a vegetation management project.

6.10.2 DEMA Emergency Management Performance Grant (EMPG)

The Delaware Emergency Management Agency offers an Emergency Management Performance Grant (EMPG) Program.[33] Delaware was granted $3,293,610 in fiscal year 2021 and $3,755,425 in fiscal year 2022. This grant program emphasizes the focus that the Federal Emergency Management Agency (FEMA) and the Department of Homeland Security (DHS) places on all-hazards emergency preparedness measures, which include risks that are associated with climate change. The DHS Strategic Plan for the 2020-2024 fiscal year supported strengthening preparedness and resilience, while the 2022-2026 FEMA Strategic Plan addressed challenges faced during emergency management. To address these challenges, FEMA provided three

[31] Bipartisan Infrastructure Law Section 40101(d) (42 U.S.C. 18711(d))
[32] Public Hearing: DNREC Grid Resilience Formula Grant Program Applications
[33] Emergency Management Performance Grant (EMPG) (Delaware)

primary goals:

1. Instill Equity as a Foundation of Emergency Management
2. Lead Whole of Community in Climate Resilience
3. Promote and Sustain a Ready FEMA and Prepared Nation

6.10.3 Hazard Mitigation Grant Program (HMGP)

The Hazard Mitigation Grant Program (HMGP)[34] allocates federal funding through FEMA to states and communities for the development of plans and implementation of projects which is aimed at implementing enduring hazard mitigation measures. The HMGP provides technical and financial assistance. Eligible activities for mitigation projects and capability and capacity building grants include the following for the HMGP:

1. Property acquisition
2. Structure elevation
3. Mitigation reconstruction
4. Flood risk reduction measures
5. Stabilization, and dry floodproofing non-residential buildings
6. Tsunami Vertical Elevation
7. Safe Rooms
8. Wildfire Management
9. Retrofitting
10. Generators
11. Earthquake Early Warning Systems
12. Innovative Mitigation Projects
13. New Plan Creation and Updates
14. Planning-Related Activities
15. Project Scoping/Advance Assistance

6.10.4 Building Resilient Infrastructure and Communities (BRIC)

The Building Resilient Infrastructure and Communities (BRIC) Grant Program[35] provides FEMA-funded opportunities for mitigation initiatives aimed at addressing priorities, including reducing risks from natural hazards to public infrastructure and essential community services. BRIC funding includes regulatory, technical, and financial assistance. Eligible activities for mitigation projects and capability and capacity building grants include the following for the BRIC Grant:

1. Property acquisition
2. Structure elevation
3. Mitigation reconstruction
4. Flood risk reduction measures
5. Stabilization, and dry floodproofing non-residential buildings
6. Tsunami Vertical Elevation
7. Safe Rooms

[34] Funded by FEMA through the Stafford Act as described in the 2023 Delaware Hazard Mitigation Plan, pp. 164, 215.
[35] Funded by FEMA as described in the 2023 Delaware Hazard Mitigation Plan, pp. 215.

8. Wildfire Management
9. Retrofitting
10. Generators
11. Earthquake Early Warning Systems
12. Innovative Mitigation Projects
13. New Plan Creation and Updates
14. Planning-Related Activities
15. Project Scoping/Advance Assistance

6.10.5 Flood Mitigation Assistance (FMA)

Flood Mitigation Assistance (FMA)[36] allocates funding to states and local communities for pre-disaster mitigation planning and projects aimed at minimizing risks of flood-related damage to structures eligible for coverage under the National Flood Insurance Program (NFIP). The FMA Grant Program offers technical and financial assistance. Eligible activities for mitigation projects and capability and capacity building grants include the following for the FMA:

1. Property acquisition
2. Structure elevation
3. Mitigation reconstruction
4. Flood risk reduction measures
5. Stabilization, and dry floodproofing non-residential buildings
6. Tsunami Vertical Elevation
7. Retrofitting
8. Innovative Mitigation Projects
9. New Plan Creation and Updates
10. Planning-Related Activities
11. Project Scoping/Advance Assistance
12. Financial Technical Assistance

6.10.6 Safeguarding Tomorrow Revolving Loan Fund (RLF)

The Safeguarding Tomorrow Revolving Loan Fund (RLF)[37] stands as FEMA's latest Hazard Mitigation Assistance (HMA) initiative. The RLF program offers capitalization grants to qualifying state, territorial, and tribal authorities for the establishment of revolving loan funds. Recipients of these grants will use the funding awarded to manage their revolving loan fund operations and extend direct loans to local governments. Eligible activities for mitigation projects and capability and capacity building grants include the following for the RLF:

1. Property acquisition
2. Structure elevation
3. Mitigation reconstruction
4. Flood risk reduction measures
5. Stabilization, and dry floodproofing non-residential buildings

[36] 2023 Delaware Hazard Mitigation Plan, pp. 176, 215.
[37] 2023 Delaware Hazard Mitigation Plan, pp. 215.

6. Tsunami Vertical Elevation
7. Safe Rooms
8. Wildfire Management
9. Retrofitting
10. Generators
11. Earthquake Early Warning Systems
12. Innovative Mitigation Projects
13. New Plan Creation and Updates
14. Planning-Related Activities
15. Project Scoping/Advance Assistance

6.11 Continued Risk Assessment and Mitigation Awareness

Delaware's State Energy Office sees proactive risk assessment and mitigation as a continuous improvement activity to be undertaken both comprehensively and individually among all state agencies and energy providers. The SEO plans to maintain a schedule of regular risk evaluation for the state's energy sector as well as maintain regular communications with utilities, energy providers, and other energy stakeholders in the state. The SEO also plans to continue to advocate for energy infrastructure upgrades and investments in new technologies.

The SEO is a regular participant in DEMA exercises and informational events. The SEO also participates in drills hosted by energy sector stakeholders such as PJM's annual Grid Security Drill. Participation in these types of exercises is an essential part of the SEO's efforts to prepare for energy emergencies and build and maintain healthy working relationships with energy stakeholders in Delaware.

CHAPTER 7. ENERGY RELATED ECONOMIC ASSISTANCE PROGRAMS AND POLICIES

7.1 Economic Assistance Programs

One of the major goals of the plan is to facilitate the distribution of financial assistance designed to help mitigate economic hardship among low-income households in the event of a serious energy supply disruption. Federal and state policies promote the use of market mechanisms to manage supply disruptions which will result in rising costs of energy to consumers. While the use of market mechanisms is efficient in balancing supply and demand across the economy, it results in a disproportionate share of impacts on low-income households due to the relatively high burden that energy costs place on their budgets.

In 2022, Delaware households had an average monthly electric bill of $128.99[38], equating to $1,547.88 per year in electricity costs alone, not including any costs related to fossil fuels which may be used for space and water heating purposes. While this statistic is the average, the actual energy cost for any individual residential customer will vary based on household size, the type, size, age, and conditions of the home, as well as the local utility or electric provider.

Since 2010, Delaware's population has increased by approximately 10.5% and is slightly more than 1 million[39] people as of July 2023. This increase in population is assumed to continue at a steady rate, which combined with climate change factors, will also increase the energy consumption trend of the state. The Annual Energy Outlook[40] for the South Atlantic region – which includes Delaware – forecasts that the growth of various end uses will be generally negative for heating, growth for cooling and water heating applications due to increased number of cooling required days throughout the year. This forecast results in an 7% increased energy consumption till 2027, likely driven by the increased space cooling demand as more people install air conditioning due to increased cooling degree days annually. To compensate for the inequitable burden that higher cooling costs place on low-income households, the plan includes a provision for increased economic assistance to help minimize impacts on this segment of the population.

7.2 National Association of State Energy Officials (NASEO) Meetings

DNREC Energy Section staff participate in two monthly meetings hosted by the National Association of State Energy Official's (NASEO) related to energy security. The first meeting is the Energy Security Committee All-Hazards call. These meetings typically include updates from internal sections withing DOE (i.e., Department of Energy's (DOE) Division of Cybersecurity, Energy, Security, and Emergency Response (CESER)), but may also include federal agencies external to DOE such as the Federal Energy Regulatory Commission (FERC). These calls provide a forum for Delaware to share information and experiences with other states, especially in the same region, learn from other states and bring back lessons learned.

Federal agency briefings are followed by individual states reporting on energy security issues in their respective state. These issues are typically related to disruptions caused by severe weather events and natural or man-made disasters. This forum provides states an opportunity to share information. In some cases, where a common event impacts several states, individual neighboring states collaborate, or several states cooperate on a regional basis.

[38] https://www.eia.gov/electricity/sales_revenue_price/pdf/table5_a.pdf
[39] https://www.census.gov/quickfacts/fact/table/DE/PST045221
[40] https://www.eia.gov/outlooks/aeo/

The second monthly NASEO call attended by Energy Section staff is the meeting of the Energy Security Committee. These calls are similar to the All-Hazards calls in format, but often are used to provide NASEO members with additional resources, education opportunities, etc. The meetings can be tailored specifically to current issues facing all states. For example, the meetings have been used to provide states instruction and updates on how to write and/or improve their State Energy Security Plans (SESP). The calls have proved invaluable in providing updates, resources, instruction, etc. to improve state plans. For example, the NASEO calls are an important component in the state's SESP in addressing risk assessment and mitigation by learning about what is happening in other states. Outside of the NASEO calls, there is not another forum that brings all the states and territories together to address mutual energy security issues.

7.3 Multi-Agency Task Force and other interagency forums

A Multi-Agency Task Force, representing various agencies involved in the economic assistance programs, convenes in the event of an energy supply disruption. The task force coordinates and oversees the distribution of both state and federal funds during an energy supply disruption. In the event of an emergency, the task force will determine the lead agency and support agency roles, adjusting the details of the operation process to the specific nature of the supply shortage.

The State Energy Office has worked with PJM and other state agencies to establish a coordinated protocol for responding to PJM alerts and taken a more forward-looking approach to grid resilience and reliability planning. In June of 2023, PJM sponsored a "call for conservation" exercise that included Delaware's four lead agencies on energy security and reliability. As a result of that exercise, key personnel in those agencies now receive notifications (alerts) of upcoming weather and other events that may adversely impact Delaware's power grid. Important information that may be included in those alerts will be disseminated up the chain of command and acted on as appropriate. Individual state agencies may further distribute information to the public and other relevant state and local agencies through respective Public Information Offices (PIO) and appropriate staff.

7.3.1 The Energy Emergency Assurance Coordinators Program

The Energy Emergency Assurance Coordinators (EEAC) Program is a cooperative effort between the U.S. Department of Energy's (DOE) Office of Cybersecurity, Energy Security, and Emergency Response (CESER), the National Association of State Energy Officials (NASEO), the National Association of Regulatory Utility Commissioners (NARUC), the National Governors Association (NGA), and the National Emergency Management Association (NEMA).

The EEAC Program provides states with a means of sharing and receiving credible, accurate, and timely information with other states and DOE leading up to and during energy emergencies. Structured communications are essential for understanding the severity, magnitude, and consequences of energy disruptions regardless of the causes.

EEACs serve as points of contact for DOE in the event of an emergency. Membership is made up of representatives from state energy offices, public utility commissions, state ESF-12 responders, emergency management agencies, homeland security agencies, local governments, and governors' offices.

Delaware has designated a primary and secondary EEAC contact, who have planning and/or response roles during energy emergencies. These individuals are registered on ISERNet, which DOE hosts. States should review and update their EEAC contacts annually. Click here to view additional guidance on registering and updating EEAC contacts.

ISERNet Designation	Contact	Role
Primary	***Provide***: Full Name, Email, Phone Agency/department	***Ex:*** ESF-12 lead for electricity
Secondary		
Additional* (optional)		

The DOE leverages the EEAC network to communicate important notices, such as situation reports and outage estimate reports. DOE distributes TLP:AMBER information (situational awareness/ analysis, alerts, etc.) to EEAC email listservs leading up to and during energy emergencies. For example, during the COVID-19 pandemic, CESER disseminated weekly COVID-19 situation reports to all states in addition to situation reports for emergency events like Hurricane Laura.

7.3.2 Grid Resilience Grants (40101d)

Since the plan was updated in 2022, the DNREC State Energy Office was awarded a grant by the United States Department of Energy pursuant to Section 40101(d) of the Infrastructure Investment and Jobs Act (IIJA, also known as the Bipartisan Infrastructure Law (BIL)). The grant will assist Delaware in improving electrical grid resiliency and reducing the likelihood and consequences of disruptive events such as outages from extreme weather, natural disasters, and made disruptions such as cyber-attacks or terrorism aimed at compromising the power grid.

In developing the grant application, the SEO engaged with stakeholders over several meetings to identify where the funding could best be deployed through individual project awards. Based on stakeholder responses to several poll questions the group agreed to prioritize and focus on funding projects that reduce overall power disruptions, reduce disruption time when incidents do occur, maximize the number of people that will benefit, and prioritize areas most at risk during severe weather and prone to flooding.

The SEO has initiated a first round of applications to deploy the 40101(d) funds to help Delaware improve the state's overall energy security through projects that promote electrical grid resiliency and security. DOE provided $1.4 grant funding annually to Delaware for five (5) separate funding years. Large entities must provide a 100% cost match for their project, while small entities (not more than 4 million MWH per year) must provide a 33.3% cost match.

7.3.3 The Governor's Energy Advisory Council (GEAC)

The Governor's Energy Advisory Council (GEAC) is charged with providing recommendations to DNREC's State Energy Office on updates to the Delaware Energy Plan and with monitoring and proposing actions to enhance Delaware's energy system, including actions to lessen the climate change impacts and providing counsel to the Governor on promoting an economic, reliable and competitive energy market for all Delaware consumers.

In 2022, the Delaware Energy Act was amended to expand the council to 25 members and update its mission. The Act was further updated in 2023, directing the State Energy Office, located within DNREC, to "provide technical and administration support" to the council and "develop and update, at least every 5 years, a comprehensive State Energy Plan" that includes but is not limited to "…encouraging and promoting conservation of energy … and encouraging and promoting the use of renewable electric generation facilities and alternative energy technologies…" and "support[s] the state's greenhouse gas emissions reductions targets…"

The Governor's Energy Advisory Council approved a set of final recommendations and submitted them to DNREC's State Energy Office for inclusion in the latest State Energy Plan update. The recommendations were made by the four workgroups the council established to review past plans and study topics in greater detail:

- Renewable Energy and Clean Technologies Workgroup Recommendations
- Energy Efficiency and Electrification Workgroup Recommendations
- Grid Modernization Workgroup Recommendations
- Environmental Justice and Energy Equity Workgroup Recommendations

The State Energy Office has incorporated the recommendations into the draft State Energy Plan.

7.3.4 Economic Assistance Coordinator

The governor may designate an Economic Assistance Coordinator to serve on the Multi-Agency Task Force. The Economic Assistance Coordinator must keep abreast of all current state and federal legislation and executive orders that may affect Delaware's Economic Assistance Programs. An Economic Assistance Coordinator will be designated by the governor to serve on the Multi-Agency Task Force as well as serve as liaison between the Energy Response Team and DEMA. The coordinator must also keep abreast of all current state and federal legislation and executive orders that may affect Delaware's Economic Assistance Programs. Other specific duties of the coordinator may include:

- Upon direction from the Energy Response Team and DEMA, the Coordinator will notify the appropriate members of the task force of the possible need for augmentation of assistance to low-income households.
- The coordinator will work with the task force to develop an interim report outlining the potential extent and duration of economic impacts on low-income households caused by the energy supply disruption.
- The coordinator, with the advice and consent of the chairman, shall notify the governor and the legislature of the need of additional funding for economic assistance programs.
- The coordinator, with the advice and consent of the task force, will offer proposals for increased funding, identifying potential funding sources;
- The coordinator will concurrently contact the U.S. Department of Energy, the U.S. Department of Health and Human Services, etc., requesting additional funding for assistance programs.
- The coordinator is responsible for briefing the task force and the Energy Response Team and DEMA on implementation of the programs and success in securing additional funding.
- The coordinator, in conjunction with the Energy Response Team and DEMA will prepare public announcements of program availability and the application process.
- The coordinator, in conjunction with Energy Response Team and DEMA, will prepare an evaluation of the program results.

7.3.5 Existing Economic Assistance Programs

The primary focus of economic assistance programs is to use existing mechanisms for distribution of funds. The plan does not seek to design a new revenue distribution program, which would respond only to an energy supply disruption. Instead, appropriate operational details are added to the process of existing programs, adapting them to a particular energy disruption at the time of the event. This approach minimizes unnecessary advance planning for a specialized program, which can be pre-empted by federal action.

Energy Efficiency Investment Fund

The Energy Efficiency Investment Fund (EEIF) provides grants to support commercial and industrial customers in replacing aging, inefficient equipment and systems with energy efficiency alternatives.

Improving the energy efficiency of a business helps to decrease operating costs, reduce energy consumption, and improve environmental performance. Support from the Energy Efficiency Investment Fund is available to perform energy assessments, to take widely-recognized (prescriptive) energy efficiency improvement steps, and to implement custom, site-specific improvements. DNREC offers both grants and low-interest loans to support energy efficiency projects throughout Delaware. The EEIF program is currently funded by the public utility tax (PUT). For more information on the public utility tax, please see the Public Utilities chapter of the Delaware State Code (30 Del.C. Ch. 55).

Sufficient funding for economic assistance programs will be determined at the time of implementation. Since it is difficult to identify funding sources prior to implementation, the programs were purposely left flexible with respect to their source of funds. Therefore, the main task of this plan is to identify existing programs which potentially could be augmented to provide maximum relief to low-income households in the most efficient manner, as determined by a Multi-Agency Task Force.

Weatherization Program

The Weatherization Assistance Program (WAP) provides safe, cost-effective energy conservation services (space and domestic water heating efficiency upgrades) to low-income residents of Delaware. The services provided include health and safety checks of the heating system, interior air quality, interior moisture levels and structural integrity; heating system efficiency improvements; air leakage reduction; insulation of attics, walls, under floors and crawlspaces; and client education in energy conservation. The weatherization program is funded through a combination of federal funds from the U.S. Department of Energy Weatherization Assistance Program, funds collected from utilities, funds from the Regional Greenhouse Gas Initiative (RGGI), and funds from the Low Income Home Energy Assistance Program (LIHEAP). The program is administered by the Division of Climate, Coastal & Energy.

Low Income Home Energy Assistance Program (LIHEAP)

The Delaware Energy Assistance Program (DEAP) is a federally funded program for low- income families that need help in meeting the costs of residential energy consumption. The Division of State Service Centers (DSSC) administers this program on a contractual basis with Catholic Charities, Inc.. Funds are provided by the U.S. Department of Health & Human Services (HHS), under the Low-Income Home Energy Assistance Program (LIHEAP). DEAP services provide assistance to income-eligible families to help them meet their home energy needs. Income eligibility is defined as 200% of the federal poverty level. (As a reference, please see the Division of Social Services' Income Eligibility tables). LIEAP has several components which include:

- Fuel Assistance: Help with home energy bills from the period of October 1 - March 31. This includes grants to income-eligible households to help pay for home heating, which includes electricity, natural gas, kerosene, propane, coal, or wood. Grants are made to both homeowners and renters.
- Crisis Assistance: This component helps households in crisis during the winter months and may be in the form of a supplemental grant to their fuel assistance benefit. In addition to being income-eligible, households must show they are experiencing a crisis (i.e., shut-off notice, out of fuel, no money to pay for fuel).
- Summer Cooling Assistance Program (SCAP): This program operates during the months of June to August and helps pay for electricity to cool homes with air conditioning during the hot, humid summer months. In addition to receiving a grant to offset the high costs of electricity to air condition a home, some populations may be eligible to receive a room-sized air conditioning unit.

Consumers and social service providers can call Catholic Charities to learn where and how to apply for assistance. To contact Catholic Charities call:

- Kent County: (302) 674-1782
- New Castle County: (302) 654-9295

- Sussex County: (302) 856-6310

For additional information about LIHEAP, the following link is available:

www.neada.org

For further information, contact the Delaware Division of State Service Centers.

What are the Income Limits for Applying for DSS Programs?

Financial eligibility criteria vary from program to program. However, the two most common benchmarks by which the Division of Medicaid & Medical Assistance sets income criteria are the:

- Federal Poverty Level (FPL) Tables
- Supplemental Security Income (SSI)

Please check the information for the specific programs or services for the exact criteria. However, the following tables may help consumers or social service providers determine eligibility.

Tio determine eligibility for the Delaware Healthy Children Program (DHCP), consumers and social service providers consult the 2016 Countable Income Limits for DHCP.

APPENDIX A. CONTACTS

MOTOR FUEL EMERGENCY CONTACTS		
Name	**Contact Details**	**Role**
Mid-Atlantic Petroleum Distributors Association	1517 Ritchie Highway, Suite 206, Arnold, MD 21012 (410)349-0808 http://www.mapda.com/	Can provide trends and locations where shortages are occurring.
American Fuel and Petrochemical Manufacturers	1667 K Street, NW St #700 Washington, D.C. 20006 General: (202) 457-0480 Contact: Jeffrey Gunnulfsen (202)552-4371 https://www.afpm.org/	Provide updates about supply chain of refineries and petrochemical manufacturers in Delaware, can redirect to federal contacts, including the DOE and DHS.
Petroleum Marketers Assoc. of America (PMAA)	1901 N Fort Myer Drive, Suite 1200 Arlington, VA 22209 Contact: Sherri Stone sstone@pmaa.org Phone:(703) 351-8000 Fax:(703) 351-9160 http://www.pmaa.org/	Provide updates about distribution and availability of petroleum related products
Delaware Division of Climate, Coastal & Energy (DCCE)	State Street Commons, Suite 10B 100 W Water Street Dover, DE 19904 Contact: Dayna Cobb (302) 735-3480 http://dnrec.alpha.delaware.gov/energy-climate/sustainable-communities/energy-assurance/	Review and approve emergency fuel waivers in collaboration with DEMA.
Delaware Emergency Management Agency (DEMA)	165 Rd 488 Smyrna, DE 19977 (302) 659-3362 Contact: Jennifer Walls http://www.dema.delaware.gov	Provides emergency assistance, updates, and information
Delaware Department of Agriculture Weights and Measures	2320 South DuPont Highway Dover, DE 19901 Contact: Steven Connors (administrator) (302)698-4602 Steven.connors@state.de.us	Should be first point of contact for RVP waiver for transporting fuel during weather related emergency due to pressure issues
MONITORING A MOTOR FUEL SHORTAGE		
Mid-Atlantic Petroleum Distributors Association	1517 Ritchie Highway, Suite 206, Arnold, MD 21012 (410)349-0808 http://www.mapda.com/	Can provide trends and locations where shortages are occurring.
American Petroleum Institute (API)	1220 L Street, NW Washington, DC 20005 (202)-682-8000 http://www.api.org/	
Wawa Inc.	260 West Baltimore Pike Wawa, PA 19063 Brian Schaller (Fuel Supply) (610)358-6884 Allison Clark (Petroleum Distribution) (610)558-8407	Assist with emergency fuel supply, fuel logistics, and help to locate open fuel retail stores

MOTOR DRIVER WAIVERS	
Level II Emergency Driving Restriction Waiver	DEMA State of Emergency Driving Restriction Waiver
Emergency Fuel Waiver Request Form	Emergency Fuel Waiver Request Form
NATURAL GAS PIPELINE COMPANIES	
Eastern Shore Natural Gas	1110 Forrest Ave, Suite 201 Dover, DE 19904 (302)734-6720 (800)282-8555
DELAWARE HEATING OIL AND KEROSENE DEALERS	
Adams Oil Co	N Pine Street Ext Seaford, DE 19973 (302)629-4531
Cochran Oil Co	229 W Hillview Ave, New Castle, DE 19720 (302)654-3333
Gooding Heating Service and Fuel	813 E 8th Street Wilmington, DE 19801 (302)656-2751
Hillside Oil Heating and Cooling	40 Brookhill Dr Newark, DE 19702 (302)738-4144
Rausch Fuel Oil Co	14 Wood Street Middletown, DE 19709 (302)378-8654
Roman Oil Company	111 Race Street, Wilmington, DE 19804 (302)888-2300
Tri Gas and Oil Co	20501 DuPont Blvd Georgetown, DE 19947 (302)856-6300 http://www.trigas-oil.com/
Vernon & Vernon	2207 Naamans Rd. Wilmington, DE 19810 (302)762-2969
Wilkins Fuel Co	701 S Washington St. Milford, DE 19963 (302)422-5597
STATE CONTACTS	
Delaware Department of Agriculture Weights and Measures	2320 South DuPont Highway Dover, DE 19901 Contact: Steven Connors (administrator) (302)698-4601 Steven.connors@state.de.us
Delaware Department of Transportation (DELDOT)	800 S Bay Road Dover, DE 19901 (302)760-2080 https://www.deldot.gov/
Delaware Division of Climate, Coastal & Energy	State Street Commons, Suite 10B 100 W Water Street Dover, DE 19904 (302) 735-3480 http://dnrec.alpha.delaware.gov/energy-climate/

Delaware Emergency Management Agency (DEMA)	165 Rd 488 Smyrna, DE 19977 (302) 659-3362 http://www.dema.delaware.gov	
List of Other Delaware Agencies	https://delaware.gov/topics/agencylist_dept	
ELECTRIC GENERATION AND DISTRIBUTION RESOURCES		
Electric Utilities	• Delmarva 1-800-375-7117 1-800-898-8042 (Emergencies) • Delaware Municipal Electric Corporation • Delaware Electric Cooperative 1-855-332-9090	
Power Plant: NRG Indian River Generating Station	29416 Power Plant Road Dagsboro DE, 19939 (609) 524-4500	
Power Plant: Calpine Edge Moor Energy Center	Calpine Wilmington, DE (713) 830-8809	
ADDITIONAL RESOURCES		
Delmarva Petroleum Service	21 Water Street, Lincoln DE, 19960 (302) 422-8148	Petroleum Products Company
American Gas Association	400 North Capital St NW #450 Washington, DC 20001 (202) 824-7000 https://www.aga.org/	
National Petroleum Council	1625 K Street, NW Ste 600 Washington, D.C. 20006 (202) 393-6100 www.npc.org	
Petroleum Marketers Assoc. of America (PMAA)	1901 N Fort Myer Drive, Suite 1200 Arlington, VA 22209 Phone: (703) 351-8000 Fax:(703) 351-9160 http://www.pmaa.org/	
National Association of State Energy Officials	1300 North 17th Street, Suite 1275 Arlington, Virginia 22209 (703) 299-8800 fax: (703) 299-6208 www.naseo.org	
National Association of Regulatory Utility Commissioners	1101 Vermont Avenue, NW Suite 200 Washington, DC 20005 Phone: (202) 898.2200 Fax: (202) 898.2213 https://www.naruc.org/	
Office of Electricity Delivery & Energy Reliability	U.S. Department of Energy 1000 Independence Avenue, SW Washington, DC 20585 (202) 586-1411 OEwebmaster@hq.doe.gov	
DHS, National Infrastructure Coordinating Center	(202) 282-9201 NICC@hq.dhs.gov	
US Computer Emergency Readiness Team (CERT)	(888)282-0870 info@us-cert.gov https://www.us-cert.gov/	

APPENDIX B. GLOSSARY OF TERMS

Active solar heating: Energy from the sun is collected and stored using mechanical pumps or fans to circulate heat-laden fluids or air between solar collectors and a building.

Actual peak reduction: The annual peak load (measured in kilowatts) reduction achieved by customers that participate in a utility demand-side management (DSM) program. It reflects the changes in the demand for electricity resulting from a utility DSM program that is in effect at the same time the utility experiences its peak load, as opposed to the installed peak load reduction capability (i.e., potential peak reduction). It should account for the regular cycling of energy efficient units during the period of annual peak load.

Adjustable speed drives: Motor drive systems that save energy by ensuring the motor's speed is properly matched to the load placed on the motor. Terms used to describe equipment and operations within this category include polyphase motors, motor oversizing, and motor rewinding.

Adjusted electricity: A measurement of electricity typically used in program assessment or evaluation activities that estimates the amount of energy used to generate electricity. To approximate the adjusted amount of electricity, the site-value of the electricity is multiplied by a factor of 3. The conversion factor of 3 is a rough approximation of the BTU value of raw fuels used to generate electricity in a steam - generation power plant.

Air conditioning: Cooling and dehumidifying the air in an enclosed space by use of a refrigeration unit powered by electricity or natural gas. *Note*: Fans, blowers, and evaporative cooling systems ("swamp coolers") that are not connected to a refrigeration unit are excluded.

Air conditioning intensity: The ratio of air-conditioning consumption or expenditures to square footage of cooled floor space and cooling degree-days (base 65 degrees F). This intensity provides a way of comparing different types of housing units and households by controlling for differences in housing unit size and weather conditions. The square footage of cooled floor space is equal to the product of the total square footage times the ratio of the number of rooms that could be cooled to the total number of rooms. If the entire housing unit is cooled, the cooled floorspace is the same as the total floorspace. The ratio is calculated on a weighted, aggregate basis according to this formula: Air-Conditioning Intensity = BTU for Air Conditioning/(Cooled Square Feet * Cooling Degree-Days)

Air pollution abatement equipment: Equipment used to reduce or eliminate airborne pollutants, including particulate matter (dust, smoke, fly, ash, dirt, etc.), sulfur oxides, nitrogen oxides (NO_x), carbon monoxide, hydrocarbons, odors, and other pollutants. Examples of air pollution abatement structures and equipment include flue-gas particulate collectors, flue-gas desulfurization units and nitrogen oxide control devices.

Alternative fuel: Alternative fuels, for transportation applications, include the following:

- methanol
- denatured ethanol, and other alcohols
- fuel mixtures containing 85 percent or more by volume of methanol, denatured ethanol, and other alcohols with gasoline or other fuels -- natural gas
- liquefied petroleum gas (propane)
- hydrogen
- coal-derived liquid fuels
- fuels (other than alcohol) derived from biological materials (biofuels such as soy diesel fuel)
- electricity (including electricity from solar energy.)

"... any other fuel the Secretary determines, by rule, is substantially not petroleum and would yield substantial energy security benefits and substantial environmental benefits." The term "alternative fuel" does not include alcohol or other blended portions of primarily petroleum-based fuels used as oxygenates

or extenders, i.e. MTBE, ETBE, other ethers, and the 10-percent ethanol portion of gasohol.

Alternative-fuel vehicle (AFV): A vehicle designed to operate on an alternative fuel (e.g., compressed natural gas, methane blend, electricity). The vehicle could be either a dedicated vehicle designed to operate exclusively on alternative fuel or a non-dedicated vehicle designed to operate on alternative fuel and/or a traditional fuel.

Alternative fuel vehicle converter: An organization (including companies, government agencies and utilities), or individual that performs conversions involving alternative fuel vehicles. An AFV converter can convert (1) conventionally fueled vehicles to AFVs, (2) AFVs to conventionally fueled vehicles, or (3) AFVs to use another alternative fuel.

Anthracite: The highest rank of coal; used primarily for residential and commercial space heating. It is a hard, brittle, and black lustrous coal, often referred to as hard coal, containing a high percentage of fixed carbon and a low percentage of volatile matter. The moisture content of fresh-mined anthracite generally is less than 15 percent. The heat content of anthracite ranges from 22 to 28 million BTU per ton on a moist, mineral-matter-free basis. The heat content of anthracite coal consumed in the United States averages 25 million BTU per ton, on the as-received basis (i.e., containing both inherent moisture and mineral matter). *Note:* Since the 1980's, anthracite refuse or mine waste has been used for steam electric power generation. This fuel typically has a heat content of 15 million BTU per ton or less.

Aviation gasoline (finished): A complex mixture of relatively volatile hydrocarbons with or without small quantities of additives, blended to form a fuel suitable for use in aviation reciprocating engines. Fuel specifications are provided in ASTM Specification D 910 and Military Specification MIL-G-5572. *Note:* Data on blending components are not counted in data on finished aviation gasoline.

Aviation gasoline blending components: Naphthas that will be used for blending or compounding into finished aviation gasoline (e.g., straight run gasoline, alkylate, reformate, benzene, toluene, and xylene). Excludes oxygenates (alcohols, ethers), butane, and pentanes plus. Oxygenates are reported as other hydrocarbons, hydrogen, and oxygenates.

Backup fuel: In a central heat pump system, the fuel or source of heat that takes over the space heating when the outdoor temperature drops below that which is feasible to operate a heat pump.

Backup Generator: A generator that is used only for test purposes, or in the event of an emergency, such as a shortage of power needed to meet customer load requirements.

Backup power: Electric energy supplied by a utility to replace power and energy lost during an unscheduled equipment outage.

Barrel: A unit of volume equal to 42 U.S. gallons.

Barrels per Calendar day: The amount of input that a distillation facility can process under usual operating conditions. The amount is expressed in terms of capacity during a 24-hour period and reduces the maximum processing capability of all units at the facility under continuous operation (see **Barrels per Stream Day** below) to account for the following limitations that may delay, interrupt, or slow down production.

1. the capability of downstream processing units to absorb the output of crude oil processing facilities of a given refinery. No reduction is necessary for intermediate streams that are distributed to other than downstream facilities as part of a refinery's normal operation;
2. the types and grades of inputs to be processed;
3. the types and grades of products expected to be manufactured;
4. the environmental constraints associated with refinery operations;
5. the reduction of capacity for scheduled downtime due to such conditions as routine inspection, maintenance, repairs, and turnaround; and
6. the reduction of capacity for unscheduled downtime due to such conditions as mechanical

problems, repairs, and slowdowns.

Barrels per Stream day: The maximum number of barrels of input that a distillation facility can process within a 24-hour period when running at full capacity under optimal crude and product slate conditions with no allowance for downtime.

Base load: The minimum amount of electric power delivered or required over a given period of time at a steady rate.

Base load capacity: The generating equipment normally operated to serve loads on an around-the-clock basis.

Base load plant: A plant, usually housing high-efficiency steam-electric units, which is normally operated to take all or part of the minimum load of a system, and which consequently produces electricity at an essentially constant rate and runs continuously. These units are operated to maximize system mechanical and thermal efficiency and minimize system operating costs.

Base period: The period of time for which data used as the base of an index number, or other ratio, have been collected. This period is frequently one of a year but it may be as short as one day or as long as the average of a group of years. The length of the base period is governed by the nature of the material under review, the purpose for which the index number (or ratio) is being compiled, and the desire to use a period as free as possible from abnormal influences in order to avoid bias.

Base rate: A fixed kilowatt-hour charge for electricity consumed that is independent of other charges and/or adjustments.

Baseboard heater: As a type of heating equipment, a system in which either electric resistance coils or finned tubes carrying steam or hot water are mounted behind shallow panels along baseboards. Baseboards rely on passive convection to distribute heated air in the space. Electric baseboards are an example of an "Individual Space Heater."

(Also see **Individual Space Heater**.)

bbl: The abbreviation for barrel(s).

bbl/d: The abbreviation for barrel(s) per day.

bbl/sd: The abbreviation for barrel(s) per stream day

bcf: The abbreviation for billion cubic feet.

Benzene (C6H6): An aromatic hydrocarbon present in small proportion in some crude oils and made commercially from petroleum by the catalytic reforming of naphthenes in petroleum naphtha. Also made from coal in the manufacture of coke. Used as a solvent in the manufacture of detergents, synthetic fibers, petrochemicals, and as a component of high- octane gasoline.

Bi-fuel vehicle: A motor vehicle that operates on two different fuels, but not on a mixture of the fuels. Each fuel is stored in a separate tank.

Biodiesel: Any liquid biofuel suitable as a diesel fuel substitute or diesel fuel additive or extender. Biodiesel fuels are typically made from oils such as soybeans, rapeseed, or sunflowers, or from animal tallow. Biodiesel can also be made from hydrocarbons derived from agricultural products such as rice hulls.

Biofuels: Liquid fuels and blending components produced from biomass (plant) feedstocks, used primarily for transportation.

Biomass: Organic non-fossil material of biological origin constituting a renewable energy source.

Biomass gas: A medium BTU gas containing methane and carbon dioxide, resulting from the action of microorganisms on organic materials such as a landfill.

Bitumen: A naturally occurring viscous mixture, mainly of hydrocarbons heavier than pentane, that may contain sulfur compounds and that, in its naturally occurring viscous state, is not recoverable at a

commercial rate through a well.

Bituminous coal: A dense coal, usually black, sometimes dark brown, often with well-defined bands of bright and dull material, used primarily as fuel in steam-electric power generation, with substantial quantities also used for heat and power applications in manufacturing and to make coke. Bituminous coal is the most abundant coal in active U.S. mining regions. Its moisture content usually is less than 20 percent. The heat content of bituminous coal ranges from 21 to 30 million BTU per ton on a moist, mineral-matter-free basis. The heat content of bituminous coal consumed in the United States averages 24 million BTU per ton, on the as-received basis (i.e., containing both inherent moisture and mineral matter).

Blending components: See motor gasoline blending components.

Blending plant: A facility that has no refining capability but is either capable of producing finished motor gasoline through mechanical blending or blends oxygenates with motor gasoline.

Bonded petroleum imports: Petroleum imported and entered into United States Customs bonded storage. These imports are not included in the import statistics until they are: (1) withdrawn from storage free of duty for use as fuel for vessels and aircraft engaged in international trade; or (2) withdrawn from storage with duty paid for domestic use.

Borderline customer: A customer located in the service area of one utility, but supplied by a neighboring utility through an arrangement between the utilities.

Bottled gas: See Liquefied petroleum gases.

Bottled gas, LPG, or propane: Any fuel gas supplied in liquid form, such as liquefied petroleum gas, propane, or butane. It is usually delivered by tank truck and stored near a building in a tank or cylinder until used.

Branded product: A refined petroleum product sold by a refiner with the understanding that the purchaser has the right to resell the product under a trade-mark, trade name, service mark, or other identifying symbol or names owned by such refiner.

British thermal unit: The quantity of heat required to raise the temperature of 1 pound of liquid water by 1 degree Fahrenheit (F) at the temperature at which water has its greatest density (approximately 39 degrees Fahrenheit).

BTU: The abbreviation for British Thermal Unit(s).

BTU conversion factors: BTU conversion factors for site energy are as follows:

Electricity ..... 3,412 BTU/kilowatt hour

Natural Gas ..... 1,031 BTU/cubic foot

Fuel Oil No.1 ..... 135,000 BTU/gallon

Kerosene ..... 135,000 BTU/gallon

Fuel Oil No.2 ..... 138,690 BTU/gallon

LPG (Propane) ..... 91,330 BTU/gallon

Wood ..... 20 million BTU/cord

BTU per cubic foot: The total heating value, expressed in BTU, produced by the combustion, at constant pressure, of the amount of the gas that would occupy a volume of 1 cubic foot at a temperature of 60 degrees F if saturated with water vapor and under a pressure equivalent to that of 30 inches of mercury at 32 degrees F and under standard gravitational force (980.665 cm. per sec. squared) with air of the same temperature and pressure as the gas, when the products of combustion are cooled to the initial temperature of gas and air when the water formed by combustion is condensed to the liquid state. (Sometimes called gross heating value or total heating value.)

BTX: The acronym for the commercial petroleum aromatics--benzene, toluene, and xylene. See individual categories for definitions.

Bunker fuels: Fuel supplied to ships and aircraft, both domestic and foreign, consisting primarily of residual and distillate fuel oil for ships and kerosene-based jet fuel for aircraft. The term "international bunker fuels" is used to denote the consumption of fuel for international transport activities. Note: For the purposes of greenhouse gas emissions inventories, data on emissions from combustion of international bunker fuels are subtracted from national emissions totals. Historically, bunker fuels have meant only ship fuel.

Captive refinery MTBE plants: MTBE (methyl tertiary butyl ether) production facilities primarily located within refineries. These integrated refinery units produce MTBE from Fluid Cat Cracker isobutylene with production dedicated to internal gasoline blending requirements.

Captive refinery oxygenate plants: Oxygenate production facilities located within or adjacent to a refinery complex.

CO control period ("seasons"): The portion of the year in which a CO nonattainment area is prone to high ambient levels of carbon monoxide. This portion of the year is to be specified by the Environmental Protection Agency but is to be not less than 4 months in length.

Coal: A readily combustible black or brownish-black rock whose composition, including inherent moisture, consists of more than 50 percent by weight and more than 70 percent by volume of carbonaceous material. It is formed from plant remains that have been compacted, hardened, chemically altered, and metamorphosed by heat and pressure over geologic time.

Coal analysis: Determines the composition and properties of coal so it can be ranked and used most effectively.

- **Proximate analysis** determines, on an as-received basis, the moisture content, volatile matter (gases released when coal is heated), fixed carbon (solid fuel left after the volatile matter is driven off), and ash (impurities consisting of silica, iron, alumina, and other incombustible matter). The moisture content affects the ease with which coal can be handled and burned. The amount of volatile matter and fixed carbon provides guidelines for determining the intensity of the heat produced. Ash increases the weight of coal, adds to the cost of handling, and can cause problems such as clinkering and slagging in boilers and furnaces.
- **Ultimate analysis** determines the amount of carbon, hydrogen, oxygen, nitrogen, and sulfur. Heating value is determined in terms of BTU, both on an as received basis (including moisture) and on a dry basis.
- **Agglomerating** refers to coal that softens when heated and forms a hard gray coke; this coal is called caking coal. Not all caking coals are coking coals. The agglomerating value is used to differentiate between coal ranks and also is a guide to determine how a particular coal reacts in a furnace.
- **Agglutinating** refers to the binding qualities of a coal. The agglutinating value is an indication of how well a coke made from a particular coal will perform in a blast furnace. It is also called a caking index.
- **Other tests** include the determination of the ash softening temperature, the ash fusion temperature (the temperature at which the ash forms clinkers or slag), the free swelling index (a guide to a coal's coking characteristics), the Gray King test (which determines the suitability of coal for making coke), and the Hardgrove grindability index (a measure of the ease with which coal can be pulverized). In a petrographic analysis, thin sections of coal or highly polished blocks of coal are studied with a microscope to determine the physical composition, both for scientific purposes and for estimating the rank and coking potential.

Coal bed: A bed or stratum of coal. Also called a coal seam.

Coal bed degasification: This refers to the removal of methane or coal bed gas from a coal mine before or

during mining.

Coal bed methane: Methane is generated during coal formation and is contained in the coal microstructure. Typical recovery entails pumping water out of the coal to allow the gas to escape. Methane is the principal component of natural gas. Coal bed methane can be added to natural gas pipelines without any special treatment.

Coal briquets: Anthracite, bituminous, and lignite briquets comprise the secondary solid fuels manufactured from coal by a process in which the coal is partly dried, warmed to expel excess moisture, and then compressed into briquets, usually without the use of a binding substance. In the reduction of briquets to coal equivalent, different conversion factors are applied according to their origin from hard coal, peat, brown coal, or lignite.

Coal carbonized: The amount of coal decomposed into solid coke and gaseous products by heating in a coke oven in a limited air supply or in the absence of air.

Coal chemicals: Coal chemicals are obtained from the gases and vapor recovered from the manufacturing of coke. Generally, crude tar, ammonia, crude light oil, and gas are the basic products recovered. They are refined or processed to yield a variety of chemical materials.

Coal coke: See **Coke(coal)** below.

Coal consumption: The quantity of coal burned for the generation of electric power (in short tons), including fuel used for maintenance of standby service.

Coal delivered: Coal which has been delivered from the coal supplier to any site belonging to the electric power company.

Coal exports: Amount of U.S. coal shipped to foreign destinations, as reported in the U.S. Department of Commerce, Bureau of Census, "Monthly Report EM 545."

Coal face: This is the exposed area from which coal is extracted.

Coal financial reporting regions: A geographic classification of areas with coal resources which is used for financial reporting of coal statistics.

- Eastern Region. Consists of the Appalachian Coal Basin. The following comprise the Eastern Region: Alabama, eastern Kentucky, Georgia, Maryland, Mississippi, Ohio, Pennsylvania, Virginia, Tennessee, North Carolina, and West Virginia.
- Midwest Region. Consists of the Illinois and Michigan Coal Basins. The following comprise the Midwest Region: Illinois, Indiana, Michigan, and western Kentucky.
- Western Region. Consists of the Northern Rocky, Southern Rocky, West Coast Coal Basins and Western Interior. The following comprise the Western Region: Alaska, Arizona, Arkansas, California, Colorado, Idaho, Iowa, Kansas, Louisiana, Missouri, Montana, New Mexico, North Dakota, Oklahoma, Oregon, Texas, South Dakota, Utah, Washington, and Wyoming.

Coal fines: Coal with a maximum particle size usually less than one-sixteenth inch and rarely above one-eighth inch.

Coal gas: Substitute natural gas produced synthetically by the chemical reduction of coal at a coal gasification facility.

Coal gasification: The process of converting coal into gas. The basic process involves crushing coal to a powder, which is then heated in the presence of steam and oxygen to produce a gas. The gas is then refined to reduce sulfur and other impurities. The gas can be used as a fuel or processed further and concentrated into chemical or liquid fuel.

Coal grade: This classification refers to coal quality and use.

- **Briquettes** are made from compressed coal dust, with or without a binding agent such as asphalt.

- **Cleaned coal or prepared coal** has been processed to reduce the amount of impurities present and improve the burning characteristics.
- **Compliance coal** is a coal, or a blend of coal, that meets sulfur dioxide emission standards for air quality without the need for flue-gas desulfurization.
- **Culm and silt** are waste materials from preparation plants. In the anthracite region, culm consists of coarse rock fragments containing as much as 30 percent small-sized coal. Silt is a mixture of very fine coal particles (approximately 40 percent) and rock dust that has settled out from waste water from the plants. The terms culm and silt are sometimes used interchangeably and are sometimes called refuse. Culm and silt have a heat value ranging from 8 to 17 million BTU per ton.
- **Low-sulfur coal** generally contains 1 percent or less sulfur by weight. For air quality standards, "low sulfur coal" contains 0.6 pounds or less sulfur per million BTU, which is equivalent to 1.2 pounds of sulfur dioxide per million BTU.
- **Metallurgical coal (or coking coal)** meets the requirements for making coke. It must have a low ash and sulfur content and form a coke that is capable of supporting the charge of iron ore and limestone in a blast furnace. A blend of two or more bituminous coals is usually required to make coke.
- **Pulverized coal** is a coal that has been crushed to a fine dust in a grinding mil l. It is blown into the combustion zone of a furnace and burns very rapidly and efficiently.
- **Slack coal** usually refers to bituminous coal one-half inch or smaller in size.
- **Steam coal** refers to coal used in boilers to generate steam to produce electricity or for other purposes.
- **Stoker coal** refers to coal that has been crushed to specific sizes (but not powdered) for burning on a grate in automatic firing equipment.

Coal imports: Amount of foreign coal shipped to the United States, as reported in the U.S. Department of Commerce, Bureau of the Census, "Monthly Report IM 145."

Coal liquefaction: A chemical process that converts coal into clean-burning liquid hydrocarbons, such as synthetic crude oil and methanol.

Coal mining productivity: Coal mining productivity is calculated by dividing total coal production by the total direct labor hours worked by all mine employees.

Coal preparation: The process of sizing and cleaning coal to meet market specifications by removing impurities such as rock, sulfur, etc. It may include crushing, screening, or mechanical cleaning.

Coal-producing regions:

- Appalachian Region. Consists of Alabama, Georgia, Eastern Kentucky, Maryland, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia.
- Interior Region (with Gulf Coast). Consists of Arkansas, Illinois, Indiana, Iowa, Kansas, Louisiana, Michigan, Mississippi, Missouri, Oklahoma, Texas, and Western Kentucky.
- Western Region. Consists of Alaska, Arizona, Colorado, Montana, New Mexico, North Dakota, Utah, Washington, and Wyoming.

Note: Some States discontinue producing coal as reserves are depleted or as production becomes uneconomic.

Coal producing districts: A classification of coal fields defined in the Bituminous Coal Act of 1937. The districts were originally established to aid in formulating minimum prices of bituminous and subbituminous coal and lignite. Because much statistical information was compiled in terms of these districts, their use for statistical purposes has continued since the abandonment of that legislation in 1943. District 24 was added

for the anthracite-producing district in Pennsylvania.

Coal production: The sum of sales, mine consumption, issues to miners, and issues to coke, briquetting, and other ancillary plants at mines. Production data include quantities extracted from surface and underground mines, and normally exclude wastes removed at mines or associated reparation plants.

Coal rank: The classification of coals according to their degree of progressive alteration from lignite to anthracite. In the United States, the standard ranks of coal include lignite, subbituminous coal, bituminous coal, and anthracite and are based on fixed carbon, volatile matter, heating value, and agglomerating (or caking) properties.

Coal sampling: The collection and proper storage and handling of a relatively small quantity of coal for laboratory analysis. Sampling may be done for a wide range of purposes, such as: coal resource exploration and assessment, characterization of the reserves or production of a mine, to characterize the results of coal cleaning processes, to monitor coal shipments or receipts for adherence to coal quality contract specifications, or to subject a coal to specific combustion or reactivity tests related to the customer's intended use. During pre-development phases, such as exploration and resource assessment, sampling typically is from natural outcrops, test pits, old or existing mines in the region, drill cuttings, or drilled cores. Characterization of a mine's reserves or production may use sample collection in the mine, representative cuts from coal conveyors or from handling and loading equipment, or directly from stockpiles or shipments (coal rail cars or barges). Contract specifications rely on sampling from the production flow at the mining or coal handling facility or at the loadout, or from the incoming shipments at the receiver's facility. In all cases, the value of a sample taken depends on its being representative of the coal under consideration, which in turn requires that appropriate sampling procedures be carefully followed.

For coal resource and estimated reserve characterization, appropriate types of samples include:

- **Face channel or channel sample:** a sample taken at the exposed coal in a mine by cutting away any loose or weathered coal then collecting on a clean surface a sample of the coal seam by chopping out a channel of uniform width and depth; a face channel or face sample is taken at or near the working face, the most freshly exposed coal where actual removal and loading of mined coal is taking place. Any partings greater than 3/8 inch and/or mineral concretions greater than 1/2 inch thick and 2 inches in maximum diameter are normally discarded from a channel sample so as better to represent coal that has been mined, crushed, and screened to remove at least gross non-coal materials.
- **Column sample:** a channel or drill core sample taken to represent the entire geologic coalbed; it includes all partings and impurities that may exist in the coalbed.
- **Bench sample:** a face or channel sample taken of just that contiguous portion of a coalbed that is considered practical to mine, also known as a "bench;" For example, bench samples may be taken of minable coal where impure coal that makes up part of the geologic coalbed is likely to be left in the mine, or where thick partings split the coal into two or more distinct minable seams, or where extremely thick coalbeds cannot be recovered by normal mining equipment, so that the coal is mined in multiple passes, or benches, usually defined along natural bedding planes.
- **Composite sample:** a recombined coalbed sample produced by averaging together thickness-weighted coal analyses from partial samples of the coalbed, such as from one or more bench samples, from one or more mine exposures or outcrops where the entire bed could not be accessed in one sample, or from multiple drill cores that were required to retrieve all local sections of a coal seam.

Coal stocks: Coal quantities that are held in storage for future use and disposition. *Note:* When coal data are collected for a particular reporting period (month, quarter, or year), coal stocks are commonly measured as of the last day of this period.

Coal sulfur: Coal sulfur occurs in three forms: organic, sulfate, and pyritic. Organic sulfur is an integral part of the coal matrix and cannot be removed by conventional physical separation. Sulfate sulfur is usually negligible. Pyritic sulfur occurs as the minerals pyrite and marcasite; larger sizes generally can be removed by cleaning the coal.

Coal Synfuel: Coal-based solid fuel that has been processed by a coal synfuel plant; and coal-based fuels such as briquettes, pellets, or extrusions, which are formed from fresh or recycled coal and binding materials.

Coal type: The classification is based on physical characteristics or microscopic constituents. Examples of coal types are banded coal, bright coal, cannel coal, and splint coal. The term is also used to classify coal according to heat and sulfur content. See **Coal grade** above.

Coal zone: A series of laterally extensive and (or) lenticular coal beds and associated strata that arbitrarily can be viewed as a unit. Generally, the coal beds in a coal zone are assigned to the same geologic member or formation.

Code of Federal Regulations: A compilation of the general and permanent rules of the executive departments and agencies of the Federal Government as published in the Federal Register. The code is divided into 50 titles that represent broad areas subject to Federal regulation. Title 18 contains the FERC regulations.

Cofiring: The process of burning natural gas in conjunction with another fuel to reduce air pollutants.

Cogeneration: The production of electrical energy and another form of useful energy (such as heat or steam) through the sequential use of energy.

Cogeneration system: A system using a common energy source to produce both electricity and steam for other uses, resulting in increased fuel efficiency.

Cogenerator: A generating facility that produces electricity and another form of useful thermal energy (such as heat or steam), used for industrial, commercial, heating, or cooling purposes. To receive status as a qualifying facility (QF) under the Public Utility Regulatory Policies Act (PURPA), the facility must produce electric energy and "another form of useful thermal energy through the sequential use of energy" and meet certain ownership, operating, and efficiency criteria established by the Federal Energy Regulatory Commission (FERC). (See the Code of Federal Regulations, Title 18, Part 292.)

Coincidental demand: The sum of two or more demands that occur in the same time interval.

Coincidental peak load: The sum of two or more peak loads that occur in the same time interval.

Coke (coal): A solid carbonaceous residue derived from low-ash, low-sulfur bituminous coal from which the volatile constituents are driven off by baking in an oven at temperatures as high as 2,000 degrees Fahrenheit so that the fixed carbon and residual ash are fused together. Coke is used as a fuel and as a reducing agent in smelting iron ore in a blast furnace. Coke from coal is grey, hard, and porous and has a heating value of 24.8 million BTU per ton.

Coke (petroleum): A residue high in carbon content and low in hydrogen that is the final product of thermal decomposition in the condensation process in cracking. This product is reported as marketable coke or catalyst coke. The conversion is 5 barrels (of 42 U.S. gallons each) per short ton. Coke from petroleum has a heating value of 6.024 million BTU per barrel.

Coke breeze: The term refers to the fine sizes of coke, usually less than one-half inch, that are recovered from coke plants. It is commonly used for sintering iron ore.

Coke button: A button-shaped piece of coke resulting from standard laboratory tests that indicates the coking or free- swelling characteristics of a coal; expressed in numbers and compared with a standard.

Coke oven gas: The mixture of permanent gases produced by the carbonization of coal in a coke oven at temperatures in excess of 1,000 degrees Celsius.

Coke plants: Plants where coal is carbonized for the manufacture of coke in slot or beehive ovens.

Coking: Thermal refining processes used to produce fuel gas, gasoline blend stocks, distillates, and petroleum coke from the heavier products of atmospheric and vacuum distillation. Includes:

- **Delayed Coking.** A process by which heavier crude oil fractions can be thermally decomposed under conditions of elevated temperatures and pressure to produce a mixture of lighter oils and petroleum coke. The light oils can be processed further in other refinery units to meet product specifications. The coke can be used either as a fuel or in other applications such as the manufacturing of steel or aluminum.
- **Flexicoking.** A thermal cracking process which converts heavy hydrocarbons such as crude oil, tar sands bitumen, and distillation residues into light hydrocarbons. Feedstocks can be any pumpable hydrocarbons including those containing high concentrations of sulfur and metals.
- **Fluid Coking.** A thermal cracking process utilizing the fluidized-solids technique to remove carbon (coke) for continuous conversion of heavy, low-grade oils into lighter products.

Compact fluorescent bulbs: These are also known as "screw-in fluorescent replacements for incandescent" or "screw- ins." Compact fluorescent bulbs combine the efficiency of fluorescent lighting with the convenience of a standard incandescent bulb. There are many styles of compact fluorescent, including exit light fixtures and floodlights (lamps containing reflectors). Many screw into a standard light socket, and most produce a similar color of light as a standard incandescent bulb. Compact fluorescent bulbs come with ballasts that are electronic (lightweight, instant, no-flicker starting, and 10 to 15% more efficient) or magnetic (much heavier and slower starting). Other types of compact fluorescent bulbs include adaptive circulation and PL and SL lamps and ballasts. Compact fluorescent bulbs are designed for residential uses; they are also used in table lamps, wall sconces, and hall and ceiling fixtures of hotels, motels, hospitals, and other types of commercial buildings with residential-type applications.

Cooling degree-days: A measure of how warm a location is over a period of time relative to a base temperature, most commonly specified as 65 degrees Fahrenheit. The measure is computed for each day by subtracting the base temperature (65 degrees) from the average of the day's high and low temperatures, with negative values set equal to zero. Each day's cooling degree-days are summed to create a cooling degree-day measure for a specified reference period. Cooling degree-days are used in energy analysis as an indicator of air conditioning energy requirements or use.

Crude oil: A mixture of hydrocarbons that exists in liquid phase in natural underground reservoirs and remains liquid at atmospheric pressure after passing through surface separating facilities. Depending upon the characteristics of the crude stream, it may also include:

- Small amounts of hydrocarbons that exist in gaseous phase in natural underground reservoirs but are liquid at atmospheric pressure after being recovered from oil well (casinghead) gas in lease separators and are subsequently commingled with the crude stream without being separately measured. Lease condensate recovered as a liquid from natural gas wells in lease or field separation facilities and later mixed into the crude stream is also included;
- Small amounts of nonhydrocarbons produced with the oil, such as sulfur and various metals;
- Drip gases, and liquid hydrocarbons produced from tar sands, oil sands, gilsonite, and oil shale.

Liquids produced at natural gas processing plants are excluded. Crude oil is refined to produce a wide array of petroleum products, including heating oils; gasoline, diesel, and jet fuels; lubricants; asphalt; ethane, propane, and butane; and many other products used for their energy or chemical content.

Crude oil acquisitions (unfinished oil acquisitions): The volume of crude oil either acquired by the respondent for processing for his own account in accordance with accounting procedures generally accepted and consistently and historically applied by the refiner concerned, or in the case of a processing

agreement, delivered to another refinery for processing for the respondent's own account.

Crude oil that has not been added by a refiner to inventory and that is thereafter sold or otherwise disposed of without processing for the account of that refiner shall be deducted from its crude oil purchases at the time when the related cost is deducted from refinery inventory in accordance with accounting procedures generally applied by the refiner concerned. Crude oil processed by the respondent for the account of another is not a crude oil acquisition.

Crude oil f.o.b. price: The crude oil price actually charged at the oil producing country's port of loading. Includes deductions for any rebates and discounts or additions of premiums, where applicable. It is the actual price paid with no adjustment for credit terms.

Crude oil input: The total crude oil put into processing units at refineries.

Crude oil landed cost: The price of crude oil at the port of discharge, including charges associated with purchasing, transporting, and insuring a cargo from the purchase point to the port of discharge. The cost does not include charges incurred at the discharge port (e.g., import tariffs or fees, wharfage charges, and demurrage).

Crude oil less lease condensate: A mixture of hydrocarbons that exists in liquid phase in natural underground reservoirs and remains liquid at atmospheric pressure after passing through surface separating facilities. Such hydrocarbons as lease condensate and natural gasoline recovered as liquids from natural gas wells in lease or field separation facilities and later mixed into the crude stream are excluded. Depending upon the characteristics of the crude stream, crude oil may also include:

- Small amounts of hydrocarbons that exist in gaseous phase in natural underground reservoirs but are liquid at atmospheric pressure after being recovered from oil well (casinghead) gas in lease separators and are subsequently commingled with the crude stream without being separately measured;
- Small amounts of nonhydrocarbons produced with the oil, such as sulfur and various metals.

Crude oil losses: Represents the volume of crude oil reported by petroleum refineries as being lost in their operations. These losses are due to spills, contamination, fires, etc., as opposed to refining processing losses.

Crude oil production: The volume of crude oil produced from oil reservoirs during given periods of time. The amount of such production for a given period is measured as volumes delivered from lease storage tanks (i.e., the point of custody transfer) to pipelines, trucks, or other media for transport to refineries or terminals with adjustments for (1) net differences between opening and closing lease inventories, and (2) basic sediment and water (BS&W).

Crude oil qualities: Refers to two properties of crude oil, the sulfur content, and API gravity, which affect processing complexity and product characteristics.

Crude oil refinery input: The total crude oil put into processing units at refineries.

Crude oil stocks: Stocks of crude oil and lease condensate held at refineries, in pipelines, at pipeline terminals, and on leases.

Crude oil used directly: Crude oil consumed as fuel by crude oil pipelines and on crude oil leases.

Crude oil, refinery receipts: Receipts of domestic and foreign crude oil at a refinery. Includes all crude oil in transit except crude oil in transit by pipeline. Foreign crude oil is reported as a receipt only after entry through customs. Crude oil of foreign origin held in bonded storage is excluded.

Dealer tank wagon (DTW) sales: Wholesale sales of gasoline priced on a delivered basis to a retail outlet.

Dedicated reserves: The volume of recoverable, salable gas reserves committed to, controlled by, or possessed by the reporting pipeline company and used for acts and services for which both the seller and the company have received certificate authorization from the Federal Energy Regulatory Commission

(FERC). Reserves include both company-owned reserves (including owned gas in underground storage), reserves under contract from independent producers, and short- term and emergency supplies from the intrastate market. Gas volumes under contract from other interstate pipelines are not included as reserves, but may constitute part or all of a company's gas supply.

Deliverability: Represents the number of future years during which a pipeline company can meet its annual requirements for its presently certificated delivery capacity from presently committed sources of supply. The availability of gas from these sources of supply shall be governed by the physical capabilities of these sources to deliver gas by the terms of existing gas-purchase contracts, and by limitations imposed by State or Federal regulatory agencies.

Delivered cost: The cost of fuel, including the invoice price of fuel, transportation charges, taxes, commissions, insurance, and expenses associated with leased or owned equipment used to transport the fuel.

Delivered energy: The amount of energy delivered to the site (building); no adjustment is made for the fuels consumed to produce electricity or district sources. This is also referred to as net energy.

Delivered (gas): The physical transfer of natural, synthetic, and/or supplemental gas from facilities operated by the responding company to facilities operated by others or to consumers.

Deliveries (electric): Energy generated by one system and delivered to another system through one or more transmission lines.

Demand: See **Energy demand**.

Demonstrated reserve base (coal): A collective term for the sum of coal in both measured and indicated resource categories of reliability, representing 100 percent of the in-place coal in those categories as of a certain date. Includes beds of bituminuous coal and anthracite 28 or more inches thick and beds of subbituminuous coal 60 or more inches thick that can occur at depths of up to 1,000 feet. Includes beds of lignite 60 or more inches thick that can be surface mined. Includes also thinner and/or deeper beds that presently are being mined or for which there is evidence that they could be mined commercially at a given time. Represents that portion of the identified coal resource from which reserves are calculated.

Demonstrated resources: Same qualifications as identified resources, but include measured and indicated degrees of geologic assurance and excludes the inferred.

Diesel-electric plant: A generating station that uses diesel engines to drive its electric generators.

Diesel fuel: A fuel composed of distillates obtained in petroleum refining operation or blends of such distillates with residual oil used in motor vehicles. The boiling point and specific gravity are higher for diesel fuels than for gasoline. **Diesel fuel system:** Diesel engines are internal combustion engines that burn diesel oil rather than gasoline. Injectors are used to spray droplets of diesel oil into the combustion chambers, at or near the top of the compression stroke. Ignition follows due to the very high temperature of the compressed intake air, or to the use of "glow plugs," which retain heat from previous ignitions (spark plugs are not used). Diesel engines are generally more fuel-efficient than gasoline engines but must be stronger and heavier because of high compression ratios

Distillate fuel oil: A general classification for one of the petroleum fractions produced in conventional distillation operations. It includes diesel fuels and fuel oils. Products known as No. 1, No. 2, and No. 4 diesel fuel are used in on- highway diesel engines, such as those in trucks and automobiles, as well as off-highway engines, such as those in railroad locomotives and agricultural machinery. Products known as No. 1, No. 2, and No. 4 fuel oils are used primarily for space heating and electric power generation.

No. 1 Distillate: A light petroleum distillate that can be used as either a diesel fuel (see **No. 1 Diesel Fuel**) or a fuel oil. See **No. 1 Fuel Oil**.

- **No. 1 Diesel Fuel:** A light distillate fuel oil that has distillation temperatures of 550 degrees

Fahrenheit at the 90-percent point and meets the specifications defined in ASTM Specification D 975. It is used in high-speed diesel engines, such as those in city buses and similar vehicles. See **No. 1 Distillate** above.

- **No. 1 Fuel Oil:** A light distillate fuel oil that has distillation temperatures of 400 degrees Fahrenheit at the 10- percent recovery point and 550 degrees Fahrenheit at the 90-percent point and meets the specifications defined in ASTM Specification D 396. It is used primarily as fuel for portable outdoor stoves and portable outdoor heaters. See **No. 1 Distillate** above.

No. 2 Distillate: A petroleum distillate that can be used as either a diesel fuel (see **No. 2 Diesel Fuel** definition below) or a fuel oil. See **No. 2 Fuel oil** below.

- **No. 2 Diesel Fuel:** A fuel that has distillation temperatures of 500 degrees Fahrenheit at the 10-percent recovery point and 640 degrees Fahrenheit at the 90-percent recovery point and meets the specifications defined in ASTM Specification D 975. It is used in high-speed diesel engines, such as those in railroad locomotives, trucks, and automobiles. See **No. 2 Distillate** above.
- **Low Sulfur No. 2 Diesel Fuel:** No. 2 diesel fuel that has a sulfur level no higher than 0.05 percent by weight. It is used primarily in motor vehicle diesel engines for on-highway use.
- **High Sulfur No. 2 Diesel Fuel:** No. 2 diesel fuel that has a sulfur level above 0.05 percent by weight.
- **No. 2 Fuel oil (Heating Oil):** A distillate fuel oil that has distillation temperatures of 400 degrees Fahrenheit at the 10-percent recovery point and 640 degrees Fahrenheit at the 90-percent recovery point and meets the specifications defined in ASTM Specification D 396. It is used in atomizing type burners for domestic heating or for moderate capacity commercial/industrial burner units. See **No. 2 Distillate** above.

No. 4 Fuel: A distillate fuel oil made by blending distillate fuel oil and residual fuel oil stocks. It conforms with ASTM Specification D 396 or Federal Specification VV-F-815C and is used extensively in industrial plants and in commercial burner installations that are not equipped with preheating facilities. It also includes No. 4 diesel fuel used for low- and medium-speed diesel engines and conforms to ASTM Specification D 975.

No. 4 Diesel Fuel and No. 4 Fuel Oil: See **No. 4 Fuel** above.

Dual fuel vehicle (1): A motor vehicle that is capable of operating on an alternative fuel and on gasoline or diesel fuel. These vehicles have at least two separate fuel systems which inject each fuel simultaneously into the engine combustion chamber.

Dual fuel vehicle (2): A motor vehicle that is capable of operating on an alternative fuel and on gasoline or diesel fuel. This term is meant to represent all such vehicles whether they operate on the alternative fuel and gasoline/diesel simultaneously (e.g., flexible-fuel vehicles) or can be switched to operate on gasoline/diesel or an alternative fuel (e.g., bi- fuel vehicles).

Dual-fired unit: A generating unit that can produce electricity using two or more input fuels. In some of these units, only the primary fuel can be used continuously; the alternate fuel(s) can be used only as a start-up fuel or in emergencies.

EIA: The Energy Information Administration. An independent agency within the U.S. Department of Energy that develops surveys, collects energy data, and analyzes and models energy issues. The Agency must meet the requests of Congress, other elements within the Department of Energy, Federal Energy Regulatory Commission, the Executive Branch, its own independent needs, and assist the general public, or other interest groups, without taking a policy position. See more information about EIA at http://www.eia.doe.gov/neic/aboutEIA/aboutus.htm

Electric generation: See **Gross generation** and **Net generation**.

Electric generation industry: Stationary and mobile generating units that are connected to the electric power grid and can generate electricity. The electric generation industry includes the —electric power

sector‖ (utility generators and independent power producers) and industrial and commercial power generators, including combined-heat-and-power producers, but excludes units at single-family dwellings.

Electric generator: A facility that produces only electricity, commonly expressed in kilowatt hours (kWh) or megawatt hours (MWh). Electric generators include electric utilities and independent power producers.

Electric hybrid vehicle: An electric vehicle that either (1) operates solely on electricity, but contains an internal combustion motor that generates additional electricity (series hybrid); or (2) contains an electric system and an internal combustion system and is capable of operating on either system (parallel hybrid).

Electric industry reregulation: The design and implementation of regulatory practices to be applied to the remaining traditional utilities after the electric power industry has been restructured. Reregulation applies to those entities that continue to exhibit characteristics of a natural monopoly. Reregulation could employ the same or different regulatory practices as those used before restructuring.

Electric industry restructuring: The process of replacing a monopolistic system of electric utility suppliers with competing sellers, allowing individual retail customers to choose their supplier but still receive delivery over the power lines of the local utility. It includes the reconfiguration of vertically-integrated electric utilities.

Electric motor vehicle: A motor vehicle powered by an electric motor that draws current from rechargeable storage batteries, fuel cells, photovoltaic arrays, or other sources of electric current.

Electric power: The rate at which electric energy is transferred. Electric power is measured by capacity and is commonly expressed in megawatts (MW).

Electric power grid: A system of synchronized power providers and consumers connected by transmission and distribution lines and operated by one or more control centers. In the continental United States, the electric power grid consists of three systems: the Eastern Interconnect, the Western Interconnect, and the Texas Interconnect. In Alaska and Hawaii, several systems encompass areas smaller than the State (e.g., the interconnect serving Anchorage, Fairbanks, and the Kenai Peninsula; individual islands).

Electric power plant: A station containing prime movers, electric generators, and auxiliary equipment for converting mechanical, chemical, and/or fission energy into electric energy.

Electric power sector: An energy-consuming sector that consists of electricity only and combined heat and power(CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public--i.e., North American Industry Classification System 22 plants. See also **Combined heat and power (CHP) plant** and **Electricity only plant**.

Electric power system: An individual electric power entity--a company; an electric cooperative; a public electric supply corporation as the Tennessee Valley Authority; a similar Federal department or agency such as the Bonneville Power Administration; the Bureau of Reclamation or the Corps of Engineers; a municipally owned electric department offering service to the public; or an electric public utility district (a "PUD"); also a jointly owned electric supply project such as the Keystone.

Emergency: The failure of an electric power system to generate or deliver electric power as normally intended, resulting in the cutoff or curtailment of service.

Emergency backup generation: The use of electric generators only during interruptions of normal power supply.

Emergency energy: Electric energy provided for a limited duration, intended only for use during emergency conditions.

Energy reserves: Estimated quantities of energy sources that are demonstrated to exist with reasonable certainty on the basis of geologic and engineering data (proved reserves) or that can reasonably be expected to exist on the basis of geologic evidence that supports projections from proved reserves (probable/indicated reserves). Knowledge of the location, quantity, and grade of robable/indicated reserves

is generally incomplete or much less certain than it is for proved energy reserves. *Note:* This term is equivalent to "Demonstrated Reserves" as defined in the resource/reserve classification contained in the U.S. Geological Survey Circular 831, 1980. Demonstrated reserves include measured and indicated reserves but exclude inferred reserves.

Energy service provider: An energy entity that provides service to a retail or end-use customer.

Energy source: Any substance or natural phenomenon that can be consumed or transformed to supply heat or power. Examples include petroleum, coal, natural gas, nuclear, biomass, electricity, wind, sunlight, geothermal, water movement, and hydrogen in fuel cells.

Energy supply: Energy made available for future disposition. Supply can be considered and measured from the point of view of the energy provider or the receiver.

Energy supplier: Fuel companies supplying electricity, natural gas, fuel oil, kerosene, or LPG (liquefied petroleum gas) to the household.

Federal Energy Regulatory Commission (FERC): The Federal agency with jurisdiction over interstate electricity sales, wholesale electric rates, hydroelectric licensing, natural gas pricing, oil pipeline rates, and gas pipeline certification. FERC is an independent regulatory agency within the Department of Energy and is the successor to the Federal Power Commission.

Federal Power Act: Enacted in 1920, and amended in 1935, the Act consists of three parts. The first part incorporated the Federal Water Power Act administered by the former Federal Power Commission, whose activities were confined almost entirely to licensing non-Federal hydroelectric projects. Parts II and III were added with the passage of the Public Utility Act. These parts extended the Act's jurisdiction to include regulating the interstate transmission of electrical energy and rates for its sale as wholesale in interstate commerce. The Federal Energy Regulatory Commission is now charged with the administration of this law.

Federal Power Commission (FPC): The predecessor agency of the Federal Energy Regulatory Commission. The Federal Power Commission was created by an Act of Congress under the Federal Water Power Act on June 10, 1920. It was charged originally with regulating the electric power and natural gas industries. It was abolished on September 30, 1977, when the Department of Energy was created. Its functions were divided between the Department of Energy and the Federal Energy Regulatory Commission, an independent regulatory agency.

Federal region: In a Presidential directive issued in 1969, various Federal agencies (among them the currently designated Department of Health and Human Services, the Department of Labor, the Office of Economic Opportunity, and the Small Business Administration) were instructed to adopt a uniform field system of 10 geographic regions with common boundaries and headquarters cities. The action was taken to correct the evolution of fragmented Federal field organization structures that each agency or component created independently, usually with little reference to other agencies' arrangements. Most Federal domestic agencies or their components have completed realignments and relocations to conform to the Standard Federal Administration Regions (SFARs).

Finished leaded gasoline: Contains more than 0.05 gram of lead per gallon or more than 0.005 gram of phosphorus per gallon. Premium and regular grades are included, depending on the octane rating. Includes leaded gasohol. Blendstock is excluded until blending has been completed. Alcohol that is to be used in the blending of gasohol is also excluded.

Finished motor gasoline: See motor gasoline (finished).

Fleet vehicle: Any motor vehicle a company owns or leases that is in the normal operations of a company. Vehicles which are used in the normal operation of a company, but are owned by company employees are not fleet vehicles. If a company provides services in addition to providing natural gas, only those vehicles that are used by the natural gas provider portion of a company should be counted as fleet vehicles. Vehicles that are considered "off-road" (e.g., farm or construction vehicles) or demonstration vehicles are not to be

counted as fleet vehicles. Fleet vehicles include gasoline/diesel powered vehicles and alternative-fuel vehicles.

Flexible fuel vehicle: A vehicle that can operate on

(1) alternative fuels (such as M85 or E85) (2) 100-percent petroleum-based fuels

(3) any mixture of an alternative fuel (or fuels) and a petroleum-based fuel.

Flexible fuel vehicles have a single fuel system to handle alternative and petroleum-based fuels. Flexible fuel vehicle and variable fuel vehicle are synonymous terms.

Fluorescent lamp: A glass enclosure in which light is produced when electricity is passed through mercury vapor inside the enclosure. The electricity creates a radiation discharge that strikes a coating on the inside surface of the enclosure, causing the coating to glow. *Note:* Traditional fluorescent lamps are usually straight or circular white glass tubes used in fixtures specially designed for them. A newer type of fluorescent lamp, the compact fluorescent lamp, takes up much less room, comes in many differently-shaped configurations, and is designed to be used in some fixtures originally intended to house incandescent lamps.

Fluorescent light bulbs: These are usually long, narrow, white tubes made of glass coated on the inside with fluorescent material, which is connected to a fixture at both ends of the light bulb; some are circular tubes. The light bulb produces light by passing electricity through mercury vapor, which causes the fluorescent coating to glow or fluoresce.

Fluorescent lighting other than compact fluorescent bulbs: In fluorescent lamps, energy is converted to light by using an electric charge to "excite" gaseous atoms within a fluorescent tube. Common types are "cool white," "warm white," etc. Special energy efficient fluorescent lights have been developed that produce the same amount of light while consuming less energy. *Note*: for definition of **compact fluorescent bulbs**, go to http://www.eia.doe.gov/glossary/glossary_c.htm#compact_bulbs .

Fossil fuel: An energy source formed in the earths crust from decayed organic material. The common fossil fuels are petroleum, coal, and natural gas.

Fossil-fuel electric generation: Electric generation in which the prime mover is a turbine rotated by high-pressure steam produced in a boiler by heat from burning fossil fuels.

Fossil fuel plant: A plant using coal, petroleum, or gas as its source of energy.

Fossil fuel steam-electric power plant: An electricity generation plant in which the prime mover is a turbine rotated by high-pressure steam produced in a boiler by heat from burning fossil fuels.

Fuel: Any material substance that can be consumed to supply heat or power. Included are petroleum, coal, and natural gas (the fossil fuels), and other consumable materials, such as uranium, biomass, and hydrogen.

Fuel cell: A device capable of generating an electrical current by converting the chemical energy of a fuel (e.g., hydrogen) directly into electrical energy. Fuel cells differ from conventional electrical cells in that the active materials such as fuel and oxygen are not contained within the cell but are supplied from outside. It does not contain an intermediate heat cycle, as do most other electrical generation techniques.

Fuel cycle: The entire set of sequential processes or stages involved in the utilization of fuel, including extraction, transformation, transportation, and combustion. Emissions generally occur at each stage of the fuel cycle.

Fuel efficiency: See **Miles per gallon**.

Fuel emergencies: An emergency that exists when supplies of fuels or hydroelectric storage for generation are at a level or estimated to be at a level that would threaten the reliability or adequacy of bulk electric power supply. The following factors should be taken into account to determine that a fuel emergency exists:

1. Fuel stock or hydroelectric project water storage levels are 50 percent or less of normal for that particular

time of the year and a continued downward trend in fuel stock or hydroelectric project water storage level is estimated; or

2. Unscheduled dispatch or emergency generation is causing an abnormal use of a particular fuel type, such that the future supply of stocks of that fuel could reach a level that threatens the reliability or adequacy of bulk electric power supply.

Fuel ethanol (C2H5OH): An anhydrous denatured aliphatic alcohol intended for gasoline blending as described in Oxygenates definition.

Fuel injection: A fuel delivery system whereby gasoline is pumped to one or more fuel injectors under high pressure. The fuel injectors are valves that, at the appropriate times, open to allow fuel to be sprayed or atomized into a throttle bore or into the intake manifold ports. The fuel injectors are usually solenoid operated valves under the control of the vehicle's on- board computer (thus the term "electronic fuel injection"). The fuel efficiency of fuel injection systems is less temperature- dependent than carburetor systems. Diesel engines always use injectors.

Fuel oil: A liquid petroleum product less volatile than gasoline, used as an energy source. Fuel oil includes distillate fuel oil (No. 1, No. 2, and No. 4), and residual fuel oil (No. 5 and No. 6).

Fuel oil supplier: See **Energy supplier**.

Fuel switching capability: The short-term capability of a manufacturing establishment to have used substitute energy sources in place of those actually consumed. Capability to use substitute energy sources means that the establishment's combustors (for example, boilers, furnaces, ovens, and blast furnaces) had the machinery or equipment either in place or available for installation so that substitutions could actually have been introduced within 30 days without extensive modifications. Fuel-switching capability does not depend on the relative prices of energy sources; it depends only on the characteristics of the equipment and certain legal constraints.

Gas plant operator: Any firm, including a gas plant owner, which operates a gas plant and keeps the gas plant records. A gas plant is a facility in which natural gas liquids are separated from natural gas or in which natural gas liquids are fractionated or otherwise separated into natural gas liquid products or both.

Gas processing unit: A facility designed to recover natural gas liquids from a stream of natural gas that may or may not have passed through lease separators and/or field separation facilities. Another function of natural gas processing plants is to control the quality of the processed natural gas stream. Cycling plants are considered natural gas processing plants.

Gas to liquids (GTL): A process that combines the carbon and hydrogen elements in natural gas molecules to make synthetic liquid petroleum products, such as diesel fuel.

Gas turbine plant: A plant in which the prime mover is a gas turbine. A gas turbine consists typically of an axial-flow air compressor and one or more combustion chambers where liquid or gaseous fuel is burned and the hot gases are passed to the turbine and where the hot gases expand drive the generator and are then used to run the compressor.

Gas well: A well completed for production of natural gas from one or more gas zones or reservoirs. Such wells contain no completions for the production of crude oil.

Gas well productivity: Derived annually by dividing gross natural gas withdrawals from gas wells by the number of producing gas wells on December 31 and then dividing the quotient by the number of days in the year.

Gasification: A method for converting coal, petroleum, biomass, wastes, or other carbon-containing materials into a gas that can be burned to generate power or processed into chemicals and fuels.

Gasohol: A blend of finished motor gasoline containing alcohol (generally ethanol but sometimes methanol) at a concentration between 5.7 percent and 10 percent by volume. Also see **Oxygenates**.

Gasoline: See **Motor gasoline (finished)**.

Gasoline blending components: Naphthas which will be used for blending or compounding into finished aviation or motor gasoline (e.g., straight-run gasoline, alkylate, reformate, benzene, toluene, and xylene). Excludes oxygenates (alcohols, ethers), butane, and pentanes plus.

Gasoline grades: The classification of gasoline by octane ratings. Each type of gasoline (conventional, oxygenated, and reformulated) is classified by three grades - Regular, Midgrade, and Premium. *Note:* Gasoline sales are reported by grade in accordance with their classification at the time of sale. In general, automotive octane requirements are lower at high altitudes. Therefore, in some areas of the United States, such as the Rocky Mountain States, the octane ratings for the gasoline grades may be 2 or more octane points lower.

- **Regular gasoline:** Gasoline having an antiknock index, i.e., octane rating, greater than or equal to 85 and less than 88. *Note:* Octane requirements may vary by altitude.
- **Midgrade gasoline:** Gasoline having an antiknock index, i.e., octane rating, greater than or equal to 88 and less than or equal to 90. Note: Octane requirements may vary by altitude.
- **Premium gasoline:** Gasoline having an antiknock index, i.e., octane rating, greater than 90. *Note:* Octane requirements may vary by altitude. s or fluids at various depths beneath the surface of the earth. The energy is extracted by drilling and/or pumping.

Gasoline motor, (leaded): Contains more than 0.05 grams of lead per gallon or more than 0.005 grams of phosphorus per gallon. The actual lead content of any given gallon may vary. Premium and regular grades are included, depending on the octane rating. Includes leaded gasohol. Blendstock is excluded until blending has been completed. Alcohol that is to be used in the blending of gasohol is also excluded.

Gate station: Location where the pressure of natural gas being transferred from the transmission system to the distribution system is lowered for transport through small diameter, low pressure pipelines.

Generating facility: An existing or planned location or site at which electricity is or will be produced.

Generating station: A station that consists of electric generators and auxiliary equipment for converting mechanical, chemical, or nuclear energy into electric energy.

Generating unit: Any combination of physically connected generators, reactors, boilers, combustion turbines, and other prime movers operated together to produce electric power.

Generation: The process of producing electric energy by transforming other forms of energy; also, the amount of electric energy produced, expressed in kilowatt hours.

Generation company: An entity that owns or operates generating plants. The generation company may own the generation plants or interact with the short-term market on behalf of plant owners.

Generator capacity: The maximum output, commonly expressed in megawatts (MW), that generating equipment can supply to system load, adjusted for ambient conditions.

Generator nameplate capacity (installed): The maximum rated output of a generator, prime mover, or other electric power production equipment under specific conditions designated by the manufacturer. Installed generator nameplate capacity is commonly expressed in megawatts (MW) and is usually indicated on a nameplate physically attached to the generator.

Geothermal energy: Hot water or steam extracted from geothermal reservoirs in the earth's crust. Water or steam extracted from geothermal reservoirs can be used for geothermal heat pumps, water heating, or electricity generation.

Geothermal plant: A plant in which the prime mover is a steam turbine. The turbine is driven either by steam produced from hot water or by natural steam that derives its energy from heat found in rock

Heat pump: Heating and/or cooling equipment that, during the heating season, draws heat into a building

from outside and, during the cooling season, ejects heat from the building to the outside. Heat pumps are vapor-compression refrigeration systems whose indoor/outdoor coils are used reversibly as condensers or evaporators, depending on the need for heating or cooling.

Heat pump (air source): An air-source heat pump is the most common type of heat pump. The heat pump absorbs heat from the outside air and transfers the heat to the space to be heated in the heating mode. In the cooling mode the heat pump absorbs heat from the space to be cooled and rejects the heat to the outside air. In the heating mode when the outside air approaches 32o F or less, air-source heat pumps loose efficiency and generally require a back- up (resistance) heating system.

Heat pump (geothermal): A heat pump in which the refrigerant exchanges heat (in a heat exchanger) with a fluid circulating through an earth connection medium (ground or ground water). The fluid is contained in a variety of loop (pipe) configurations depending on the temperature of the ground and the ground area available. Loops may be installed horizontally or vertically in the ground or submersed in a body of water.

Heat pump efficiency: The efficiency of a heat pump, that is, the electrical energy to operate it, is directly related to temperatures between which it operates. Geothermal heat pumps are more efficient than conventional heat pumps or air conditioners that use the outdoor air since the ground or ground water a few feet below the earth's surface remains relatively constant throughout the year. It is more efficient in the winter to draw heat from the relatively warm ground than from the atmosphere where the air temperature is much colder, and in summer transfer waste heat to the relatively cool ground than to hotter air. Geothermal heat pumps are generally more expensive ($2,000-$5,000) to install than outside air heat pumps. However, depending on the location geothermal heat pumps can reduce energy consumption (operating cost) and correspondingly, emissions by more than 20 percent compared to high-efficiency outside air heat pumps. Geothermal heat pumps also use the waste heat from air-conditioning to provide free hot water heating in the summer.

Heating degree-days (HDD): A measure of how cold a location is over a period of time relative to a base temperature, most commonly specified as 65 degrees Fahrenheit. The measure is computed for each day by subtracting the average of the day's high and low temperatures from the base temperature (65 degrees), with negative values set equal to zero.

Each day's heating degree-days are summed to create a heating degree-day measure for a specified reference period. Heating degree-days are used in energy analysis as an indicator of space heating energy requirements or use.

Heating equipment: Any equipment designed and/or specifically used for heating ambient air in an enclosed space. Common types of heating equipment include: central warm air furnace, heat pump, plug-in or built-in room heater, boiler for steam or hot water heating system, heating stove, and fireplace. *Note:* A cooking stove in a housing unit is sometimes reported as heating equipment, even though it was built for preparing food.

Housing unit: A house, an apartment, a group of rooms, or a single room if it is either occupied or intended for occupancy as separate living quarters by a family, an individual, or a group of one to nine unrelated persons. Separate living quarters means the occupants (1) live and eat separately from other persons in the house or apartment and (2) have direct access from the outside of the buildings or through a common hall--that is, they can get to it without going through someone else's living quarters. Housing units do not include group quarters such as prisons or nursing homes where ten or more unrelated persons live. A common dining area used by residents is an indication of group quarters. Hotel and motel rooms are considered housing units if occupied as the usual or permanent place of residence.

Incandescent lamp: A glass enclosure in which light is produced when a tungsten filament is electrically heated so that it glows. Much of the energy is converted into heat; therefore, this class of lamp is a relatively inefficient source of light. Included in this category are the familiar screw-in light bulbs, as well as

somewhat more efficient lamps, such as tungsten halogen lamps, reflector or r-lamps, parabolic aluminized reflector (PAR) lamps, and ellipsoidal reflector (ER) lamps.

Incandescent light bulbs, including regular or energy-efficient light bulbs: An incandescent bulb is a type of electric light in which light is produced by a filament heated by electric current. The most common example is the type you find in most table and floor lamps. In commercial buildings, incandescent lights are used for display lights in retail stores, hotels, and motels. This includes the very small, high-intensity track lights used to display merchandise or provide spot illumination in restaurants. Energy efficient light bulbs, known as "watt-savers," use less energy than a standard incandescent bulb. "Long-life" bulbs, bulbs that last longer than standard incandescent but produce considerably less light, are not considered energy-efficient bulbs. This category also includes halogen lamps. Halogen lamps are a special type of incandescent lamp containing halogen gas to produce a brighter, whiter light than standard incandescent. Halogen lamps come in three styles: bulbs, models with reflectors, and infrared models with reflectors. Halogen lamps are especially suited to recessed or "canned fixtures," track lights, and outdoor lights.

Incentives demand-Side Management (DSM) program assistance: This DSM program assistance offers monetary or non-monetary awards to encourage consumers to buy energy-efficient equipment and to participate in programs designed to reduce energy usage. Examples of incentives are zero or low-interest loans, rebates, and direct installation of low cost measures, such as water heater wraps or duct work for distributing the cool air; the units condition air only in the room or areas where they are located.

Incremental effects: The annual changes in energy use (measured in megawatt hours) and peak load (measured in kilowatts) caused by new participants in existing DSM (demand-Side Management) programs and all participants in new DSM programs during a given year. Reported Incremental Effects are annualized to indicate the program effects that would have occurred had these participants been initiated into the program on January 1 of the given year. Incremental effects are not simply the Annual Effects of a given year minus the Annual Effects of the prior year, since these net effects would fail to account for program attrition, equipment degradation, building demolition, and participant dropouts. Please note that Incremental Effects are not a monthly disaggregate of the Annual Effects, but are the total year's effects of only the new participants and programs for that year.

Incremental energy costs: The additional cost of producing and/or transmitting electric energy above some previously determined base cost.

Independent power producer: A corporation, person, agency, authority, or other legal entity or instrumentality that owns or operates facilities for the generation of electricity for use primarily by the public, and that is not an **electric utility**.

Independent system operator (ISO): An independent, Federally regulated entity established to coordinate regional transmission in a non-discriminatory manner and ensure the safety and reliability of the electric system.

Independent power producer: A corporation, person, agency, authority, or other legal entity or instrumentality that owns or operates facilities for the generation of electricity for use primarily by the public, and that is not an **electric utility**.

Independent system operator (ISO): An independent, Federally regulated entity established to coordinate regional transmission in a non-discriminatory manner and ensure the safety and reliability of the electric system.

Indian coal lease: A lease granted to a mining company to produce coal from Indian lands in exchange for royalties and other revenues; obtained by direct negotiation with Indian tribal authorities, but subject to approval and administration by the U.S. Department of the Interior.

Indicated reserves: See **Probable energy reserves**.

Indicated resources, coal: Coal for which estimates of the rank, quality, and quantity are based partly on

sample analyses and measurements and partly on reasonable geologic projections. Indicated resources are computed partly from specified measurements and partly from projection of visible data for a reasonable distance on the basis of geologic evidence. The points of observation are 1/2 to 1-1/2 miles apart. Indicated coal is projected to extend as a 1/2-mile-wide belt that lies more than 1/4 mile from the outcrop, points of observation, or measurement.

Indirect cost: Costs not directly related to mining or milling operations, such as overhead, insurance, security, office expenses, property taxes, and similar administrative expenses.

Insulation: Any material or substance that provides a high resistance to the flow of heat. The different types include blanket or batt, foam, or loose fill, which are used to reduce heat transfer by conduction. Dead air space is an insulating medium within a multi-pane window or between a window and a storm window as it reduces passage of heat through conduction. Reflective materials are used to reduce heat transfer by radiation.

Insulation around heating and/or cooling ducts: Extra insulation around the heating and/or cooling ducts intended to reduce the loss of hot or cold air as it travels to different parts of the residence.

Insulation around hot-water pipes: Wrapping of insulating material around hot-water pipes to reduce the loss of heat through the pipes.

Insulation around water heater: Blanket insulation wrapped around the water heater to reduce loss of heat. To qualify under this definition, this wrapping must be in addition to any insulation provided by the manufacturer.

Insulator: A material that is a very poor conductor of electricity. The insulating material is usually a ceramic or fiberglass when used in the transmission line and is designed to support a conductor physically and to separate it electrically from other conductors and supporting material.

Intermediate grade gasoline: A grade of unleaded gasoline with an octane rating intermediate between "regular" and "premium." Octane boosters are added to gasolines to control engine pre-ignition or "knocking" by slowing combustion rates.

Intermediate load (electric system): The range from base load to a point between base load and peak. This point may be the midpoint, a percent of the peak load, or the load over a specified time period.

Intermittent electric generator or intermittent resource: An electric generating plant with output controlled by the natural variability of the energy resource rather than dispatched based on system requirements. Intermittent output usually results from the direct, non-stored conversion of naturally occurring energy fluxes such as solar energy, wind energy, or the energy of free-flowing rivers (that is, run-of-river hydroelectricity).

Internal Collector Storage (ICS): A solar thermal collector in which incident solar radiation is absorbed by the storage medium.

Internal combustion plant: A plant in which the prime mover is an internal combustion engine. An internal combustion engine has one or more cylinders in which the process of combustion takes place, converting energy released from the rapid burning of a fuel-air mixture into mechanical energy. Diesel or gas-fired engines are the principal types used in electric plants. The plant is usually operated during periods of high demand for electricity.

Interruptible gas: Gas sold to customers with a provision that permits curtailment or cessation of service at the discretion of the distributing company under certain circumstances, as specified in the service contract.

Interruptible load: This demand-Side Management category represents the consumer load that, in accordance with contractual arrangements, can be interrupted at the time of annual peak load by the action of the consumer at the direct request of the system operator. This type of control usually involves large-volume commercial and industrial consumers. Interruptible Load does not include Direct Load Control.

Interruptible or curtailable rate: A special electricity or natural gas arrangement under which, in return for lower rates, the customer must either reduce energy demand on short notice or allow the electric or natural gas utility to temporarily cut off the energy supply for the utility to maintain service for higher priority users. This interruption or reduction in demand typically occurs during periods of high demand for the energy (summer for electricity and winter for natural gas).

Interruptible power: Power and usually the associated energy made available by one utility to another. This transaction is subject to curtailment or cessation of delivery by the supplier in accordance with a prior agreement with the other party or under specified conditions.

Interstate companies: Natural gas pipeline companies subject to Federal Energy Regulatory Commission (FERC) jurisdiction.

Interstate pipeline: Any person engaged in natural gas transportation subject to the jurisdiction of Federal Energy Regulatory Commission (FERC) under the Natural Gas Act.

Jet fuel: A refined petroleum product used in jet aircraft engines. It includes kerosene-type jet fuel and naphtha-type jet fuel.

Kerosene: A light petroleum distillate that is used in space heaters, cook stoves, and water heaters and is suitable for use as a light source when burned in wick-fed lamps. Kerosene has a maximum distillation temperature of 400 degrees Fahrenheit at the 10-percent recovery point, a final boiling point of 572 degrees Fahrenheit, and a minimum flash point of 100 degrees Fahrenheit. Included are No. 1-K and No. 2-K, the two grades recognized by ASTM Specification D 3699 as well as all other grades of kerosene called range or stove oil, which have properties similar to those of No. 1 fuel oil. Also see **Kerosene-type jet fuel**.

Kerosene-type jet fuel: A kerosene-based product having a maximum distillation temperature of 400 degrees Fahrenheit at the 10-percent recovery point and a final maximum boiling point of 572 degrees Fahrenheit and meeting ASTM Specification D 1655 and Military Specifications MIL-T-5624P and MIL-T-83133D (Grades JP-5 and JP-8). It is used for commercial and military turbojet and turboprop aircraft engines.

Commercial: Kerosene-type jet fuel intended for use in commercial aircraft.

Military: Kerosene-type jet fuel intended for use in military aircraft.

Ketone-alcohol (cyclohexanol): An oily, colorless, hygroscopic liquid with a camphor-like odor. Used in soapmaking, dry cleaning, plasticizers, insecticides, and germicides.

Kilovolt-Ampere (kVa): A unit of apparent power, equal to 1,000 volt-amperes; the mathematical product of the volts and amperes in an electrical circuit.

Kilowatt (kW): One thousand watts.

Kilowatt-electric (kWe): One thousand watts of electric capacity.

Kilowatt hour (kWh): A measure of electricity defined as a unit of work or energy, measured as 1 kilowatt (1,000 watts) of power expended for 1 hour. One kWh is equivalent to 3,412 BTU.

Kilovolt-Ampere (kVa): A unit of apparent power, equal to 1,000 volt-amperes; the mathematical product of the volts and amperes in an electrical circuit.

Leaded gasoline: A fuel that contains more than 0.05 gram of lead per gallon or more than 0.005 gram of phosphorus per gallon.

Leaded premium gasoline: Gasoline having an antiknock index (R+M/2) greater than 90 and containing more than 0.05 grams of lead or 0.005 grams of phosphorus per gallon.

Leaded regular gasoline: Gasoline having an antiknock index (R+M/2) greater than or equal to 87 and less than or equal to 90 and containing more than 0.05 grams of lead or 0.005 grams of phosphorus per gallon.

Load (electric): The amount of electric power delivered or required at any specific point or points on a

system. The requirement originates at the energy-consuming equipment of the consumers.

Load control program: A program in which the utility company offers a lower rate in return for having permission to turn off the air conditioner or water heater for short periods of time by remote control. This control allows the utility to reduce peak demand.

Local distribution company (LDC): A legal entity engaged primarily in the retail sale and/or delivery of natural gas through a distribution system that includes mainlines (that is, pipelines designed to carry large volumes of gas, usually located under roads or other major right-of-ways) and laterals (that is, pipelines of smaller diameter that connect the end user to the mainline). Since the restructuring of the gas industry, the sale of gas and/or delivery arrangements may be handled by other agents, such as producers, brokers, and marketers that are referred to as "non-LDC."

Loss of service (15 minutes): Any loss in service for greater than 15 minutes by an electric utility of firm loads totaling more than 200 MW, or 50 percent of the total load being supplied immediately prior to the incident, whichever is less. However, utilities with a peak load in the prior year of more than 3000 MW are only to report losses of service to firm loads totaling more than 300 MW for greater than 15 minutes. (The DOE shall be notified with service restoration and in any event, within three hours after the beginning of the interruption.)

Low Income Home Energy Assistance Program (LIHEAP): The purpose of LIHEAP is to assist eligible households to meet the cost of heating or cooling in residential dwellings. The Federal government provides the funds to the States that administer the program.

Main heating fuel: The form of energy used most frequently to heat the largest portion of the floorspace of a structure. The energy source designated as the main heating fuel is the source delivered to the site for that purpose, not any subsequent form into which it is transformed on site to deliver the heat energy (e.g., for buildings heated by a steam boiler, the main heating fuel is the main input fuel to the boiler, not the steam or hot water circulated through the building.)

Note: In commercial buildings, the heating must be to at least 50 degrees Fahrenheit.

Mains: A system of pipes for transporting gas within a distributing gas utility's retail service area to points of connection with consumer service pipes.

Measured heated area of residence: The floor area of the housing unit that is enclosed from the weather and heated. Basements are included whether or not they contain finished space. Garages are included if they have a wall in common with the house. Attics that have finished space and attics that have some heated space are included. Crawl spaces are not included even if they are enclosed from the weather. Sheds and other buildings that are not attached to the house are not included. "Measured" area means the measurement of the dimensions of the home, using a metallic, retractable, 50- foot tape measure. "Heated area" is that portion of the measured area that is heated during most of the season. Rooms that are shut off during the heating season to save on fuel are not counted. Attached garages that are unheated and unheated areas in the attics and basements are also not counted.

Measured reserves: See Proved energy reserves.

Measured resources, coal: Coal resources for which estimates of the rank, quality, and quantity have been computed, within a margin of error of less than 20 percent, from sample analyses and measurements from closely spaced and geologically well known sample sites. Measured resources are computed from dimensions revealed in outcrops, trenches, mine workings, and drill holes. The points of observation and measurement are so closely spaced and the thickness and extent of coals are so well defined that the tonnage is judged to be accurate within 20 percent. Although the spacing of the points of observation necessary to demonstrate continuity of the coal differs from region to region, according to the character of the coalbeds, the point of observation are no greater than 1/2 mile apart. Measured coal is projected to extend as a belt 1/4 mile wide from the outcrop or points of observation or measurement.

Megawatt (MW): One million watts of electric power, typically used as a reference to output or delivery capacity.

Megawatt electric (MWe): One million watts of electric capacity.

Megawatt hour (MWh): One thousand kilowatt-hours or 1 million watt-hours, typically used as a reference of the amount of electricity produced, delivered or consumed over time.

Naphtha: A generic term applied to a petroleum fraction with an approximate boiling range between 122 degrees Fahrenheit and 400 degrees Fahrenheit.

Naphtha less than 401 degrees Fahrenheit: See **Petrochemical feedstocks**.

Naphthas: Refined or partly refined light distillates with an approximate boiling point range of 27 degrees to 221 degrees Centigrade. Blended further or mixed with other materials, they make high-grade motor gasoline or jet fuel. Also, used as solvents, petrochemical feedstocks, or as raw materials for the production of town gas.

Naphtha-type jet fuel: A fuel in the heavy naphtha boiling range having an average gravity of 52.8 degrees API, 20 to 90 percent distillation temperatures of 290 degrees to 470 degrees Fahrenheit, and meeting Military Specification MIL -T- 5624L (Grade JP-4). It is used primarily for military turbojet and turboprop aircraft engines because it has a lower freeze point than other aviation fuels and meets engine requirements at high altitudes and speeds. Note: Beginning with January 2004 data, naphtha-type jet fuel is included in **Miscellaneous Products**.

National Association of Regulatory Utility Commissioners (NARUC): An affiliation of the public service commissioners to promote the uniform treatment of members of the railroad, public utilities, and public service commissions of the 50 states, the District of Columbia, the Commonwealth of Puerto Rico, and the territory of the Virgin Islands.

National Rural Electric Cooperative Association (NRECA): A national organization dedicated to representing the interests of cooperative electric utilities and the consumers they serve. Members come from the 46 states that have an electric distribution cooperative.

Natural gas: A gaseous mixture of hydrocarbon compounds, the primary one being **methane**. NOTE: The Energy Information Administration measures **wet natural gas** and its two sources of production, **associated/dissolved natural gas** and **nonassociated natural gas**, and **dry natural gas**, which is produced from **wet natural gas**.

Natural gas, "dry": See **Dry natural gas**.

Natural gas field facility: A field facility designed to process natural gas produced from more than one lease for the purpose of recovering condensate from a stream of natural gas; however, some field facilities are designed to recover propane, normal butane, pentanes plus, etc., and to control the quality of natural gas to be marketed.

Natural gas gross withdrawals: Full well-stream volume of produced natural gas, excluding condensate separated at the lease.

Natural gas hydrates: Solid, crystalline, wax-like substances composed of water, methane, and usually a small amount of other gases, with the gases being trapped in the interstices of a water-ice lattice. They form beneath permafrost and on the ocean floor under conditions of moderately high pressure and at temperatures near the freezing point of water.

Natural gas liquids (NGL): Those hydrocarbons in natural gas that are separated from the gas as liquids through the process of absorption, condensation, adsorption, or other methods in gas processing or cycling plants. Generally such liquids consist of propane and heavier hydrocarbons and are commonly referred to as lease condensate, natural gasoline, and liquefied petroleum gases. Natural gas liquids include natural gas plant liquids (primarily ethane, propane, butane, and isobutane; see **Natural Gas Plant Liquids)** and lease

condensate (primarily pentanes produced from natural gas at lease separators and field facilities; see **Lease Condensate**).

Natural gas liquids production: The volume of natural gas liquids removed from natural gas in lease separators, field facilities, gas processing plants, or cycling plants during the report year.

Natural gas marketed production: Gross withdrawals of natural gas from production reservoirs, less gas used for reservoir repressuring, nonhydrocarbon gases removed in treating and processing operations, and quantities vented and flared.

Natural gas plant liquids: Those hydrocarbons in natural gas that are separated as liquids at natural gas processing plants, fractionating, and cycling plants, and, in some instances, field facilities. Lease condensate is excluded. Products obtained include ethane; liquefied petroleum gases (propane, butanes, propane-butane mixtures, ethane-propane mixtures); isopentane; and other small quantities of finished products, such as motor gasoline, special naphthas, jet fuel, kerosene, and distillate fuel oil.

Natural Gas Policy Act of 1978 (NGPA): Signed into law on November 9, 1978, the NGPA is a framework for the regulation of most facets of the natural gas industry.

Natural gas processing plant: Facilities designed to recover natural gas liquids from a stream of natural gas that may or may not have passed through lease separators and/or field separation facilities. These facilities control the quality of the natural gas to be marketed. Cycling plants are classified as gas processing plants.

Natural gas production: See **Dry natural gas production**.

Natural gas utility demand-side management (DSM) program sponsor: A DSM (demand-side management) program sponsored by a natural gas utility that suggests ways to increase the energy efficiency of buildings, to reduce energy costs, to change the usage patterns, or to promote the use of a different energy source.

Natural gasoline: A term used in the gas processing industry to refer to a mixture of liquid hydrocarbons (mostly pentanes and heavier hydrocarbons) extracted from natural gas. It includes isopentane.

Natural Gasoline and Isopentane: A mixture of hydrocarbons, mostly pentanes and heavier, extracted from natural gas, that meets vapor pressure, end-point, and other specifications for natural gasoline set by the Gas Processors Association. Includes isopentane which is a saturated branch-chain hydrocarbon, (C5H12), obtained by fractionation of natural gasoline or isomerization of normal pentane.

Net generation: The amount of gross generation less the electrical energy consumed at the generating station(s) for station service or auxiliaries. *Note*: Electricity required for pumping at pumped-storage plants is regarded as electricity for station service and is deducted from gross generation.

No. 1 diesel fuel: A light distillate fuel oil that has a distillation temperature of 550 degrees Fahrenheit at the 90-percent recovery point and meets the specifications defined in ASTM Specification D 975. It is used in high speed diesel engines generally operated under frequent speed and load changes, such as those in city buses and similar vehicles. See **No. 1 distillate** below.

No. 1 distillate: A light petroleum distillate that can be used as either a diesel fuel (see **No. 1 diesel fuel** above) or a fuel oil (see **No. 1 fuel oil** (below).

No. 1 fuel oil: A light distillate fuel oil that has distillation temperatures of 400 degrees Fahrenheit at the 10-percent recovery point and 550 degrees Fahrenheit at the 90-percent recovery point and meets the specifications defined in ASTM Specification D 396. It is used primarily as fuel for portable outdoor stoves and portable outdoor heaters. See **No. 1 Distillate** above.

No. 2 diesel fuel: A distillate fuel oil that has a distillation temperature of 640 degrees Fahrenheit at the 90-percent recovery point and meets the specifications defined in ASTM Specification D 975. It is used in high-speed diesel engines that are generally operated under uniform speed and load conditions, such as those in railroad locomotives, trucks, and automobiles. See **No. 2 Distillate** below.

No. 2 distillate: A petroleum distillate that can be used as either a diesel fuel (see **No. 2 diesel fuel** above) or

a fuel oil (see **No. 2 fuel oil** below).

No. 2 fuel oil (heating oil): A distillate fuel oil that has a distillation temperature of 640 degrees Fahrenheit at the 90- percent recovery point and meets the specifications defined in ASTM Specification D 396. It is used in atomizing type burners for domestic heating or for moderate capacity commercial/industrial burner units. See **No. 2 Distillate** above.

No. 2 fuel oil and No. 2 diesel sold to consumers for all other end uses: Those consumers who purchase fuel oil or diesel fuel for their own use including: commercial/institutional buildings (including apartment buildings), manufacturing and nonmanufacturing establishments, farms (including farm houses), motor vehicles, commercial or private boats, military, governments, electric utilities, railroads, construction, logging or any other nonresidential end-use purpose.

No. 2 fuel oil sold to private homes for heating: Private household customers who purchase fuel oil for the specific purpose of heating their home, water heating, cooking, etc., excluding farm houses, farming and apartment buildings.

No. 4 fuel oil: A distillate fuel oil made by blending distillate fuel oil and residual fuel oil stocks. It conforms with ASTM Specification D 396 or Federal Specification VV-F-815C and is used extensively in industrial plants and in commercial burner installations that are not equipped with preheating facilities. It also includes No. 4 diesel fuel used for low- and medium-speed diesel engines and conforms to ASTM Specification D 975.

No. 5 and no. 6 fuel oil sold directly to the ultimate consumer: Includes ships, mines, smelters, manufacturing plants, electric utilities, drilling, railroad.

No. 5 and no. 6 fuel oil sold to refiners or other dealers who will resale the product: Includes all volumes of No. 5 and No. 6 fuel oil purchased by a trade or business with the intent of reselling the product to the ultimate consumers. **Nonattainment area:** Any area that does not meet the national primary or secondary ambient air quality standard established by the Environmental Protection Agency for designated pollutants, such as carbon monoxide and ozone.

North American Electric Reliability Council (NERC): A council formed in 1968 by the electric utility industry to promote the reliability and adequacy of bulk power supply in the electric utility systems of North America. NERC consists of regional reliability councils and encompasses essentially all the power regions of the contiguous United States, Canada, and Mexico. See the various NERC Regional Reliability Councils here: http://www.nerc.com/regional/

North American Industry Classification System (NAICS): A new classification scheme, developed by the Office of Management and Budget to replace the Standard Industrial Classification (SIC) System, that categorizes establishments according to the types of production processes they primarily use.

Nuclear electric power (nuclear power): Electricity generated by the use of the thermal energy released from the fission of nuclear fuel in a reactor.

Nuclear fuel: Fissionable materials that have been enriched to such a composition that, when placed in a nuclear reactor, will support a self-sustaining fission chain reaction, producing heat in a controlled manner for process use.

Nuclear reactor: An apparatus in which a nuclear fission chain reaction can be initiated, controlled, and sustained at a specific rate. A reactor includes fuel (fissionable material), moderating material to control the rate of fission, a heavy- walled pressure vessel to house reactor components, shielding to protect personnel, a system to conduct heat away from the reactor, and instrumentation for monitoring and controlling the reactor's systems.

Number of mines: The number of mines, or mines collocated with preparation plants or tipples, located in a particular geographic area (State or region). If a mine is mining coal across two counties within a State, or across two States, then it is counted as two operations. This is done so that EIA can separate production by State and county.

Octane: A flammable liquid hydrocarbon found in petroleum. Used as a standard to measure the anti-knock properties of motor fuel.

Octane rating: A number used to indicate gasoline's antiknock performance in motor vehicle engines. The two recognized laboratory engine test methods for determining the antiknock rating, i.e., octane rating, of gasolines are the Research method and the Motor method. To provide a single number as guidance to the consumer, the antiknock index (R + M)/2, which is the average of the Research and Motor octane numbers, was developed.

OEM: Original Equipment Manufacturer.

Off-highway use: Includes petroleum products sales for use in:

1. **Construction.** Construction equipment including earthmoving equipment, cranes, stationary generators, air compressors, etc.
2. **Other.** Sales for off-highway uses other than construction. Sales for logging are included in this category.

Volumes for off-highway use by the agriculture industry are reported under "Farm Use" (which includes sales for use in tractors, irrigation pumps, other agricultural machinery, etc.)

Oil company use: Includes sales to drilling companies, pipelines or other related oil companies not engaged in the selling of petroleum products. Includes fuel oil that was purchased or produced and used by company facilities for the operation of drilling equipment, other field or refinery operations, and space heating at petroleum refineries, pipeline companies, and oil-drilling companies. Oil used to bunker vessels is counted under vessel bunkering. Sales to other oil companies for field use are included, but sales for use as refinery charging stocks are excluded

OPEC (Organization of the Petroleum Exporting Countries): An organization founded in Baghdad, Iraq, in September 1960, to unify and coordinate members' petroleum policies. OPEC members' national oil ministers meet regularly to discuss prices and, since 1982, to set crude oil production quotas. Original OPEC members include Iran, Iraq, Kuwait, Saudi Arabia, and Venezuela. Between 1960 and 1975, the organization expanded to include Qatar (1961), Indonesia (1962), Libya (1962), the United Arab Emirates (1967), Algeria (1969), Nigeria (1971), Ecuador (1973), and Gabon (1975)**.** Ecuador withdrew in December 1992, and Gabon withdrew in January 1995. Although Iraq remains a member of OPEC, Iraqi production has not been a part of any OPEC quota agreements since March 1998. For more information, go to OPEC's website at http://www.opec.org/opec_web/en/about_us/24.htm .

Operable capacity: The amount of capacity that, at the beginning of the period, is in operation; not in operation and not under active repair, but capable of being placed in operation within 30 days; or not in operation but under active repair that can be completed within 90 days. Operable capacity is the sum of the operating and idle capacity and is measured in barrels per calendar day or barrels per stream day.

Operable generators/units: Electric generators or generating units that are available to provide power to the grid or generating units that have been providing power to the grid but are temporarily shut down. This includes units in standby status, units out of service for an indefinite period, and new units that have their construction complete and are ready to provide test generation. A nuclear unit is operable once it receives its Full Power Operating License.

Operable nuclear unit (U.S.): A U.S. nuclear generating unit that has completed low-power testing and is in possession of a full-power operating license issued by the Nuclear Regulatory Commission.

Operating capacity: The component of operable capacity that is in operation at the beginning of the period.
Operating day: A normal business day. Days when a company conducts business due to emergencies or other unexpected events are not included.

Operator, gas plant: The person responsible for the management and day-to-day operation of one or more

natural gas processing plants as of December 31 of the report year. The operator is generally a working-interest owner or a company under contract to the working-interest owner(s). Plants shut down during the report year are also to be considered "operated" as of December 31.

Operator, oil and/or gas well: The person responsible for the management and day-to-day operation of one or more crude oil and/or natural gas wells as of December 31 of the report year. The operator is generally a working-interest owner or a company under contract to the working-interest owner(s). Wells included are those that have proved reserves of crude oil, natural gas, and/or lease condensate in the reservoirs associated with them, whether or not they are producing. Wells abandoned during the report year are also to be considered "operated" as of December 31.

Organization for Economic Cooperation and Development (OECD): An international organization helping governments tackle the economic, social and governance challenges of a globalized economy. Its membership comprises about 30 member countries. With active relationships with some 70 other countries, NGOs, and civil society, it has a global reach. For details about the organization, visit **http://www.oecd.org**

Organization of the Petroleum Exporting Countries (OPEC): Countries that have organized for the purpose of negotiating with oil companies on matters of oil production, prices, and future concession rights. Current members (as of the date of writing this definition) are Algeria, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the Uni ted Arab Emirates, and Venezuela. See OPEC's site at **http://www.opec.org** for more information.

Oxygenated gasoline: Finished motor gasoline, other than reformulated gasoline, having an oxygen content of 2.7 percent or higher by weight and required by the U.S. Environmental Protection Agency (EPA) to be sold in areas designated by EPA as carbon monoxide (CO) nonattainment areas. See **Nonattainment area**. *Note:* Oxygenated gasoline excludes oxygenated fuels program reformulated gasoline (OPRG) and reformulated gasoline blendstock for oxygenate blending (RBOB). Data on gasohol that has at least 2.7 percent oxygen, by weight, and is intended for sale inside CO nonattainment areas are included in data on oxygenated gasoline. Other data on gasohol are included in data on conventional gasoline.

Oxygenated gasoline (includes Gasohol): Finished motor gasoline, other than reformulated gasoline, having an oxygen content of 2.7 percent or higher by weight. Includes gasohol. *Note:* Oxygenated gasoline excludes oxygenated fuels program reformulated gasoline (OPRG) and reformulated gasoline blendstock for oxygenate blending (RBOB).

Oxygenates: Substances which, when added to gasoline, increase the amount of oxygen in that gasoline blend. Ethanol, Methyl Tertiary Butyl Ether (MTBE), Ethyl Tertiary Butyl Ether (ETBE), and methanol are common oxygenates.

Ozone: A molecule made up of three atoms of oxygen. Occurs naturally in the stratosphere and provides a protective layer shielding the Earth from harmful ultraviolet radiation. In the troposphere, it is a chemical oxidant, a greenhouse gas, and a major component of photochemical smog.

Packaged air conditioning units: Usually mounted on the roof or on a slab beside the building. (These are known as self-contained units, or Direct Expansion (DX). They contain air conditioning equipment as well as fans, and may or may not include heating equipment.) These are self-contained units that contain the equipment that generates cool air and the equipment that distributes the cooled air. These units commonly consume natural gas or electricity. The units are mounted on the rooftop, exposed to the elements. They typically blow cool air into the building through duct work, but other types of distribution systems may exist. The units usually serve more than one room. There are often several units on the roof of a single building. Also known as: Packaged Terminal Air Conditioners (PTAC). These packaged units are often constructed as a single unit for heating and for cooling.

Packaged units: Units built and assembled at a factory and installed as a self-contained unit to heat or cool all or portions of a building. Packaged units are in contrast to engineer-specified units built up from

individual components for use in a given building. Packaged Units can apply to heating equipment, cooling equipment, or combined heating and cooling equipment. Some types of electric packaged units are also called "Direct Expansion" or DX units.

Payment method for utilities: The method by which fuel suppliers or utility companies are paid for all electricity, natural gas, fuel oil, kerosene, or liquefied petroleum gas used by a household. Households that pay the utility company directly are classified as "all paid by household." Households that pay directly for at least one but not all of their fuels used and that has at least one fuel charge included in the rent were classified as "some paid, some included in rent." Households for which all fuels used are included in rent were classified as "all included in rent." If the household did not fall into one of these categories, it was classified as "other." Examples of households falling into the "other" category are: (1) households for which fuel bills were paid by a social service agency or a relative, and (2) households that paid for some of their fuels used but paid for other fuels through another arrangement.

Peak day withdrawal: The maximum daily withdrawal rate (Mcf/d) experienced during the reporting period.

Peak demand: The maximum load during a specified period of time.

Peak kilowatt: One thousand peak watts.

Peak load: The maximum load during a specified period of time.

Peak load month: The month of greatest plant electrical generation during the winter heating season (Oct-Mar) and summer cooling season (Apr-Sept), respectively.

Peak load plant: A plant usually housing old, low-efficiency steam units, gas turbines, diesels, or pumped-storage hydroelectric equipment normally used during the peak-load periods.

Peak megawatt: One million peak watts.

Peak watt: A manufacturer's unit indicating the amount of power a photovoltaic cell or module will produce at standard test conditions (normally 1,000 watts per square meter and 25 degrees Celsius).

Peaking capacity: Capacity of generating equipment normally reserved for operation during the hours of highest daily, weekly, or seasonal loads. Some generating equipment may be operated at certain times as peaking capacity and at other times to serve loads on an around-the-clock basis.

Petroleum: A broadly defined class of liquid hydrocarbon mixtures. Included are crude oil, lease condensate, unfinished oils, refined products obtained from the processing of crude oil, and natural gas plant liquids. *Note:* Volumes of finished petroleum products include nonhydrocarbon compounds, such as additives and detergents, after they have been blended into the products.

Petroleum Administration for Defense District (PADD): A geographic aggregation of the 50 States and the District of Columbia into five Districts, with PADD I further split into three subdistricts. The PADDs include the States listed below: PADD I (East Coast):

- PADD IA (New England): Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.
- PADD IB (Central Atlantic): Delaware, District of Columbia, Maryland, New Jersey, New York, and
- Pennsylvania.
- PADD IC (Lower Atlantic): Florida, Georgia, North Carolina, South Carolina, Virginia, and West Virginia.
- PADD II (Midwest): Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, Oklahoma, South Dakota, Tennessee, and Wisconsin.
- PADD III (Gulf Coast): Alabama, Arkansas, Louisiana, Mississippi, New Mexico, and Texas.
- PADD IV (Rocky Mountain): Colorado, Idaho, Montana, Utah, and Wyoming.

- PADD V (West Coast): Alaska, Arizona, California, Hawaii, Nevada, Oregon, and Washington

Petroleum imports: Imports of petroleum into the 50 states and the District of Columbia from foreign countries and from Puerto Rico, the Virgin Islands, and other U.S. territories and possessions. Included are imports for the Strategic Petroleum Reserve and withdrawals from bonded warehouses for onshore consumption, offshore bunker use, and military use. Excluded are receipts of foreign petroleum into bonded warehouses and into U.S. territories and U.S. Foreign Trade Zones.

Petroleum jelly: A semi-solid oily product produced from de-waxing lubricating oil basestocks.

Petroleum products: Petroleum products are obtained from the processing of crude oil (including lease condensate), natural gas, and other hydrocarbon compounds. Petroleum products include unfinished oils, liquefied petroleum gases, pentanes plus, aviation gasoline, motor gasoline, naphtha-type jet fuel, kerosene-type jet fuel, kerosene, distillate fuel oil, residual fuel oil, petrochemical feedstocks, special naphthas, lubricants, waxes, petroleum coke, asphalt, road oil, still gas, and miscellaneous products.

Petroleum refinery: An installation that manufactures finished petroleum products from crude oil, unfinished oils, natural gas liquids, other hydrocarbons, and alcohol.

Petroleum stocks, primary: For individual products, quantities that are held at refineries, in pipelines and at bulk terminals that have a capacity of 50,000 barrels or more, or that are in transit thereto. Stocks held by product retailers and resellers, as well as tertiary stocks held at the point of consumption, are excluded. Stocks of individual products held at gas processing plants are excluded from individual product stimates but are included in other oils estimates and total.

Pipeline, distribution: A pipeline that conveys gas from a transmission pipeline to its ultimate consumer.

Pipeline freight: Refers to freight carried through pipelines, including natural gas, crude oil, and petroleum products (excluding water). Energy is consumed by various electrical components of the pipeline, including, valves, other, appurtenances attaches to the pipe, compressor units, metering stations, regulator stations, delivery stations, holders and fabricated assemblies.

Pipeline fuel: Gas consumed in the operation of pipelines, primarily in compressors.

Pipeline, gathering: A pipeline that conveys gas from a production well/field to a gas processing plant or transmission pipeline for eventual delivery to end-use consumers.

Pipeline (natural gas): A continuous pipe conduit, complete with such equipment as valves, compressor stations, communications systems, and meters for transporting natural and/or supplemental gas from one point to another, usually from a point in or beyond the producing field or processing plant to another pipeline or to points of utilization. Also refers to a company operating such facilities.

Pipeline (petroleum): Crude oil and product pipelines used to transport crude oil and petroleum products, respectively (including interstate, intrastate, and intracompany pipelines), within the 50 states and the District of Columbia.

Pipeline purchases: Gas supply contracted from and volumes purchased from other natural gas companies as defined by the Natural Gas Act, as amended (52 Stat. 821), excluding independent producers, as defined in Paragraph 154.91(a), Chapter I, Title 18 of the Code of Federal Regulations.

Pipeline quality natural gas: A mixture of hydrocarbon compounds existing in the gaseous phase with sufficient energy content, generally above 900 British thermal units, and a small enough share of impurities for transport through commercial gas pipelines and sale to end-users.

Pipeline, transmission: A pipeline that conveys gas from a region where it is produced to a region where it is to be distributed.

Pipelines, rate regulated: FRS (Financial Reporting System Survey) establishes three pipeline segments: crude/liquid (raw materials); natural gas; and refined products. The pipelines included in these segments are all federally or State rate- regulated pipeline operations, which are included in the reporting company's

consolidated financial statements. However, at the reporting company's option, intrastate pipeline operations may be included in the U.S. Refining/Marketing Segment if: they would comprise less than 5 percent of U.S. Refining/Marketing Segment net PP&E, revenues, and earnings in the aggregate; and if the inclusion of such pipelines in the consolidated financial statements adds less than $100 million to the net PP&E reported for the U.S. Refining/Marketing Segment.

Population-weighted degree-days: Heating or cooling degree-days weighted by the population of the area in which the degree-days are recorded. To compute national population-weighted degree-days, the Nation is divided into nine Census regions comprised of from three to eight states that are assigned weights based on the ratio of the population of the region to the total population of the Nation. Degree-day readings for each region are multiplied by the corresponding population weight for each region, and these products are then summed to arrive at the national population weighted degree-day figure.

Potential peak reduction: The potential annual peak load reduction (measured in kilowatts) that can be deployed from Direct Load Control, Interruptible Load, Other Load Management, and Other DSM Program activities. (Please note that Energy Efficiency and Load Building are not included in Potential Peak Reduction.) It represents the load that can be reduced either by the direct control of the utility system operator or by the consumer in response to a utility request to curtail load. It reflects the installed load reduction capability, as opposed to the Actual Peak Reduction achieved by participants, during the time of annual system peak load.

Power (electrical): An electric measurement unit of power called a voltampere is equal to the product of 1 volt and 1 ampere. This is equivalent to 1 watt for a direct current system, and a unit of apparent power is separated into real and reactive power. Real power is the work-producing part of apparent power that measures the rate of supply of energy and is denoted as kilowatts (kW). Reactive power is the portion of apparent power that does no work and is referred to as kilovars; this type of power must be supplied to most types of magnetic equipment, such as motors, and is supplied by generator or by electrostatic equipment. Voltamperes are usually divided by 1,000 and called kilovoltamperes (kVA). Energy is denoted by the product of real power and the length of time utilized; this product is expressed as kilowatt hours.

Power production plant: All the land and land rights, structures and improvements, boiler or reactor vessel equipment, engines and engine-driven generator, turbogenerator units, accessory electric equipment, and miscellaneous power plant equipment are grouped together for each individual facility.

Power transfer limit: The maximum power that can be transferred from one electric utility system to another without overloading any facility in either system.

Powerhouse: A structure at a hydroelectric plant site that contains the turbine and generator.

PP&E, additions to: The current year's expenditures on property, plant, and equipment (PP&E). The amount is predicated upon each reporting company's accounting practice. That is, accounting practices with regard to capitalization of certain items may differ across companies, and therefore this figure in FRS (Financial Reporting System) will be a function of each reporting company's policy.

Premium gasoline: Gasoline having an antiknock index (R+M/2) greater than 90. Includes both leaded premium gasoline as well as unleaded premium gasoline

Primary coal: All coal milled and, when necessary, washed and sorted.

Primary energy: All energy consumed by end users, excluding electricity but including the energy consumed at electric utilities to generate electricity. (In estimating energy expenditures, there are no fuel-associated expenditures for hydroelectric power, geothermal energy, solar energy, or wind energy, and the quantifiable expenditures for process fuel and intermediate products are excluded.)

Primary energy consumption: Primary energy consumption is the amount of site consumption, plus losses that occur in the generation, transmission, and distribution of energy.

Primary energy consumption expenditures: Expenditures for energy consumed in each of the four major

end-use sectors, excluding energy in the form of electricity, plus expenditures by the electric utilities sector for energy used to generate electricity. There are no fuel-associated expenditures for associated expenditures for hydroelectric power, geothermal energy, photovoltaic and solar energy, or wind energy. Also excluded are the quantifiable consumption expenditures that are an integral part of process fuel consumption.

Primary fuels: Fuels that can be used continuously. They can sustain the boiler sufficiently for the production of electricity.

Primary metropolitan statistical area (PMSA): A component area of a **Consolidated metropolitan statistical area** consisting of a large, urbanized county or cluster of counties (cities and towns in New England) that demonstrate strong internal economic and social links in addition to close ties with the central core of the larger area. To qualify, an area must meet specified statistical criteria that demonstrate these links and have the support of local opinion.

Probable (indicated) reserves, coal: Reserves or resources for which tonnage and grade are computed partly from specific measurements, samples, or production data and partly from projection for a reasonable distance on the basis of geological evidence. The sites available are too widely or otherwise inappropriately spaced to permit the mineral bodies to be outlined completely or the grade established throughout.

Production, natural gas: The volume of natural gas withdrawn from reservoirs less (1) the volume returned to such reservoirs in cycling, repressuring of oil reservoirs, and conservation operations; less (2) shrinkage resulting from the removal of lease condensate; and less (3) nonhydrocarbon gases where they occur in sufficient quantity to render the gas unmarketable. Volumes of gas withdrawn from gas storage reservoirs and native gas, which has been transferred to the storage category, are not considered production. Flared and vented gas is also considered production. (This differs from "Marketed Production" which excludes flared and vented gas.)

Production, natural gas, dry: The volume of natural gas withdrawn from reservoirs during the report year less (1) the volume returned to such reservoirs in cycling, repressuring of oil reservoirs, and conservation operations; less (2) shrinkage resulting from the removal of lease condensate and plant liquids; and less (3) nonhydrocarbon gases where they occur in sufficient quantity to render the gas unmarketable. Volumes of gas withdrawn from gas storage reservoirs and native gas, which has been transferred to the storage category, are not considered production. This is not the same as marketed production, because the latter also excludes vented and flared gas, but contains plant liquids.

Production, natural gas liquids: Production of natural gas liquids is classified as follows:

---Contract Production. Natural gas liquids accruing to a company because of its ownership of liquids extraction facilities that it uses to extract liquids from gas belonging to others, thereby earning a portion of the resultant liquids.

---Leasehold Production. Natural gas liquids produced, extracted, and credited to a company's interest.

---Contract Reserves. Natural gas liquid reserves corresponding to the contract production defined above.

---Leasehold Reserves. Natural gas liquid reserves corresponding to leasehold production defined above.

Production, natural gas, wet after lease separation: The volume of natural gas withdrawn from reservoirs less (1) the volume returned to such reservoirs in cycling, repressuring of oil reservoirs, and conservation operations; less (2) shrinkage resulting from the removal of lease condensate; and less (3) nonhydrocarbon gases where they occur in sufficient quantity to render the gas unmarketable. *Note:* Volumes of gas withdrawn from gas storage reservoirs and native gas that has been transferred to the storage category are not considered part of production. This production concept is not the same as marketed production, which excludes vented and flared gas.

Production, oil, and gas: The lifting of oil and gas to the surface and gathering, treating, field processing (as in the case of processing gas to extract liquid hydrocarbons), and field storage. The production function shall

normally be regarded as terminating at the outlet valve on the lease or field production storage tank. If unusual physical or operational circumstances exist, it may be more appropriate to regard the production function as terminating at the first point at which oil, gas, or gas liquids are delivered to a main pipeline, a common carrier, a refinery, or a marine terminal.

Propane (C3H8): A normally gaseous straight-chain hydrocarbon. It is a colorless paraffinic gas that boils at a temperature of -43.67 degrees Fahrenheit. It is extracted from natural gas or refinery gas streams. It includes all products designated in ASTM Specification D1835 and Gas Processors Association Specifications for commercial propane and HD-5 propane.

Propane air: A mixture of propane and air resulting in a gaseous fuel suitable for pipeline distribution.

Propane, consumer grade: A normally gaseous paraffinic compound (C3H8), which includes all products covered by Natural Gas Policy Act Specifications for commercial and HD-5 propane and ASTM Specification D 1835. Excludes: feedstock propanes, which are propanes not classified as consumer-grade propanes, including the propane portion of any natural gas liquid mixes, i.e., butane-propane mix.

Public utility: Enterprise providing essential public services, such as electric, gas, telephone, water, and sewer under legally established monopoly conditions.

Public utility district: Municipal corporations organized to provide electric service to both incorporated cities and towns and unincorporated rural areas.

Public Utility Holding Company Act of 1935 (PUHCA): This act prohibits acquisition of any wholesale or retail electric business through a holding company unless that business forms part of an integrated public utility system when combined with the utility's other electric business. The legislation also restricts ownership of an electric business by non-utility corporations.

Public Utility Regulatory Policies Act (PURPA) of 1978: One part of the National Energy Act, PURPA contains measures designed to encourage the conservation of energy, more efficient use of resources, and equitable rates. Principal among these were suggested retail rate reforms and new incentives for production of electricity by co-generators and users of renewable resources. The Commission has primary authority for implementing several key PURPA programs.

Publicly owned electric utility: A class of ownership found in the electric power industry. This group includes those utilities operated by municipalities and State and Federal power agencies.

PVCs that convert sunlight directly into energy: A method for producing energy by converting sunlight using photovoltaic cells (PVCs) that are solid-state single converter devices. Although currently not in wide usage, commercial customers have a growing interest in usage and, therefore, DOE has a growing interest in the impact of PVCs on energy consumption. Economically, PVCs are competitive with other sources of electricity.

Quality or grade (of coal): An informal classification of coal relating to its suitability for use for a particular purpose. Refers to individual measurements such as heat value, fixed carbon, moisture, ash, sulfur, major, minor, and trace elements, coking properties, petrologic properties, and particular organic constituents. The individual quality elements may be aggregated in various ways to classify coal for such special purposes as metallurgical, gas, petrochemical, and blending usages.

R-value: A measure of a material's resistance to heat flow in units of Fahrenheit degrees x hours x square feet per BTU. The higher the R-value of a material, the greater its insulating capability. The R-value of some insulating materials is 3.7 per inch for fiberglass and cellulose, 2.5 per inch for vermiculite, and more than 4 per inch for foam. All building materials have some R-value. For example, a 4-inch brick has an R-value of 0.8, and half-inch plywood has an R-value of 0.6. The below table converts the most common "R" values to inches. For other "R" values, divide the "R" value by 3 to get the number of inches.

"R"-Value Inches

3	1
11	3.5
19	6
52	18

Rack sales: Wholesale truckload sales or smaller of gasoline where title transfers at a terminal.

Reformulated gasoline: Finished gasoline formulated for use in motor vehicles, the composition, and properties of which meet the requirements of the reformulated gasoline regulations promulgated by the U.S. Environmental Protection Agency under Section 211(k) of the Clean Air Act. It includes gasoline produced to meet or exceed emissions performance and benzene content standards of federal-program reformulated gasoline even though the gasoline may not meet all of the composition requirements (e.g. oxygen content) of federal-program reformulated gasoline. *Note:* This category includes Oxygenated Fuels Program Reformulated Gasoline (OPRG). Reformulated gasoline excludes Reformulated Blendstock for Oxygenate Blending (RBOB) and Gasoline Treated as Blendstock (GTAB).

Reseller: A **firm** (other than a refiner) that is engaged in a trade or business that buys refined petroleum products and then sells them to a purchaser who is not the ultimate consumer of those refined products.

Reserves, coal: Quantities of unextracted coal that comprise the demonstrated base for future production, including both proved and probable reserves. Also see **Proved energy reserves; Probable energy reserves; Energy reserves; Proved (measured) reserves, coal;** and **Probable(indicated) reserves, coal**.

Reserves, energy: See **Proved energy reserves**.

Reserves, net: Includes all proved reserves associated with the company's net working interests.

Reserves changes: Positive and negative revisions, extensions, new reservoir discoveries in old fields, and new field discoveries that occurred during the report year.

Residential propane price: The "bulk keep full" price for home delivery of consumer-grade propane intended for use in space heating, cooking, or hot water heaters in residences.

Residual fuel oil: A general classification for the heavier oils, known as No. 5 and No. 6 fuel oils, that remain after the distillate fuel oils and lighter hydrocarbons are distilled away in refinery operations. It conforms to ASTM Specifications D 396 and D 975 and Federal Specification VV-F-815C. No. 5, a residual fuel oil of medium viscosity, is also known as Navy Special and is defined in Military Specification MIL-F-859E, including Amendment 2 (NATO Symbol F-770). It is used in steam-powered vessels in government service and inshore powerplants. No. 6 fuel oil includes Bunker C fuel oil and is used for the production of electric power, space heating, vessel bunkering, and various industrial purposes.

Retail motor gasoline prices: Motor gasoline prices calculated each month by the Bureau of Labor Statistics (BLS) in conjunction with the construction of the Consumer Price Index.

Rural Electrification Administration (REA): A lending agency of the U. S. Department of Agriculture, the REA makes self-liquidating loans to qualified borrowers to finance electric and telephone service to rural areas. The REA finances the construction and operation of generating plants, electric transmission and distribution lines, or systems for the furnishing of initial and continued adequate electric services to persons in rural areas not receiving central station service.

Scheduled outage: The shutdown of a generating unit, transmission line, or other facility for inspection or maintenance, in accordance with an advance schedule.

Spot market (natural gas): A market in which natural gas is bought and sold for immediate or very near-term delivery, usually for a period of 30 days or less. The transaction does not imply a continuing arrangement between the buyer and the seller. A spot market is more likely to develop at a location with numerous pipeline interconnections, thus allowing for a large number of buyers and sellers. The Henry Hub in southern Louisiana is the best-known spot market for natural gas.

SPR: See **Strategic Petroleum Reserve** (below).

Stand-alone generator: A power source/generator that operates independently of or is not connected to an electric transmission and distribution network; used to meet a load(s) physically close to the generator.

Standby electricity generation: Involves use of generators during times of high demand on utilities to avoid extra "peak- demand" charges.

Standby facility: A facility that supports a utility system and is generally running under no-load. It is available to replace or supplement a facility normally in service.

Station (electric): A plant containing prime movers, electric generators, and auxiliary equipment for converting mechanical, chemical, and/or nuclear energy into electric energy.

Station use: Energy that is used to operate an electric generating plant. It includes energy consumed for plant lighting, power, and auxiliary facilities, regardless of whether the energy is produced at the plant or comes from another source.

Strategic Petroleum Reserve (SPR): Petroleum stocks maintained by the Federal Government for use during periods of major supply interruption

Subbituminous coal: A coal whose properties range from those of lignite to those of bituminous coal and used primarily as fuel for steam-electric power generation. It may be dull, dark brown to black, soft, and crumbly, at the lower end of the range, to bright, jet black, hard, and relatively strong, at the upper end. Subbituminous coal contains 20 to 30 percent inherent moisture by weight. The heat content of subbituminous coal ranges from 17 to 24 million BTU per ton on a moist, mineral-matter-free basis. The heat content of subbituminous coal consumed in the United States averages 17 to 18 million BTU per ton, on the as-received basis (i.e., containing both inherent moisture and mineral matter).

Tanker and barge: Vessels that transport crude oil or petroleum products. **Note:** Data are reported for movements between PAD Districts; from a PAD District to the Panama Canal; or from the Panama Canal to a PAD District.

Three-phase power: Power generated and transmitted from generator to load on three conductors.

Transformer: An electrical device for changing the voltage of alternating current.

Transmission and distribution loss: Electric energy lost due to the transmission and distribution of electricity. Much of the loss is thermal in nature.

Transmission (electric) (verb): The movement or transfer of electric energy over an interconnected group of lines and associated equipment between points of supply and points at which it is transformed for delivery to consumers or is delivered to other electric systems. Transmission is considered to end when the energy is transformed for distribution to the consumer.

Transmission circuit: A conductor used to transport electricity from generating stations to load.

Transmission line: A set of conductors, insulators, supporting structures, and associated equipment used to move large quantities of power at high voltage, usually over long distances between a generating or receiving point and major substations or delivery points.

Transmission network: A system of transmission or distribution lines so cross-connected and operated as to permit multiple power supply to any principal point.

Transmission system (electric): An interconnected group of electric transmission lines and associated equipment for moving or transferring electric energy in bulk between points of supply and points at which it is transformed for delivery over the distribution system lines to consumers or is delivered to other electric systems.

Transmission type (engine): The transmission is the part of a vehicle that transmits motive force from the engine to the wheels, usually by means of gears for different speeds using either a hydraulic "torque-

converter" (automatic) or clutch assembly (manual). On front-wheel drive cars, the transmission is often called a "transaxle." Fuel efficiency is usually higher with manual rather than automatic transmissions, although modern, computer-controlled automatic transmissions can be efficient.

Transmitting utility: A regulated entity which owns and may construct and maintain wires used to transmit wholesale power. It may or may not handle the power dispatch and coordination functions. It is regulated to provide non- discriminatory connections, comparable service, and cost recovery. According to the Energy Policy Act of 1992, it includes any electric utility, qualifying cogeneration facility, qualifying small power production facility, or Federal power marketing agency which owns or operates electric power transmission facilities which are used for the sale of electric energy at wholesale.

Underground storage: The storage of natural gas in underground reservoirs at a different location from which it was produced.

Vehicle fuel consumption: Vehicle fuel consumption is computed as the vehicle miles traveled divided by the fuel efficiency reported in miles per gallon (MPG). Vehicle fuel consumption is derived from the actual vehicle mileage collected and the assigned MPGs obtained from EPA certification files adjusted for on-road driving. The quantity of fuel used by vehicles.

Vehicle fuel efficiencies: See **Miles per gallon**.

Vehicle fuel expenditures: The cost, including taxes, of the gasoline, gasohol, or diesel fuel added to the vehicle's tank. Expenditures do not include the cost of oil or other items that may have been purchased at the same time as the vehicle fuel.

Vehicle identification number (VIN): A set of codes, usually alphanumeric characters, assigned to a vehicle at the factory and inscribed on the vehicle. When decoded, the VIN provides vehicle characteristics. The VIN is used to help match vehicles to the EPA certification file for calculating MPGs.

Wet natural gas: A mixture of hydrocarbon compounds and small quantities of various nonhydrocarbons existing in the gaseous phase or in solution with crude oil in porous rock formations at reservoir conditions. The principal hydrocarbons normally contained in the mixture are methane, ethane, propane, butane, and pentane. Typical nonhydrocarbon gases that may be present in reservoir natural gas are water vapor, carbon dioxide, hydrogen sulfide, nitrogen, and trace amounts of helium. Under reservoir conditions, natural gas and its associated liquefiable portions occur either in a single gaseous phase in the reservoir or in solution with crude oil and are not distinguishable at the time as separate substances. *Note*: The Securities and Exchange Commission and the Financial Accounting Standards Board refer to this product as **natural gas**.

APPENDIX C. DELAWARE MOTOR FUEL SUPPLY

1.1.1 Motor Fuel Overview

Access **Delaware Updated Quick Energy Facts here**

1.1.2 Fuel Usage(s)

Petroleum products include distillate fuel oil (diesel fuel and heating oil), liquefied petroleum gases (LPGs, including propane and butane), jet fuel, residual fuel oil, kerosene, aviation gasoline, and petroleum coke. In 2020, Delaware consumed approximated 20 million barrels of petroleum products.[41] In 2020, the transportation sector accounted for 68% of the petroleum consumed in Delaware, mostly as motor gasoline. Motor gasoline is chiefly used to fuel automobiles and light trucks for highway use. Smaller quantities are used for off-highway driving, boats, recreational vehicles, and various farm and other equipment. Delaware requires the use of reformulated motor gasoline blended with ethanol throughout the State.

The industrial sector is the second largest petroleum consuming sector and accounted for about 24% of all petroleum consumption in Delaware. The residential and commercial sectors, as well as electric utilities accounted for the remaining 8% of Delaware's petroleum consumption.[42] Approximately 18% of Delaware households used petroleum products (propane or fuel oil) as their primary energy source for home heating.[43]

1.1.3 Fuel Source and Supply

Since the State of Delaware has no crude oil production, it relies on crude oil supplies largely delivered via the Delaware River. Petroleum is supplied to Delaware in crude state from Canada, South America, and Middle East. The Port of Delaware City receives crude oil that is delivered to the State's single medium-sized refinery. The refinery can process about 182,200 barrels of crude oil per calendar day during peak times and its production includes conventional and reformulated gasoline, low-sulfur diesel, home-heating oil.[44] Other ports receiving crude oil by ship tanker or barge are located in Edgemoor, Claymont, and Wilmington. The Port of Wilmington also includes a state-of-the-art bulk petroleum terminal and storage depot that handles heating oil, fuel oil, and other petroleum products that are shipped into the State.[45]

1.1.4 Fuel Delivery

The Delaware City Refining Corporation (subsidiary of PBF Energy) supplies petroleum products to regional markets and is connected to a distribution network that includes pipelines, barges, tankers, trucks, and railroads. Additional petroleum products are supplied to Delaware retail/wholesale locations via transport trucks loaded at the Port of Wilmington storage facility and also via trucks located at marine supplied terminal facilities along the Delaware River in Pennsylvania and New Jersey; and also from inland terminals supplied via private and common carrier pipeline networks.

1.1.5 What can go wrong?

A motor fuel shortage emergency could occur due to a disruption in the supply and delivery system to include a mix of the following factors:

- Unloading facilities disrupted
- Ship accident in channels
- Electric power outage causing gasoline stations to close (Valero Refinery can operate on emergency power)
- Truck transport becomes constrained due to ice and snow or other natural disasters

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[41] https://www.eia.gov/state/print.php?sid=DE
[42] https://www.eia.gov/state/seds/data.php?incfile=/state/seds/sep_use/tx/use_tx_DE.html&sid=DE
[43] https://www.eia.gov/state/print.php?sid=DE
[44] Ibid
[45] Ibid

- Shortage due to labor strikes
- Extended cold snap combined with just-in-time inventory management
- Product shortage due to high export rate
- Imports reduced for political or economic reasons
- Imbalance in supply and demand
- Cyber or physical attacks

The portion of Delaware lying south of the Chesapeake and Delaware Canal is somewhat more vulnerable to situational supply shortages in instances where any of the bridges that span the canal are closed due to weather conditions. This could isolate Dover and areas to the south from sources of supply in New Castle County, Delaware, Pennsylvania and New Jersey.

1.1.6 Motor Fuel Emergency Response Phases

The section below describes the Delaware energy emergency response phases and activities associated with a motor fuel emergency. Each phase describes an appropriate level of mobilization required to address a potential or developing emergency.

a. Phase I: Monitor and Alert Activities

Phase I of the energy emergency response involves the normal ongoing energy supply, demand, and price monitoring. State agencies regularly monitor data and information as it becomes available through energy supply reporting systems (see Appendix H on Monitoring Fuel Supplies) and pay special attention to supply and distribution problems. The table below describes the specific activities associated with Phase I and the lead and support agencies responsible for these activities.

PHASE I: RESPONSE ACTIVITY-MOTOR FUEL SHORTAGE		
Actions to Take	**Lead Agency**	**Support Agency**
Continue normal operations and ramp-up the frequency of monitoring motor fuel prices and supplies.	Delaware Department of Agriculture (DA) Energy Response Team	Staff
Update emergency contact lists. Contact representatives of motor fuel suppliers and distributors to assess the causes, probable duration, and geographic extent of the shortage and the steps providers can take to alleviate or avert a shortage (convene meetings if necessary).	Delaware DA Energy Response Team	Delaware DA Energy Response Team State Agencies
Develops lists of trucking companies that employ fleets of diesel trucks and construction companies that utilize large numbers of diesel-powered units. These lists will be used if the situation escalates and the Governor requests the companies to voluntarily reduce operations.	Delaware DA Energy Response Team	Fleets
Prepare to issue public appeals for voluntary conservation through the Governor's Press Secretary for motor fuels in case situation escalates to Pre-Emergency Phase II.	Delaware DA Energy Response Team	Staff
During a shortage of diesel fuel, the Governor may request trucking companies to voluntarily reduce operations in order to conserve fuel. Employers will be encouraged to allow employees to use accumulated vacation time.	Governor	DEMA State Agencies

Delaware DA - Energy Response Team will review procedures with appropriate agencies for reduction of the 65 MPH speed limit to 55 MPH and increased enforcement of the 55 MPH speed limit for all diesel-powered vehicles.	Governor	DEMA State Agencies
Delaware DA - Energy Response Team reviews procedures with appropriate agencies for the suspension of truck weight and size regulations in order to conserve diesel motor fuel. Delaware DA - Energy Response Team reviews public information announcements concerning possible suspension of truck weight and size regulations.	Governor	DEMA State Agencies
Implement state government vehicle motor fuel conservation program.	Delaware DA Energy Response Team	DEMA State Agencies
Governor may request aid of USDOE and congressional delegation to secure additional supplies of motor fuel.	Governor, Delaware DA Energy Response Team	USDOE Congressional Delegation
If motor fuel shortage increases, Delaware DA - Energy Response Team will recommend to the Governor that the state escalate to Pre-Emergency Phase II. Delaware DA - Energy Response Team will notify all in-state and out-of-state agencies and companies of the escalation.	Governor	Delaware Energy Response Team
If motor fuel shortage is forecasted to diminish and start to return to normal, Delaware DA - Energy Response Team will recommend to the Governor a de-escalation back to normal day-to-day activity. Notify all in-state and out-of-state agencies and companies of the de-escalation.	Governor	Delaware DA Energy Response Team
PHASE I: PUBLIC INFORMATION- MOTOR FUEL SHORTAGE		
Actions to Take	**Lead Agency**	**Support Agency**
The DEMA Joint Information Center (JIC) will provide information to newspapers and radio and television stations on how consumers can conserve motor fuel. The public will be informed on what it can do to voluntarily conserve motor fuel (see information in Appendix D).	JIC DEMA PIO	Delaware DA - Energy Response Team Staff
The Joint Information Center (JIC) will implement motor fuel public information program and issue public appeals for voluntary conservation.	JIC	Delaware DA - Energy Response Team DEMA Staff
The Joint Information Center (JIC) team will establish a central media center and press briefings at scheduled times to facilitate news flow to the media.	JIC	Delaware DA - Energy Response Team DEMA Staff

1.1.7 Governor's Motor Fuel Advisory Group

The Emergency Motor Fuel Advisory Group (EMAG), representing various agencies involved in the economic assistance programs, convenes in the event of an energy supply disruption. The EMAG coordinates and oversees the distribution of both state and federal funds during a motor fuel supply disruption. In the event of an emergency, the EMAG determines the lead agency and support agency roles, adjusting the details of the operation process to the specific nature of the supply shortage. When a fuel emergency is a matter of statewide concern the Governor may institute an executive order for the EMAG. The duties and responsibilities of the council are:

5. Identify those rules and regulations which assist with the efficient utilization of fuel within the state and recommend the administrative and legislative options necessary to respond to a petroleum product shortage. This could include emergency powers legislation, executive orders, rules, proclamations, and regulations.
6. Define programs to manage supply and reduce fuel usage where appropriate and review and recommend programs to promote conservation, prevention of waste, recycling and salvage of fuel supplies and resources by the public and private sectors.
7. Review those existing standards and requirements which may need to be suspended or modified and which affect or are affected by the use of fuel, including those relating to air quality control, the type and composition of various fuels, the production and distribution of energy resources, and the hours and days during which public buildings and commercial and industrial establishments may be or are required to remain open.

7.3.6 Phase II: Assess and Determine Action

In Phase II, having noticed early signs of what might become an energy emergency, responding agencies intensify data and information collection efforts and ensure that the most recent information is available. This information is analyzed to evaluate potential outcomes and assess possible courses of action. Phase II is activated when motor fuel (gasoline and diesel) shortages increase, and industry representatives and others directly involved indicate an impending motor fuels shortage. At this stage, the following key activities should take place:

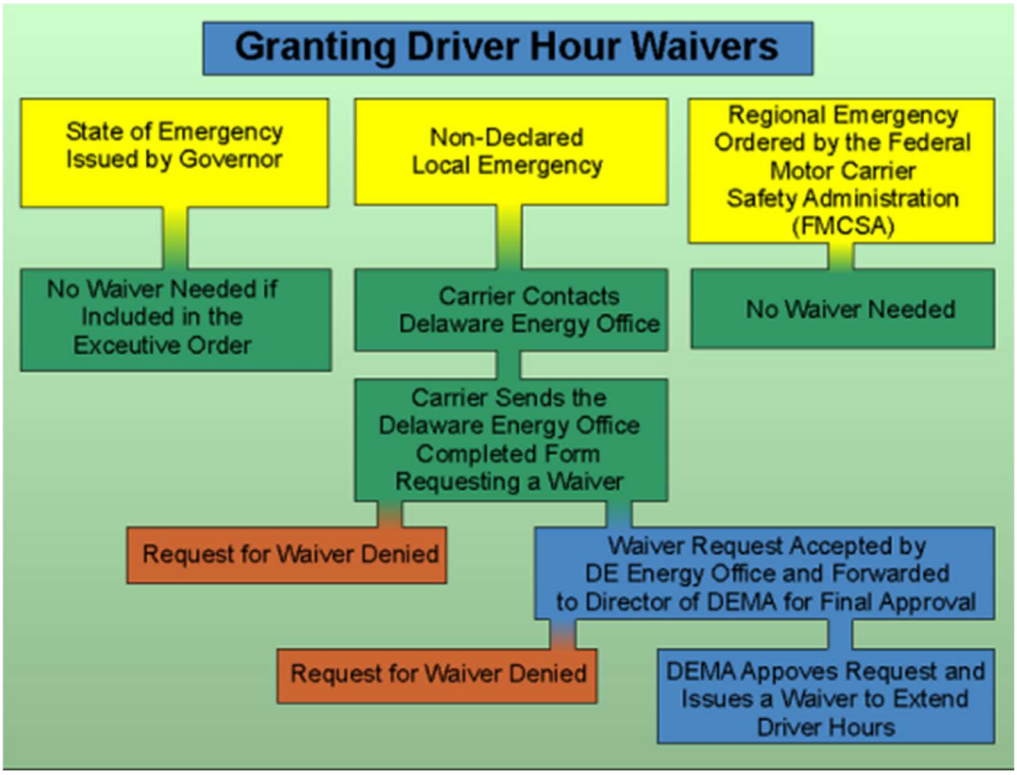
- Appropriate contacts throughout state government should be informed of the results of this assessment.
- Appropriate action can then be determined. If no action is required, monitoring and evaluation continue and further updates are made as changes occur.

Federal assistance would generally be available in the case of a national/international energy emergency. The emergency planning agencies and representatives from other state departments, as appropriate, would be responsible for coordinating and monitoring federal programs. Federal assistance may be requested sooner without a declaration of a national emergency to provide the following;

- Waiver federal driver hour requirements;[46]
- Waiver vehicle fuel air quality standards;
- Lifting Fuel Load Limits[47]
- Request Coast Guard to intensify ice breaking (if Delaware River is frozen hampering barge movement);
- and Request Strategic Petroleum Reserve (SPR) or the Northeast Heating Oil Reserves.

[46] Under certain emergency conditions, including an emergency declaration by the governor, the US Dept. of Transportation and the State of Delaware may waive federal Hours-of-Service regulations for commercial motor vehicle driver. This action is intended to prevent delaying needed fuel deliveries.

[47] The US Dept. of Transportation and DELDOT restrict load limits on certain Delaware Highways; fuel trucks are normally restricted to a maximum of 7,800 gallons per delivery. In a declared emergency, the fuel load limit can be raised to 9,000 gallons per delivery.



The table below describes the specific activities associated with Phase II and the lead and support agencies responsible for these activities. It also describes the actions that should be taken to inform and educate the public about the emergency.

PHASE II: RESPONSE ACTIVITY-MOTOR FUEL SHORTAGE		
Actions to Take	**Lead Agency**	**Support Agency**
The Governor may request trucking and construction companies to reduce operations.	Governor Delaware DA - Energy Response Team	DEMA State Agencies
Delaware DA - Energy Response Team will review procedures with appropriate agencies for reduction of the 65 MPH speed limit to 55 MPH and increased enforcement of the 55 MPH speed limit for all diesel-powered vehicles.	Energy Response Team	DEMA State Agencies
Delaware DA - Energy Response Team will request the DEMA and the Joint Information Center (JIC) to implement public information program and issue public directives for mandatory conservation (see this Appendix D for motor fuel conservation measures).	DEMA JIC	DEMA State Agencies
Delaware DA - Energy Response Team, together with other state agencies and industry, will determine rules and regulations that will be required to implement a mandatory ban on the use of certain diesel-powered vehicles if the situation escalates to Emergency Phase III.	Energy Response Team	DEMA State Agencies
Arrange with adjacent states to facilitate fuel transport by truck. Request suspension of USDOT Drivers Hours of Service Restrictions, request deferral of USDOT Vehicle Inspection	Energy Response Team USDOT	Fuel Transport Dealers

Requirements, and make other requests for federal assistance as listed above.		
Exempt fuel transports from 55 mph restrictions.	GOV Delaware DA - Energy	DEMA State Agencies
Direct fuel distributors to decline to accept new customers to discourage hoarding.	DEMA JIC	Fuel Transport Dealers
If the motor fuel shortage is forecast to diminish and start to return to normal, recommend to the Governor a de-escalation to Verification Phase I. Notify all in-state and out-of-state agencies and companies of the de- escalation.	Governor Energy Response Team	DEMA State Agencies
If the motor fuel shortage is forecast to worsen, recommend to the Governor an escalation to Emergency Phase III. Notify all in-state and out- of state agencies and companies of the escalation.	Governor Energy Response Team	DEMA State Agencies
PHASE II: PUBLIC INFORMATION-MOTOR FUEL SHORTAGE		
Actions to Take	**Lead Agency**	**Support Agency**
Energy Response Team monitors DOE-EIA Monthly Fuel Outlook which discusses fuel supply and demand in the upcoming month. Press releases are issued when appropriate.	JIC DEMA	Delaware DA - Energy Response Team
Promote Carpooling/Vanpooling/Mass Transit. This is an ongoing function of Energy Response Team and the Highway Department. Energy Response Team staff develops and disseminates materials on gasoline conservation.	JIC DEMA	Delaware DA - Energy Response Team
Inform media and public when supply conditions return to normal, and Governor rescinds the rule reducing speed limit from 65 to 55 MPH.	JIC DEMA	Delaware DA - Energy Response Team
The JIC staff at the EOC must inform the public and provide the ability for the system to go from mandatory measures to voluntary measures to normal conduct of business Energy Response Team will review public information announcements concerning speed limit reduction and enforcement.	JIC DEMA	Delaware DA - Energy Response Team

7.3.7 Local/County Government Actions

The Delaware Energy Response Team staff may assist local governments in designing programs to reduce gasoline consumption in their fleets. Specifically, the Delaware Energy Response Team may design generic conservation programs for fleets of various sizes incorporating the concepts of fleet management and routing/scheduling techniques. Delaware DA Energy Response Team staff may also assist local governments in performing vehicle use studies with priority use established, fuel management plans, and alternatives developed for non-priority use. Local government is in the best position to know how the gasoline shortage is affecting the area, it is essential to include representatives in the implementation plan. Discussions with local government representatives will help to determine the best mechanism for this involvement.

Specific issues of interest to local governments include:

1. Ability of locals to enforce any mandatory measures in light of manpower and funding limitations.
2. Role of local governments in providing timely public information on supply situation.
3. Provision of information on location and availability of gasoline, including a statewide hotline.
4. Maintenance of essential and priority uses for health, safety, fire, and mass transit.

7.3.8 Phase III: Actions and Feedback

Once a decision has been made that specific state government action is necessary to assure the health, welfare, and safety of citizens, and the continued economic well being of the state, Phase III activity begins. This includes:

- Implementing programs to maximize available supplies and/or to minimize existing demand levels and monitoring these activities to determine their effectiveness;
- Increasing the level of communication among state agencies and others;
- If the nature of the problem involves multiple states, information and mutual aid sharing among state energy coordinators, using the EEAC website, should begin; (the password-protected Energy Emergency Assurance Coordinators website through which authorized state energy emergency coordinators may access valuable energy security information, including daily news summaries, emergency situation reports, lessons learned from other states, links to outage and curtailment information, and the ability to email messages to colleagues in other jurisdictions).
- Convening emergency planning and response organizations to consider actions that might be taken by the various state departments and agencies;
- If implementation of voluntary programs or other emergency deterrent actions fail to mitigate the emergency, begin implementing additional actions;
- If the situation continues to deteriorate, recommending that a State of Energy Emergency be declared (usually by the Governor). The Governor may also be called upon to declare a State of Disaster. State legislation regarding State of Energy Emergency and/or State of Disaster will dictate further action and assign responsibility among pertinent parties; and
- If it appears that all other options available to the state prove inadequate, the next level of mobilization is to request federal assistance.

The table below describes the specific activities associated with Phase III and the lead and support agencies responsible for these activities. It also describes the actions that should be taken to inform and educate the public about the emergency.

PHASE III: RESPONSE ACTIVITY-MOTOR FUEL SHORTAGE		
Actions to Take	**Lead Agency**	**Support Agency**
Delaware DA - Energy Response Team will continue the intensified level of monitoring and maintenance of contacts with suppliers, distributors, and users until conditions have returned to normal. Increase Delaware DA - Energy Response Team hours of operations and shift schedules to address current situation. Delaware DA - Energy Response Team monitors motor fuel supply and demand Information from DOE-EIA Monthly Fuel Outlook, which discusses fuel supply and demand in the upcoming month.	Delaware DA- Energy Response Team	DEMA State Agencies
Delaware DA - Energy Response Team will assist the public information team at the Joint Information Center (JIC) in continuing the public information program and appeals for mandatory conservation measures, as necessary, or until conditions have returned to normal.	Delaware DA Energy Response Team DEMA JIC	DEMA State Agencies
Prepare necessary mandatory rules and regulations to cope with the emergency shortage of motor fuel for the Governor. Delaware DA - Energy Response Team may recommend that the Delaware Motor Fuel Set-Aside Program to be implemented by the Governor. This program is more fully explained in Appendix C.	Delaware DA Energy Response Team Governor	DEMA State Agencies

The Governor, utilizing emergency powers, may implement the rules and regulations concerning the banning of certain diesel-powered vehicles and issue rules reducing speed limit from 65 MPH to 55 MPH and issues orders for strict enforcement of the 55 MPH speed limit for diesel powered vehicles.	GOV Delaware DA Energy Response Team	Delaware DA - Energy Response Team DEMA
Recommend to the Governor the limits for the use of vehicles by businesses and local governments, including schools. Also, recommend the use of vehicles by state government agencies.	GOV Del DA Energy Response Team	DEMA State Agencies
Governor may issue rules suspending truck weight and size regulations and orders for enforcement of truck weight and size regulations as revised by suspension.	GOV	Delaware DA - Energy Response Team
Implement public information program and issue public directives for mandatory fuel conservation. See Appendix D for an outline of motor fuel conservation measures.	Delaware DA Energy Response Team DEMA JIC	DEMA
As motor fuel supply improves and product becomes available, Delaware DA - Energy Response Team will advise the Governor on the removal of the mandatory ban on diesel powered vehicles; continuation of voluntary reduction in use of diesel-powered vehicles; and eventual return to normal conditions. The Governor may rescind rules suspending truck weight and size limits and return truck weight and size regulations to those that existed previously.	GOV	Delaware DA - Energy Response Team
Inform all in-state and out-of-state agencies and companies when Emergency Phase III is terminated and the state has returned to normal and release of the mandatory conservation measures for motor fuel.	Delaware DA - Energy Response Team	DEMA
PHASE III: PUBLIC INFORMATION-MOTOR FUEL SHORTAGE		
Actions to Take	**Lead Agency**	**Support Agency**
Continue public information program and appeals for mandatory fuel conservation measures, as necessary, or until conditions have returned to normal.	Delaware DA - Energy Response Team DEMA JIC	Media Delaware DA - Energy Response Team Staff
The JIC will inform the public through the media. When appropriate, the director of Delaware DA - Energy Response Team may inform the public through the media.	Delaware DA - Energy Response Team DEMA JIC	Media Delaware DA - Energy Response Team
Delaware DA - Energy Response Team and the JIC will ensure the media is apprised of the fuel situation and given specific voluntary conservation measures to implement. In order for the public to cooperate in conservation measures, it must be fully informed on the gravity of the situation and must be given specific instructions on the conservation measures it is requested to implement.	Delaware DA - Energy Response Team DEMA JIC	Media Delaware DA - Energy Response Team Staff
Implement public information program and issue public appeals for mandatory conservation. Develop media release procedures. Establish a central media center and press briefings at scheduled times to facilitate news flow to the media.	Delaware DA - Energy Response Team DEMA JIC	Media Delaware DA - Energy Response Team Staff
The public is carefully informed of the motor fuel shortage and that the state is in Pre-Emergency Phase II. Public information announcements must be extremely conscious of not being alarming in tone. They should be informative, but not cause panic buying of products and hoarding.	Delaware DA - Energy Response Team DEMA JIC	Media Delaware DA - Energy Response Team Staff

7.3.9 Phase IV: Review Lessons Learned

In Phase IV, as emergency operations are phased out, responding state agencies should evaluate the

emergency preparedness programs and activities that were implemented. Agencies should report the results of the evaluation to interested parties such as the Governor's Office, the SEO, cabinet level officers, legislative committees, and energy policy councils. Evaluation activities should include:

- Developing reports that describe nature of the energy emergency and a chronology of the actions taken to respond to it;
- Summarizing mitigation action results and assessing the effectiveness of specific actions taken to respond to the emergency; and
- Performing critical reviews of the overall performance of the state's energy emergency plans in addressing an emergency.[48]

[48] It should be noted that movement from one phase to another is as much a matter of judgment as it is a matter of objective definition.

APPENDIX D. DELAWARE ELECTRICITY SUPPLY

7.4 Electricity Overview

Delaware Updated Quick Energy Facts Click Here!

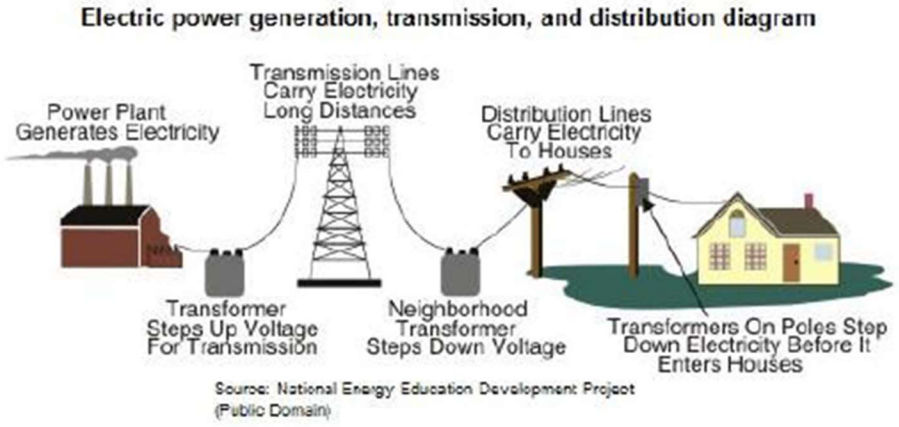
7.4.1 Fuel Usage(s)

Electricity is an energy source of primein the residential, commercial, and industrial sectors in Delaware. In addition to using electricity for lighting, appliances, and other purposes, approximately 37% of Delaware households use electricity as their primary energy source for home heating.[49] E lectricity also powers Delaware's communications, computer, and control support technologies, making it a critical energy source for key support functions.

7.4.2 Fuel Source and Supply

In 2022, an estimated 4,305 gigawatt-hours (GWh) of electricity were generated in Delaware [50]. Since 2010, electric generation fueled by natural gas fired power plants increased from 51% to 86% in 2021, with coal-fired plants dropping from 46% to only 7% - approximately half of the current 5% in-state renewable generation produced.[51] Delaware receives its coal supplies primarily by rail from West Virginia, Kentucky, Colorado, and Virginia. Delaware's natural gas comes from Pennsylvania by way of the interstate natural gas pipeline.[52] Delaware generates approximately 2/3 of the electricity needed to meet demand and imports the rest from the PJM Interconnection.[53] Delaware's renewable portfolio standard requires retail electricity suppliers to generate 25% of the electricity sold in the state from renewable energy resources by 2026, and 40% by 2035[54].

7.4.3 Fuel Delivery



Electricity is generated at power plants and delivered to end-use customers over a system of transmission and distribution power lines, also referred to as the power grid. The diagram to the right provides a visual summary of the electricity transmission and distribution steps from the power plant to the end use customers. Transformers at substations increase or decrease voltages for different stages of transporting electricity. When electricity leaves the power plant, it travels to a substation where it is transformed to a high voltage. This reduces line losses when the electricity travels over long distances. Once it arrives at a substation near its intended destination, a step-down transformer reduces the electric voltage so that it the electricity can travel over smaller distribution lines to homes and businesses. Delaware's transmission and distribution network is connected to and interacts with the regional electric

[49] As of 2020. https://www.eia.gov/state/data.php?sid=DE#ConsumptionExpenditures
[50] https://www.eia.gov/electricity/state/Delaware/
[51] Energy Information Administration Electric Power Industry Generation by Primary Energy Source Bask to 1990, Delaware.
[52] https://www.eia.gov/state/analysis.php?sid=DE
[53] PJM is the regional transmission system operator, based in Valley Forge, PA. Utilities, electricity wholesalers and independent suppliers depend on PJM to balance the supply and demand of electricity within most of the Mid-Atlantic region, including Pennsylvania, New Jersey, Maryland, Delaware and the District of Columbia.
[54] Senate Bill 33, 2021 – Revised RPS target - https://legis.delaware.gov/BillDetail?legislationId=48278

power grid in the PJM interconnection.

Generator Name	Owner	County	Sum Cap. (MW)	Type	2023 Gen. (GWh)	% of State 2023
Hay Road	Calpine Mid-Atlantic Generation LLC	New Castle County	1,136	Natural Gas	1,957	45.5%
Delaware City Plant	Delaware City Refining Company LLC	New Castle County	265	Natural Gas	1,249	29.0%
Garrison Energy Center	Garrison Energy Center LLC	Kent County	361	Natural Gas	817	19.0%
ENGIE Solidago Solar Project - Hybrid	ENGIE Solidago Solar LLC	New Castle	50	Solar PV	93	2.2%
Energy Center Dover	Energy Center Dover LLC	Kent County	118	Natural Gas	90	2.1%
Milford Solar Farm	Milford Solar LLC	Kent	11.8	Solar PV	18	0.4%
Warren F Sam Beasley Generation Station	Delaware Municipal Electric Corp	Kent County	98	Natural Gas	18	0.4%
Dover Sun Park	Arevon Energy, Inc.	Kent	10	Solar PV	16	0.4%
Edge Moor	Calpine Mid-Atlantic Generation LLC	New Castle County	710	Natural Gas	0	0.0%
NAES McKee Run	NAES Corporation - (DE)	Kent County	113.6	Natural Gas	0	0.0%
Christiana	Calpine Mid-Atlantic Generation LLC	New Castle County	52	Petroleum	0	0.0%
Van Sant Station	NAES Corporation - (DE)	Kent County	45.1	Petroleum	0	0.0%
Red Lion Energy Center	Diamond State Generation Partners, LLC	New Castle County	27	Natural Gas	0	0.0%
West Station (DE)	Calpine Mid-Atlantic Generation LLC	New Castle County	20	Petroleum	0	0.0%
Delaware City 10	Delaware City Refining Company LLC	New Castle County	18.5	Petroleum	0	0.0%
Indian River Generating Station	Indian River Operations Inc	Sussex County	16.1	Petroleum	0	0.0%
Edge Moor	Calpine Mid-Atlantic Generation LLC	New Castle County	15	Petroleum	0	0.0%
Brookside Newark	Diamond State Generation Partners, LLC	New Castle County	3.1	Natural Gas	0	0.0%
AGT001 Centerville Fuel Cell	2016 ESA Project Company, LLC	New Castle County	1.3	Natural Gas	0	0.0%
Indian River Generating Station	Indian River Operations Inc	Sussex County	426	Coal	-9	-0.2%

Table 10: Electric Generating Facilities in Delaware

7.4.4 What can go wrong?

Delaware's electricity profile is a combination of investor-, cooperatively- and government-owned, regulated and unregulated entities using several different sources of power for generation. Because it is connected to, and interacts with, regional electric power grids, more so than other sources of energy, electricity is potentially exposed to interruption at every point from generation to final distribution.

An electric emergency could occur due to a possible disruption in the supply, transmission, and distribution system to include a mix of the following factors:

- Transmission constraints
- Damaged power lines due to natural disaster or terrorism
- Inopperable coal trains and rail facilities due to weather, accident, labor problems at the mining site, and train labor problems
- Freezing coal piles at generating plants
- Natural gas supply and transportation interruptions related to natural forces or pipeline operational issues
- Cyber attack on the electric grid

7.5 Electricity Emergency Response Phases

The section below describes the Delaware energy emergency response phases and activities associated with an electric emergency. Each phase describes an appropriate level of mobilization required to address a potential or developing emergency situation.

7.5.1 Phase I: Monitor and Alert Activates

Phase I of emergency response involves the normal ongoing energy supply, demand, and price monitoring. State agencies regularly monitor data and information as it becomes available through energy supply reporting systems (see Appendix H on Monitoring Fuel Supplies) and pay special attention to supply and distribution problems. The table below describes the specific activities associated with Phase I and the lead and support agencies responsible for these activities.

PHASE I: RESPONSE ACTIVITY-ELECTRICITY EMERGENCY		
Activity	**Lead Agency**	**Support Agency**
Monitor international and domestic events	ESF-12 Group Delaware DA - Energy Response Team Electric Utility Companies	DEMA EOC DE Delaware Public Service Commission (PSC)
Train appropriate Delaware Energy Office staff.	ESF-12 Group Delaware DA - Energy Response Team Electric Utility Companies	DEMA EOC State Departments DEMA PIO
Attend periodic exercises to establish and test emergency protocols.	ESF-12 Group Delaware DA - Energy Response Team Electric Utility Companies	DEMA EOC State Departments DEMA PIO
Update and maintain a network of public and private sector contacts. Prepares Internal memos.	ESF-12 Group Delaware DA - Energy Response Team Electric Utility Companies	DEMA EOC State Departments DEMA PIO

7.5.2 Phase II: Assess and Determine Action

In Phase II, having noticed early signs of what might become an energy emergency, responding agencies intensify data and information collection efforts and ensure that the most recent information is available. This information is analyzed to evaluate potential outcomes and assess possible courses of action. At this stage, the following key activities should take place.

- Appropriate contacts throughout state government should be informed of the results of this assessment.
- Appropriate further action should be determined. If no action is required, monitoring and evaluation continue, and further updates are made as changes occur.

The table below describes the specific activities associated with Phase II and the lead and support agencies responsible for these activities. It also describes the actions that should be taken to inform and educate the

public about the emergency.

PHASE II: RESPONSE ACTIVITY-ELECTRICITY EMERGENCY		
Actions to Take:	**Lead Agency**	**Support Agency**
Communicate with a network of contacts in private and public sectors to monitor local conditions in the electricity supply and distribution market.	ESF-12 Group Delaware DA - Energy Response Team Electric Utility Companies	DEMA EOC Delaware Public Service Commission (PSC)
Prepare to implement Delaware government electricity emergency conservation program.	ESF-12 Group Delaware DA - Energy Response Team Electric Utility Companies	DEMA EOC State Departments DEMA PIO
Prepare to implement reduced temperatures and operating procedures in state owned buildings and facilities.	ESF-12 Group Delaware DA - Energy Response Team Electric Utility Companies	DEMA EOC State Departments DEMA PIO
Prepare to request all building owners and operators to reduce building temperatures and operating conditions.	ESF-12 Group Delaware DA - Energy Response Team Electric Utility Companies	DEMA EOC State Departments DEMA PIO
Prepare to request employers to assist in electricity conservation efforts by modifying working hours and building temperatures.	ESF-12 Group Delaware DA - Energy Response Team Electric Utility Companies	DEMA EOC State Departments DEMA PIO
Notify all other agencies, associations, and companies that have roles in the ESF-12 plan of the escalation to Verification Phase I.	ESF-12 Group Delaware DA - Energy Response Team Electric Utility Companies	DEMA EOC State Departments DEMA PIO
If electricity shortage increases escalate to Pre-Emergency Phase III. Notify all city departments, agencies, and companies of the escalation.	ESF-12 Group Delaware DA - Energy Response Team Electric Utility Companies	DEMA EOC State Departments Private Business Agencies
PHASE II: PUBLIC INFORMATION-ELECTRICITY EMERGENCY		
Actions to Take:	**Lead Agency**	**Support Agency**
The DEMA PIO will provide information to newspapers and radio and television stations for consumers on how to conserve electricity. The public must be informed as to what it can do to voluntarily conserve electricity. As staff deems certain mitigation measures appropriate, existing formatted public information announcements must be edited to describe the specific, current situation. The public will be apprised of the situation and must be given specific voluntary conservation measures to implement. In order for the public to cooperate in conservation measures, it must be fully informed on the gravity of the situation and must be given specific instructions on the conservation measures it is requested to implement.	ESF-12 Group Delaware DA - Energy Response Team Electric Utility Companies DEMA PIO	DEMA EOC State Departments DEMA PIO

Electricity and Home Furnaces

Most natural gas, propane, and fuel oil furnaces rely on electricity to power the various fans and electrical devices. During a severe or prolonged shortage of electricity, it may be necessary to open temporary shelters for individuals or families who have run out of fuel or whose furnaces will not function due to a loss of electricity. In response to this possible emergency, DEMA, local governments, and the Red Cross have an established system with mass care and shelter providers that may be utilized. Local chapters of the American Red Cross are prepared through the national, regional, and state organizations to provide emergency shelter care.

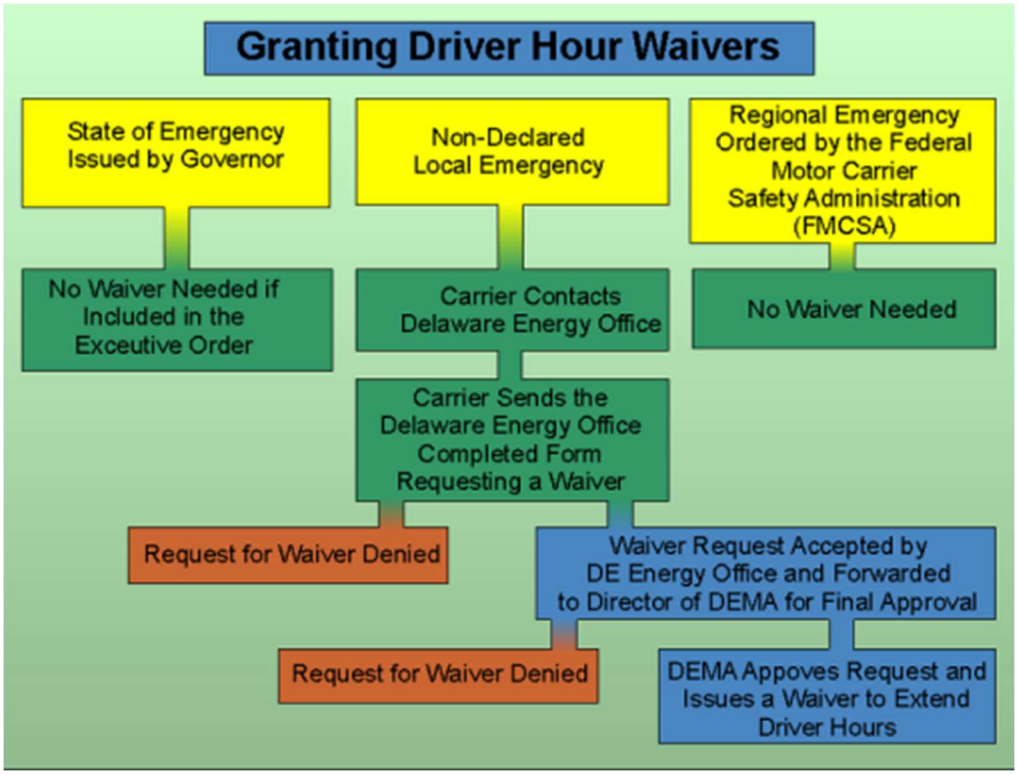
7.5.3 Phase III: Actions and Feedback

Once a decision has been made that specific state government action is necessary to assure the health, welfare, and safety of citizens, and the continued economic well- being of the state, Phase III activity begins. This includes:

- Implementing programs to maximize available supplies and/or to minimize existing demand levels and monitoring these activities to determine their effectiveness;
- Increasing the level of communication among state agencies and others;
- If the nature of the problem involves multiple states, information and mutual aid sharing among state energy coordinators, using the EEAC website, should begin; (the password-protected Energy Emergency Assurance Coordinators website through which authorized state energy emergency coordinators may access valuable energy security information, including daily news summaries, emergency situation reports, lessons learned from other states, links to outage and curtailment information, and the ability to email messages to colleagues in other jurisdictions).
- Convening emergency planning and response organizations to consider actions that might be taken by the various state departments and agencies;
- If implementation of voluntary programs or other emergency deterrent actions fail to mitigate the emergency, begin implementing additional actions;
- If the situation continues to deteriorate, recommending that a State of Energy Emergency be declared (usually by the Governor). The Governor may also be called upon to declare a —State of Disaster. State legislation regarding —State of Energy Emergency and/or —State of Disaster will dictate further action and assign responsibility among pertinent parties; and
- If it appears that all other options available to the state prove inadequate, the next level of mobilization is to request federal assistance.

Federal assistance would generally be available in the case of a national/international energy emergency. The emergency planning agencies and representatives from other state departments, as appropriate, would be responsible for coordinating and monitoring federal programs. Federal assistance may be requested sooner without a declaration of a national emergency to provide the following;

- Waiver federal driver hour requirements;
- Waiver vehicle fuel air quality standards;
- Request Coast Guard to intensify ice breaking (if Delaware River is frozen hampering barge movement);
- and Request Strategic Petroleum Reserve (SPR) or the Northeast Heating Oil Reserves.



The table below describes the specific activities associated with Phase III and the lead and support agencies responsible for these activities. It also describes the actions that should be taken to inform and educate the public about the emergency.

PHASE III: RESPONSE ACTIVITY-ELECTRICITY EMERGENCY		
Actions To Take	**Lead Agency**	**Support Agency**
Implement public information program and issue public appeals for voluntary electricity conservation.	ESF-12 GROUP Delaware DA - Energy Response Team Electric Utility Companies	DEMA EOC Delaware Public Service Commission (PSC)
Implement state energy emergency conservation program. Advise state departments to alter temperature and operating conditions in city buildings and facilities.	ESF-12 GROUP Delaware DA - Energy Response Team Electric Utility COMPANIES	State Departments City/County Agencies
If electricity shortage worsens escalate to Emergency Phase IV. DEMA will notify all agencies and companies of the escalation.	ESF-12 GROUP Delaware DA - Energy Response Team Electric Utility Companies	State Departments City/County Agencies
If electricity shortage is forecast to diminish and start to return to normal order a de-escalation back to Readiness Phase I. Notify all agencies and companies of the de-escalation.	ESF-12 GROUP Delaware DA - Energy Response Team Electric Utility Companies	State Departments City/County Agencies
Implement state energy emergency conservation program. Advise state departments to alter temperature and operating conditions in city buildings and facilities.	ESF-12 GROUP Delaware DA - Energy Response Team Electric Utility COMPANIES	State Departments City/County Agencies
If electricity shortage worsens escalate to Emergency Phase IV. DEMA will notify all agencies and companies of the escalation.	ESF-12 GROUP Delaware DA - Energy Response Team Electric Utility Companies	State Departments City/County Agencies

If electricity shortage is forecast to diminish and start to return to normal order a de-escalation back to Readiness Phase I. Notify all agencies and companies of the de-escalation.	ESF-12 GROUP Delaware DA - Energy Response Team Electric Utility Companies	State Departments City/County Agencies
PHASE III: PUBLIC INFORMATION-ELECTRICITY EMERGENCY		
Actions To Take	**Lead Agency**	**Support Agency**
The same public information principles applicable to Phase II are also applicable to Phase III. Public information announcements will convey non-alarming tone. They will be informative and not cause panic buying of products and hoarding.	ESF-12 Group Delaware DA - Energy Response Team Electric Utility Companies DEMA PIO	Local Media Electric Company PIO
The DEMA PIO will provide information to consumers through newspapers and radio and television stations on how to conserve electricity. As staff deems certain mitigation measures appropriate, existing formatted public information announcements must be edited to describe the specific, current situation.	ESF-12 Group Delaware DA - Energy Response Team Electric Utility Companies DEMA PIO	Local Media Electric Company PIO

7.5.4 Phase IV: Review Lessons Learned

In Phase IV, as emergency operations are phased out, responding state agencies should evaluate the emergency preparedness programs and activities that were implemented. Agencies should report the results of the evaluation to interested parties such as the Governor's Office, cabinet level officers, legislative committees, and energy policy councils. Evaluation activities should include:

- Developing reports that describe nature of the energy emergency and a chronology of the actions taken to respond to it;
- Summarizing mitigation actions results and assessing the effectiveness of specific actions taken to respond to the emergency; and
- Performing critical reviews of the overall performance of the state's energy emergency plans in addressing an emergency.[55]

[55] It should be noted that movement from one phase to another is as much a matter of judgment as it is a matter of objective definition.

APPENDIX E. NATURAL GAS SHORTAGE EMERGENCY

7.6 Natural Gas Overview

Delaware Updated Quick Energy Facts Click Here!

7.6.1 Fuel Usage(s)

Since 2010, electric generation fueled by natural gas fired power plants increased from 51% to 91% in 2022 – 28% of Delawares gas consumption – with coal-fired plants dropping from 46% to only 2% - approximately half of the current 5% in-state renewable generation produced.[56] In 2021, nearly forty percent[57] of the state's gas was consumed by the industrial sector for purposes such as a fuel for combined heat and power systems and as a feedstock to produce fertilizer, chemicals, and hydrogen.[58] In the residential and commercial sectors, overall natural gas usage in 2021 was 14% and 18% respectively of the state's overall total usage, and largely used for space and water heating as well as cooking and clothes drying clothes.[59] Some natural gas is used for transportation as a vehicle fuel in the form of liquefied and compressed natural gas.[60]

7.6.2 Fuel Source and Supply

North America's interconnected system of underground pipelines transports natural gas from production areas to local distribution companies, or LDCs. To help ensure reliable service, natural gas can be stored underground in salt caverns, aquifers, and depleted reservoirs for use during peak demand. On the Delaware Peninsula, there is limited availability of natural gas pipeline and storage capability. Eastern Shore Natural Gas Company (ESNG) owns and operates the only transmission pipeline south of the Chesapeake and Delaware Canal. ESNG receives natural gas at three pipeline interconnections in southeastern Pennsylvania. The pipeline transports and delivers natural gas through several hundred miles of transmission pipeline to the ESNG's Delaware and Maryland Divisions, four additional non- affiliated local distribution companies, a as well as some electric generation and industrial customers located in Delaware, the Eastern Shore of Maryland and Pennsylvania.

7.6.3 Fuel Delivery

There are four gas utility companies in Delaware. To deliver gas to homes and industry distribution companies use an extensive network of small-diameter distribution pipes or mains to bring natural gas service to residential, commercial, industrial and electricity generation customers.

7.6.4 What Can Go wrong?

A natural gas shortage emergency could occur due to a possible disruption in the supply system to include a mix of the following factors:

- Rupture intrastate or interstate pipelines due to accidental, natural disasters, terrorism, or other causes
- Shortage due to labor strikes
- Reduction in supply for political or economic reasons.
- A supply and demand imbalance
- Physical or cyber attacks

[56] Energy Information Administration Electric Power Industry Generation by Primary Energy Source Bask to 1990, Delaware.
[57] https://www.eia.gov/state/seds/data.php?incfile=/state/seds/sep_fuel/html/fuel_use_ng.html&sid=US&sid=DE
[58] https://www.eia.gov/energyexplained/index.php?page=natural_gas_use
[59] Ibid
[60] Ibid

7.6.5 Information Sharing

TSA Pipeline Security Stakeholder Conference Calls - Since March 2006, TSA has conducted regular conference calls with pipeline security partners. These conference calls are used to share pipeline security information and educate security partners on many of the programs, activities, and initiatives within the pipeline mode or within the Transportation Sector. These conference calls also provide pipeline security partners with the opportunity to ask questions and bring up other important issues for discussion. Unscheduled stakeholder conference calls can be conducted on short notice as the need arises.

7.7 Natural Gas Emergency Response Phases

The section below describes the Delaware energy emergency response phases and activities associated with a natural gas emergency. Each phase describes an appropriate level of mobilization required to address a potential or developing emergency situation.

7.7.1 Phase I Monitor and Alert Activities

In the Monitor and Alert Phase, the DE Energy Response Team staff monitors international and domestic events and undertakes the following activities:

- Attends periodic exercises to establish and test emergency protocols
- Trains appropriate DE Energy Response Team staff
- Updates and maintains a network of public and private sector contacts
- Prepares Internal Advisory Reports as needed.

The table below describes the specific activities associated with Phase I and the lead and support agencies responsible for these activities.

PHASE I RESPONSE ACTIVITY-NATURAL GAS SHORTAGE		
Actions To Take	**Lead**	**Support**
Conduct appropriate telephone surveys for seasonal propane supplies and prices. Communicate with a network of contacts in private and public sectors to monitor local conditions in the natural gas market.	ESF-12 Group DE Energy Response Team Gas Companies	Propane Delivery Companies
Monitor media for local, national, and international events that might impact natural gas supplies and prices in the State.	ESF-12 Group DE Energy Response Team	State Departments Local Media
Prepare to implement state government emergency conservation program.	ESF-12 Group DE Energy Response Team	State Departments Local Media
Prepare to implement reduced temperatures and operating procedures in state buildings and facilities.	ESF-12 Group DE Energy Response Team	State Departments Local Media
Prepare to request all building owners and operators to reduce building temperatures and operating conditions	ESF-12 Group DE Energy Response Team	Businesses DEMA Staff
Prepare to request employers to assist in propane conservation efforts by modifying working hours and building temperatures.	ESF-12 Group DE Energy Response Team	DEMA Staff
Notify all other agencies, associations, and companies that have roles in the SEERP, and other New England state energy offices of the escalation to Pre-Emergency Phase II.	ESF-12 Group DE Energy Response Team	DEMA Staff

If propane fuel shortage increases, DE Energy Response Team and the DEMA Director may recommend to the Governor that the State escalate to Pre-Emergency Phase II. Notify all in-state and out-of-state agencies and companies of the escalation.	DE Energy Response Team DEMA Director ESF- 12 Group	DEMA Staff
PHASE I PUBLIC INFORMATION-NATURAL GAS SHORTAGE		
Actions To Take	**Lead**	**Support**
DEMA PIO may provide information to newspapers and radio and television stations for consumers on how to conserve propane fuel. The public must be informed as to what it can do to voluntarily conserve propane. As staff deems certain mitigation measures appropriate, existing formatted public information announcements must be edited to describe the specific, current situation. The public will be notified of the situation and must be given specific voluntary conservation measures to implement. In order for the public to cooperate in conservation measures, it must be fully informed on the gravity of the situation and must be given specific instructions on the conservation measures it is requested to implement.	DEMA PIO	Local Media

7.7.2 Phase II Assess and Determine Action

Phase II is activated when supply problems of natural gas, are reported by reliable sources such as the fuel retailers, distributors, and the terminals. The Phase II may be activated if the DE Energy Response Team determines that a heating oil shortage is occurring or may shortly occur. During this phase, the DE Energy Response Team will:

- Rapidly determine the nature, extent, and duration of a potential, impending, or actual energy emergency
- Coordinate energy emergency response activities with the DEMA, other appropriate state agencies, the U.S. Department of Energy, other state governments, local government agencies, and private industry
- Provide a detailed Situation Report that assesses the potential or actual impacts of the emergency on energy prices and supplies.
- If required, use the informal fuels set-aside program to ensure that emergency and essential services receive adequate supplies of fuel
- Recommend further actions (if any) to DEMA

The table below describes the specific activities associated with Phase II and the lead and support agencies responsible for these activities. It also describes the actions that should be taken to inform and educate the public about the emergency.

PHASE II: RESPONSE ACTIVITY-NATURAL GAS SHORTAGE		
Actions To Take	**Lead**	**Support**
Prepare to implement reduced temperatures and operating procedures in state buildings and facilities.	ESF-12 Group DE Energy Response Team Gas Companies	DEMA EOC State Departments
Prepare to request a voluntary reduction of natural gas by consumers, businesses, schools, institutions, and state building operators.	ESF-12 Group DE Energy Response Team Gas Companies	DEMA EOC Businesses Local Government
The DE Energy Response Team and DEMA PIO requests to voluntarily assist in natural gas conservation efforts with certain high use activities.	ESF-12 Group DE Energy Response Team Gas Companies	DEMA EOC Local Media State Departments

Notify all other agencies, associations, and companies that have roles in the ESF 12 of the escalation to Pre-Emergency Phase II.	ESF-12 Group DE Energy Response Team Gas Companies	DEMA EOC DE Public Service Commission (PSC)
If monitoring activities indicate a possible shortage of natural gas, contact Energy and arrange a meeting to discuss possible escalation to Pre-Emergency Phase II. Determine from Energy or other agencies: causes, possible duration, and geographic extent of the shortage and steps the providers can take to alleviate or avert a shortage.	ESF-12 Group DE Energy Response Team Gas Companies	DEMA EOC DE Public Service Commission (PSC)
If natural gas shortage increases at the State level, the DE Energy Response Team and DEMA may recommend to the Governor of the State's escalation to Pre-Emergency Phase II. Notify all in-state agencies, local governments, and companies of the escalation.	ESF-12 Group DE Energy Response Team Gas Companies Governor	DEMA EOC DE Public Service Commission (PSC)
PHASE II: PUBLIC INFORMATION-NATURAL GAS SHORTAGE		
Actions To Take	**Lead**	**Support**
The DE Energy Response Team and DEMA PIO will provide information to local governments, newspapers and radio and television stations for consumers on how to conserve natural gas. The public must be informed as to what it can do to voluntarily conserve natural gas. As staff deems certain mitigation measures appropriate, existing formatted public information announcements must be edited to describe the specific, current situation. The public will be apprised of the situation and must be given specific voluntary conservation measures to implement. In order for the public to cooperate in conservation measures, it must be fully informed on the gravity of the situation and must be given specific instructions on the conservation measures it is requested to implement.	ESF-12 Group DE Energy Response Team Gas Companies DEMA PIO	DEMA EOC DE Public Service Commission (PSC) Local Media State Departments

7.7.3 Phase III Actions and Feedback

Phase III is activated when natural gas shortages increase, and industry representatives and others directly involved indicate an impending natural gas shortage. This phase is characterized by an increased level of government activity as the energy problem worsens. During this phase, the DE Energy Response Team Planning staff will:

- Continue to coordinate energy emergency response activities with the Governor's Office of Emergency Services, other appropriate state agencies, the U.S. Department of Energy, other state governments, local government agencies, and private industry.
- Continue to provide periodic Situation Reports that describe the nature of the energy emergency, the potential or actual impacts on energy prices and supplies, and the expected duration of the event.
- If required, continue to use the informal fuels set-aside program to ensure that emergency and essential services receive adequate supplies of fuel.
- Recommend to the DE Energy Response Team appropriate voluntary demand reduction measures that may be used to mitigate the impacts of the propane fuel shortage.

The table below describes the specific activities associated with Phase III and the lead and support agencies responsible for these activities. It also describes the actions that should be taken to inform and educate the public about the emergency.

PHASE III: RESPONSE ACTIVITY-NATURAL GAS SHORTAGE		
Actions To Take	**Lead**	**Support**
The DE Energy Response Team will increase monitoring and analysis of natural gas stocks, consumption patterns, prices, product delivery, including maintaining regular contact with suppliers and distributors regarding adequacy of natural gas product and will supply information to the DEMA EOC. Continue meetings with natural gas suppliers.	ESF-12 Group DE Energy Response Team Gas Companies	State Departments Local Media Local Government PIOs
The DEMA EOC implements public information program and may issue public appeals for voluntary natural gas conservation.	ESF-12 Group DE Energy Response Team Gas Companies DEMA PIO	State Departments Local Government Local Media
If monitoring activities indicates a possible sustained shortage of natural gas, contact the Delaware Public Service Commission and determine: causes, possible duration, and geographic extent of the shortage and steps the providers can take to alleviate or avert a shortage.	ESF-12 Group DE Energy Response Team Gas Companies	PSC State Departments Local Government Local Media
Implement Delaware emergency conservation program. Inform state departments to make adjustments to employee working hours, where possible, and reduce temperature and operating conditions in state buildings and facilities.	ESF-12 Group DE Energy Response Team Gas Companies	State Departments Local Media Businesses & Industry
If natural gas situation worsens the State escalates to Emergency Phase III the DEMA EOC will notify state departments and Delaware companies of the escalation.	ESF-12 Group DE Energy Response Team Gas Companies	State Departments Local Media Businesses &Industry
If natural gas shortage is forecast to diminish and start to return to normal the DEMA EOC will de-escalate back to Verification Phase I. The DEMA EOC will notify all state departments and local companies of the de-escalation.	ESF-12 Group DE Energy Response Team Gas Companies	State Departments Local Media Businesses & Industry
PHASE III: PUBLIC INFORMATION-NATURAL GAS SHORTAGE		
Actions To Take	**Lead**	**Support**
The DEMA PIO will provide information to newspapers and radio and television stations on how consumers can conserve natural gas. The public will be informed as to what it can do to voluntarily conserve natural gas.	ESF-12 Group DE Energy Response Team Gas Companies	State Departments Local Media Businesses &Industry
Implement procedures concerning media releases and interviews. Discuss the possibility of establishing a central media center and press briefings at scheduled times to facilitate news flow to the media.	ESF-12 Group DE Energy Response Team Gas Companies	State Departments Local Media Businesses & Industry
The DEMA PIO prepares public information announcements to describe the specific, current situation.	ESF-12 Group DE Energy Response Team Gas Companies	State Departments Local Media Businesses & Industry
The DEMA EOC will ensure the media is apprised of the situation and given specific voluntary conservation measures for the public to implement.	ESF-12 Group DE Energy Response Team Gas Companies PIODEMA PIO	State Departments Local Media Businesses & Industry

APPENDIX F. HEATING OIL AND KEROSENE EMERGENCY

7.8 Heating Oil and Kerosene Overview

Delaware Updated Quick Energy Facts Click Here!

7.8.1 Fuel Usage(s)

Kerosene and No. 2 fuel oil are the two types of residential heating oil used in Delaware. Kerosene is used as primary heating fuel in less than two percent of Delaware residences[61]. Mobile homes are generally without basements and underground storage is not appropriate because of the higher cost of tank installation and the possible relocation of mobile homes from site to site.

Kerosene is also used for cooking, domestic hot water, and vented and unvented spaces heaters. Unvented space heaters may be moved from room to room. It is also an attractive option for low or medium income households because of its low initial cost and flexibility.

No. 2 Fuel Oil is the primary heating fuel for about 10% of the residential market.[62] No. 2 Fuel Oil must be kept at moderate temperature for it to flow. Usually the basement is selected for fuel storage, although tanks are occasionally installed underground.

In the commercial sector, kerosene's primary usage in Delaware is as a blending component added to Diesel fuel to keep it flowing at winter temperatures. Typical Diesel fuel in the Winter may contain 35 to 50% kerosene, with blends upwards to 70% sometimes needed to compensate for the colder weather. Diesel fuel is used in the trucking and construction industries for mobile equipment. Diesel fuel is also used in some stationary plant installations for diesel generator-sets or other prime movers. In the residential sector, kerosene can be used to blend with No. 2 Fuel Oil for very cold weather.

7.8.2 Fuel Source and Supply

The Delaware City Refinery in Delaware City is the only refinery operating in the State. It has a capacity of 182,200 barrels per day. Delaware's crude oil supply generally enters by ship tanker or barge into ports in Delaware City, Edgemoor, Claymont, and Wilmington. Delaware fuel oil suppliers truck the product from the terminals to wholesale or retail distribution sites.

7.8.3 Fuel Delivery

Kerosene and heating oil is supplied in Delaware by several heating oil dealers.

7.8.4 What Can Go Wrong?

A heating oil emergency could occur due to a possible disruption in the supply system to include a mix of the following factors:

- Delaware, Pennsylvania, and New Jersey refineries down for repairs or labor problems
- Unloading facilities inoperable due to weather or accident and including electricity failure
- Truck transport constrained due to ice and snow or other natural disasters
- Product shortage due to high export rate
- Shortage due to labor strikes
- Reduction in imports for political or economic reasons
- Imbalance in supply and demand
- Cyber and physical attacks

[61] https://www.eia.gov/state/data.php?sid=DE
[62] Ibid

7.8.5 Heating Oil and Kerosene Emergency Response Phases

The section below describes the Delaware energy emergency response phases and activities associated with a heating oil or kerosene emergency. Each phase describes an appropriate level of mobilization required to address a potential or developing emergency situation.

7.8.6 Phase I Monitor and Alert Activities

Phase 1 involves the normal ongoing energy supply, demand, and price monitoring. State agencies regularly monitor data and information as it becomes available through energy supply reporting systems (see appendix H) and pay special attention to supply and distribution problems. This phase is activated when supply problems of kerosene and/or fuel oil are reported by the suppliers. The table below describes the specific activities associated with Phase I and the lead and support agencies responsible for these activities.

PHASE I: RESPONSE ACTIVITY-HEATING OIL SHORTAGE		
Actions To Take	**Lead**	**Support**
Conduct appropriate telephone surveys for seasonal heating oil and kerosene supplies and prices. Communicate with a network of contacts in private and public sectors to monitor local conditions in the heating oil and propane markets.	ESF-12 Group DE Energy Response Team Gas Companies	Heating Oil Delivery Companies
Monitor media for local, national, and international events that might impact heating oil shortage supplies and prices in the State.	ESF-12 Group DE Energy Response Team	State Departments Local Media
Prepare to implement state government emergency conservation program.	ESF-12 Group DE Energy Response Team	State Departments Local Media
Prepare to implement reduced temperatures and operating procedures in state buildings and facilities.	ESF-12 Group DE Energy Response Team	State Departments Local Media
Prepare to request all building owners and operators to reduce building temperatures and operating conditions	ESF-12 Group DE Energy Response Team	Businesses DEMA Staff
Prepare to request employers to assist in heating oil conservation efforts by modifying working hours and building temperatures. .	ESF-12 Group DE Energy Response Team	DEMA Staff
Notify all other agencies, associations, and companies that have roles in the SEERP, and other New England state energy offices of the escalation to Phase II.	ESF-12 Group DE Energy Response Team	DEMA Staff
If heating oil shortage increases, DE Energy Response Team and the DEMA Director may recommend to the Governor that the State escalate to Phase II. Notify all in-state and out-of-state agencies and companies of the escalation.	DE Energy Response Team DEMA Director ESF- 12 Group	DEMA Staff
PHASE I: PUBLIC INFORMATION-HEATING OIL SHORTAGE		
Actions To Take	**Lead**	**Support**
DEMA PIO may provide information to newspapers and radio and television stations for consumers on how to conserve during a heating oil shortage. The public must be informed as to what it can do to voluntarily conserve heating oil. As staff deems certain mitigation measures appropriate, existing formatted public information announcements must be edited to describe the specific, current situation. The public will be notified of the situation and must be given specific voluntary conservation measures to implement. In order for the public to cooperate in conservation measures, it must be fully informed on the gravity of the situation and must be given specific instructions on the conservation measures it is requested to implement.	DEMA PIO	Local Media

7.8.7 Phase II Assess and Determine Action

In Phase II, having noticed early signs of what might become an energy emergency, the responding agencies intensify data and information collection efforts and ensure that the most recent information is available. This information is analyzed to ensure that the most recent information is available. The information is analyzed to evaluate potential outcomes and assess possible courses of action.

- Appropriate contact through state government should be informed of the results of this assessment
- Appropriate action can then be determined. If no action is required, monitoring and evaluation continue, and further updates are made as changes occur.

Phase II is activated when supply problems of heating oil, are reported by reliable sources such as the fuel retailers, distributors, and the terminals. The Verification Phase II may be activated if the DE Energy Response Team determines that a heating oil shortage is occurring or may shortly occur. During this phase, the DE Energy Response Team will: Rapidly determine the nature, extent, and duration of a potential, impending, or actual energy emergency. Coordinate energy emergency response activities with the DEMA, other appropriate state agencies, the U.S. Department of Energy, other state governments, local government agencies, and private industry. The DE Energy Response Team may provide a detailed Situation Report that assesses the potential or actual impacts of the emergency on energy prices and supplies. If required, use the informal fuels set-aside program to ensure that emergency and essential services receive adequate supplies of fuel. Recommend further actions (if any) to DEMA.

The table below describes the specific activities associated with Phase II and the lead and support agencies responsible for these activities. It also describes the actions that should be taken to inform and educate the public about the emergency.

PHASE II: RESPONSE ACTIVITY-HEATING OIL SHORTAGE		
Official Actions To Take:	**Lead**	**Support**
Conduct appropriate telephone surveys for seasonal heating oil/kerosene supplies and prices. Communicate with a network of contacts in private and public sectors to monitor local conditions in the heating oil/kerosene market.	ESF-12 Group DE Energy Response Team Gas Companies	Heating Oil and Kerosene Delivery Companies
Monitor media for local, national, and international events that might impact heating oil and kerosene supplies and prices in the State.	ESF-12 Group DE Energy Response Team	State Departments Local Media
Prepare to implement state government emergency conservation program.	ESF-12 Group DE Energy Response Team	State Departments Local Media
Prepare to implement reduced temperatures and operating procedures in state buildings and facilities.	ESF-12 Group DE Energy Response Team	State Departments Local Media
Prepare to request all building owners and operators to reduce building temperatures and operating conditions	ESF-12 Group DE Energy Response Team	Businesses DEMA Staff
Prepare to request employers to assist in propane conservation efforts by modifying working hours and building temperatures. .	ESF-12 Group DE Energy Response Team	DEMA Staff
Notify all other agencies, associations, and companies that have roles in the SEERP, and other New England state energy offices of the escalation to Phase II.	ESF-12 Group DE Energy Response Team	DEMA Staff
If propane fuel shortage increases, DE Energy Response Team and the DEMA Director may recommend to the Governor that the State escalate to Phase III. Notify all in-state and out-of-state agencies and companies of the escalation.	DE Energy Response Team DEMA Director ESF- 12 Group	DEMA Staff

If propane fuel shortage improves, the DE Energy Response Team and the DEMA Director may recommend to the Governor a de-escalation back to Phase I (normal conditions). Notify all in-state and out-of-state agencies and companies of the de-escalation.	DE Energy Response Team DEMA Director ESF- 12 Group	DEMA Staff
PHASE II: PUBLIC INFORMATION-HEATING OIL SHORTAGE		
Official Actions To Take	**Lead**	**Support**
DEMA PIO may provide information to newspapers and radio and television stations for consumers on how to conserve heating oil. The public must be informed as to what it can do to voluntarily conserve propane. As staff deems certain mitigation measures appropriate, existing formatted public information announcements must be edited to describe the specific, current situation. The public will be notified of the situation and must be given specific voluntary conservation measures to implement. In order for the public to cooperate in conservation measures, it must be fully informed on the gravity of the situation and must be given specific instructions on the conservation measures it is requested to implement.	DEMA PIO	Local Media

7.8.8 Phase III Actions and Feedback

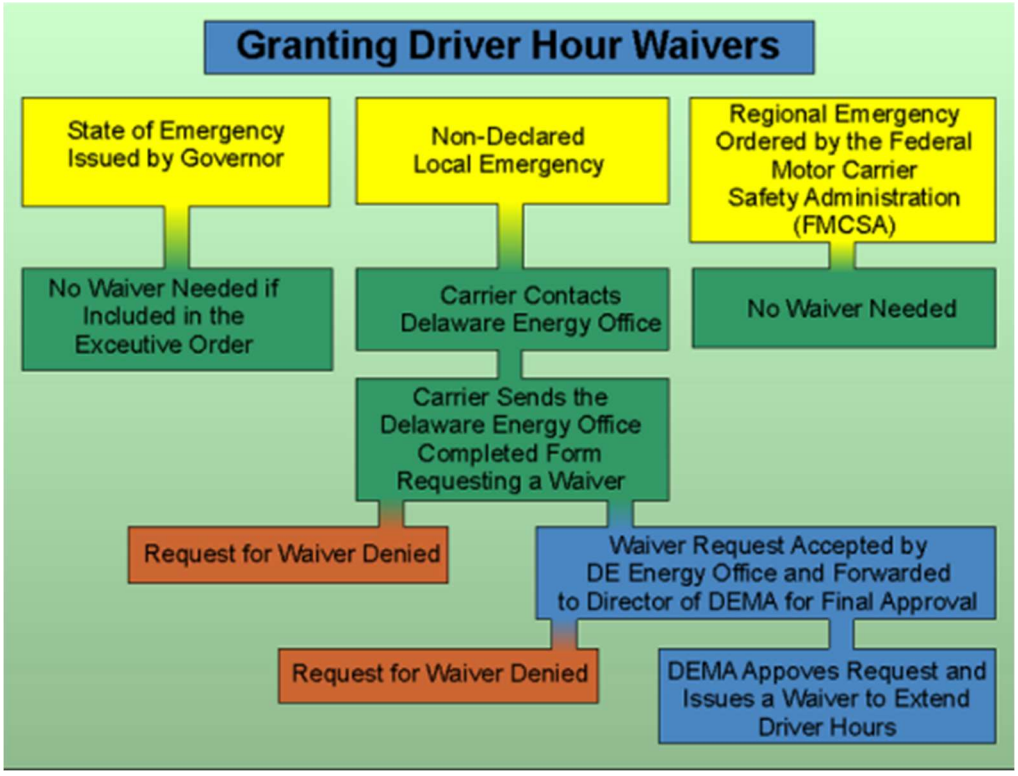
Once a decision has been made that specific state government action is necessary to assure the health, welfare, and safety of citizens, and the continued economic well-being of the State, Phase III activity begins. This includes:

- Implementing programs to maximize available supplies and/or to minimize existing demand levels and monitoring these activities to determine their effectiveness;
- Increasing the level of communication among state agencies and others;
- If the nature of the problem involves multiple states, information and mutual aid sharing among state energy coordinators, using the EEAC website, should begin; (the password-protected Energy Emergency Assurance Coordinators website through which authorized state energy emergency coordinators may access valuable energy security information, including daily news summaries, emergency situation reports, lessons learned from other states, links to outage and curtailment information, and the ability to email messages to colleagues in other jurisdictions).
- Convening emergency planning and response organizations to consider actions that might be taken by the various state departments and agencies;
- If implementation of voluntary programs or other emergency deterrent actions fail to mitigate the emergency, begin implementing additional actions;
- If the situation continues to deteriorate, recommending that a —State of Energy Emergency‖ be declared (usually by the Governor). The Governor may also be called upon to declare a —State of Disaster. State legislation regarding —State of Energy Emergency‖ and/or —State of Disaster‖ will dictate further action and assign responsibility among pertinent parties; and
- If it appears that all other options available to the state prove inadequate, the next level of mobilization is to request federal assistance.

Federal assistance would generally be available in the case of a national/international energy emergency. The emergency planning agencies and representatives from other state departments, as appropriate, would be responsible for coordinating and monitoring federal programs; Federal assistance may be requested sooner without a declaration of a national emergency to provide the following;

- Waiver federal driver hour requirements;
- Waiver vehicle fuel air quality standards;

- Request Coast Guard to intensify ice breaking (if Delaware River is frozen hampering barge movement; and Request Strategic Petroleum Reserve (SPR) or the Northeast Heating Oil Reserves.



The table below describes the specific activities associated with Phase III and the lead and support agencies responsible for these activities. It also describes the actions that should be taken to inform and educate the public about the emergency.

PHASE III: RESPONSE ACTIVITY-HEATING OIL SHORTAGE		
Official Actions To Take	**Lead**	**Support**
Increase monitoring and analysis of heating oil stocks, product deliveries, consumption patterns and prices, including maintaining regular contact with suppliers and distributors regarding adequacy of propane product. Continue consultations and meetings with members of the propane industry.	DEMA Staff DE Energy Response Team ESF-12 Group	DEMA Staff
Implement public information program and issue public appeals for voluntary conservation. See this section for heating oil conservation measures and formatted Propane Public Announcements.	DEMA Staff DE Energy Response Team ESF-12 Group	DEMA Staff
If propane fuel situation worsens, DE Energy Response Team and the DEMA Director may recommend to the Governor that the State escalate to Phase III. DEMA will notify all in-state and out-of-state agencies and companies of the escalation.	DEMA Staff DE Energy Response Team ESF-12 Group	DEMA Staff State Departments Schools & Businesses
If heating oil shortage is forecast to diminish and start to return to normal, DE Energy Response Team and the DEMA Director may recommend to the Governor a de- escalation back to Phase I. Notify all in-state and out-of-state agencies and companies of the de-escalation.	DEMA Staff DE Energy Response Team ESF-12 Group	DEMA Staff State Departments Schools & Businesses
During a severe or prolonged shortage of heating oil, it may be necessary to open temporary shelters for individuals or families that have run out of fuel.	DEMA PIO DEMA Staff	Red Cross Delaware VOAD

PHASE III: PUBLIC INFORMATION-HEATING OIL SHORTAGE		
Official Actions To Take	**Lead**	**Support**
The same public information principles applicable to Phase II are also applicable to Phase III. The difference is that the situation is graver and more severe. In addition, the conservation measures imposed are mandatory. Public information announcements will convey non-alarming tone. They will be informative and not cause panic buying of product and hoarding. The public will be informed not only of the measures themselves, but also of the method of enforcing implementation of the conservation measures.	DEMA PIO DEMA Staff	Local Media DEMA Staff
The Governor requests, through DEMA and the media, voluntary conservation in residences by lowering thermostats or other controls to between 60 and 65 during the time the space is occupied during the day and evenings; between 55 and 60 at night; and to 50 in unoccupied facilities (see governor's press release Chapter 11).	DEMA PIO DEMA Staff	Local Media DEMA Staff
The public is carefully informed of the fully inform the public of the heating shortage and that the State is in Phase III. Public information announcements in must be extremely conscious of not being alarming in the tone of the announcements. They should be informative; but not cause panic buying of product and hoarding.	DEMA PIO DEMA Staff	Local Media DEMA Staff

7.8.9 Phase IV Review Lessons Learned

In Phase IV, as emergency operations are phased out, responding state agencies should evaluate the emergency preparedness programs and activities that were implemented and report the results to interested parties such as the Governor's Office, cabinet level officers, legislative committees, and energy policy councils. Evaluation activities should include:

- Reports describing the nature of the energy emergency and a chronology of the actions taken to respond to it;
- Evaluation of mitigation actions results and of the effectiveness of specific actions taken to respond to the emergency; and
- Critical reviews of the overall performance of the state energy emergency plans in addressing the emergency
- It should be noted that movement from one phase to another is as much a matter of judgement as it is a matter or objective definition. Heating Oil Shortage Emergency

APPENDIX G. PROPANE SHORTAGE EMERGENCY

7.9 Propane Overview

Delaware Updated Quick Energy Facts Click Here!

7.9.1 Fuel Usage(s)

Propane is a liquified petroleum gas that is used as a primary heating fuel by many Delawareans. 10% of the residential sector utilizes propane for space heating[63], typically used in homes in rural areas, especially those that have no provision for keeping the fuel supply in a heated area. Propane fuel is also used in several types of portable and mobile equipment including barbecue grills, camping lanterns, camping cook stoves, motor homes, house and camping trailers. Some manufacturing companies that do not have underground piped natural gas distribution systems utilize propane in various manufacturing processes and in product production lines. Restaurants use propone for cooking in areas not served by natural gas pipelines and some also use it for space heating. Other small businesses may use for space heating and domestic hot water. Propane is also used to fuel some trucks in the state and other machinery such as fork-lifts used in enclosed warehouses.

7.9.2 Fuel Source and Supply

Propane is derived from unrefined oil and gas that is shipped to refineries and gas processing plants. As noted in Chapter 5, the State of Delaware has no crude oil production and it relies on crude oil supplies largely delivered via the Delaware River. The Port of Wilmington also includes a state-of-the-art bulk petroleum terminal and storage depot that handles heating oil, fuel oil, and other petroleum products that are shipped into the State. Liquefied petroleum gases, including propane, are stored in underground reservoirs.

The large natural gas public utilities in the State are required by the Public Utilities Commission to maintain a significant supply of reserve, alternate fuel in case of a shortfall of natural gas supply due to a pipeline disruption or other causes. In-state stored propane supplies provide this emergency alternative fuel reserve for the natural gas systems.

7.9.3 Fuel Delivery

Propane is transported to from refiners and processing plants to downstream storage terminals. It is distributed to end users with cylinder delivery trucks and bulk propane tankers.

7.9.4 What Can Go Wrong?

A propane shortage emergency could occur due to a disruption in the supply and delivery system to include a mix of the following factors:

- Unloading facilities disrupted
- Ship accident in channels
- Truck transport becomes constrained due to ice and snow, or other natural disasters
- Shortage due to labor strikes
- Extended cold snap combined with just-in-time inventory management
- Product shortage due to high export rate
- Imports reduced for political or economic reasons
- Imbalance in supply and demand
- Cyber and physical attacks

The portion of Delaware lying south of the Chesapeake and Delaware Canal is somewhat more

[63] https://www.eia.gov/state/data.php?sid=DE#ConsumptionExpenditures

vulnerable to situational supply shortages in instances where any of the bridges that span the canal are closed due to weather conditions. This could isolate Dover and areas to the south from sources of supply in New Castle County, Delaware; Pennsylvania and New Jersey.

7.9.5 Propane Emergency Response Phases

The section below describes the Delaware energy emergency response phases and activities associated with a propane emergency. Each phase describes an appropriate level of mobilization required to address a potential or developing emergency situation.

7.9.6 Phase I Monitor and Alert Activities

Phase I involves the normal ongoing energy supply, demand, and price monitoring. State agencies regularly monitor data and information as it becomes available through energy supply reporting systems (see Appendix H on Monitoring Fuel Supplies) and pay special attention to supply and distribution problems. This phase is activated when supply problems of propane are reported by the propane suppliers. The table below describes the specific activities associated with Phase I and the lead and support agencies responsible for these activities.

PHASE I: RESPONSE ACTIVITIES-PROPANE FUEL SHORTAGE		
Actions To Take	**Lead**	**Support**
Conduct appropriate telephone surveys for seasonal propane supplies and prices. Communicate with a network of contacts in private and public sectors to monitor local conditions in the propane market.	ESF-12 Group DE Energy Response Team Gas Companies	Propane Delivery Companies
Monitor media for local, national, and international events that might impact propane supplies and prices in the State.	ESF-12 Group DE Energy Response Team	State Departments Local Media
Prepare to implement state government emergency conservation program.	ESF-12 Group DE Energy Response Team	State Departments Local Media
Prepare to implement reduced temperatures and operating procedures in state buildings and facilities.	ESF-12 Group DE Energy Response Team	State Departments Local Media
Prepare to request all building owners and operators to reduce building temperatures and operating conditions	ESF-12 Group DE Energy Response Team	Businesses DEMA Staff
Prepare to request employers to assist in propane conservation efforts by modifying working hours and building temperatures.	ESF-12 Group DE Energy Response Team	DEMA Staff
Notify all other agencies, associations, and companies that have roles in the SEERP, and other New England state energy offices of the escalation to Pre-Emergency Phase II.	ESF-12 Group DE Energy Response Team	DEMA Staff
If propane fuel shortage increases, DE Energy Response Team and the DEMA Director may recommend to the Governor that the State escalate to Verification Phase II. Notify all in-state and out-of-state agencies and companies of the escalation.	DE Energy Response Team DEMA Director ESF- 12 Group	DEMA Staff
PHASE I: PUBLIC INFORMATION-PROPANE FUEL SHORTAGE		
Actions To Take	**Lead**	**Support**

DEMA PIO may provide information to newspapers and radio and television stations for consumers on how to conserve propane fuel. The public must be informed as to what it can do to voluntarily conserve propane. As staff deems certain mitigation measures appropriate, existing formatted public information announcements must be edited to describe the specific, current situation. The public will be notified of the situation and must be given specific voluntary conservation measures to implement. In order for the public to cooperate in conservation measures, it must be fully informed on the gravity of the situation and must be given specific instructions on the conservation measures it is requested to implement.	DEMA PIO	Local Media

7.9.7 Phase II Assess and Determine Action

In Phase II, having noticed early signs of what might become an energy emergency, responding agencies intensify data and information collection efforts and ensure that the most recent information is available. This information is analyzed to evaluate potential outcomes and assess possible courses of action.

- Appropriate contacts through outstate government should be informed of the results of this assessment.
- Appropriate action can then be determined. If no action is required, monitoring and evaluation continue and further updates are made as changes occur.

Propane Phase II is activated when supply problems are reported by reliable sources such as the fuel retailers, distributors, and the terminals. The Verification Phase II may be activated if the DE Energy Response Team determines that a propane shortage is occurring or may shortly occur. During this phase, the DE Energy Response Team will:

- Rapidly determine the nature, extent, and duration of a potential, impending, or actual energy emergency.
- Coordinate energy emergency response activities with the DEMA, other appropriate state agencies, the U.S. Department of Energy, other state governments, local government agencies, and private industry.
- Provide a detailed Situation Report that assesses the potential or actual impacts of the emergency on energy prices and supplies.
- If required, use the informal fuels set-aside program to ensure that emergency and essential services receive adequate supplies of fuel. Recommend further actions (if any) to DEMA.

The table below describes the specific activities associated with Phase II and the lead and support agencies responsible for these activities. It also describes the actions that should be taken to inform and educate the public about the emergency.

PHASE II: RESPONSE ACTIVITY-PROPANE FUEL SHORTAGE		
Actions To Take	**Lead**	**Support**
Conduct appropriate telephone surveys for seasonal propane supplies and prices. Communicate with a network of contacts in private and public sectors to monitor local conditions in the propane market.	ESF-12 Group DE Energy Response Team Gas Companies	Propane Delivery Companies
Monitor media for local, national, and international events that might impact propane supplies and prices in the State.	ESF-12 Group DE Energy Response Team	State Departments Local Media
Prepare to implement state government emergency conservation program.	ESF-12 Group DE Energy Response Team	State Departments Local Media

Prepare to implement reduced temperatures and operating procedures in state buildings and facilities.	ESF-12 Group DE Energy Response Team	State Departments Local Media
Prepare to request all building owners and operators to reduce building temperatures and operating conditions	ESF-12 Group DE Energy Response Team	Businesses DEMA Staff
Prepare to request employers to assist in propane conservation efforts by modifying working hours and building temperatures.	ESF-12 Group DE Energy Response Team	DEMA Staff
Notify all other agencies, associations, and companies that have roles in the SEERP, and other New England state energy offices of the escalation to Pre-Emergency Phase II.	ESF-12 Group DE Energy Response Team	DEMA Staff
If propane fuel shortage increases, DE Energy Response Team and the DEMA Director may recommend to the Governor that the State escalate to Pre-Emergency Phase III. Notify all in-state and out-of-state agencies and companies of the escalation.	DE Energy Response Team DEMA Director ESF-12 Group	DEMA Staff
If propane fuel shortage improves, the DE Energy Response Team and the DEMA Director may recommend to the Governor a de-escalation back to Readiness Phase I (normal conditions). Notify all in-state and out-of-state agencies and companies of the de- escalation.	DE Energy Response Team DEMA Director ESF-12 Group	DEMA Staff
PHASE II: PUBLIC INFORMATION-PROPANE FUEL SHORTAGE		
Actions To Take	**Lead**	**Support**
DEMA PIO may provide information to newspapers and radio and television stations for consumers on how to conserve propane fuel. The public must be informed as to what it can do to voluntarily conserve propane. As staff deems certain mitigation measures appropriate, existing formatted public information announcements must be edited to describe the specific, current situation. The public will be notified of the situation and must be given specific voluntary conservation measures to implement. In order for the public to cooperate in conservation measures, it must be fully informed on the gravity of the situation and must be given specific instructions on the conservation measures it is requested to implement.	DEMA PIO	Local Media

7.9.8 Phase III Actions and Feedback

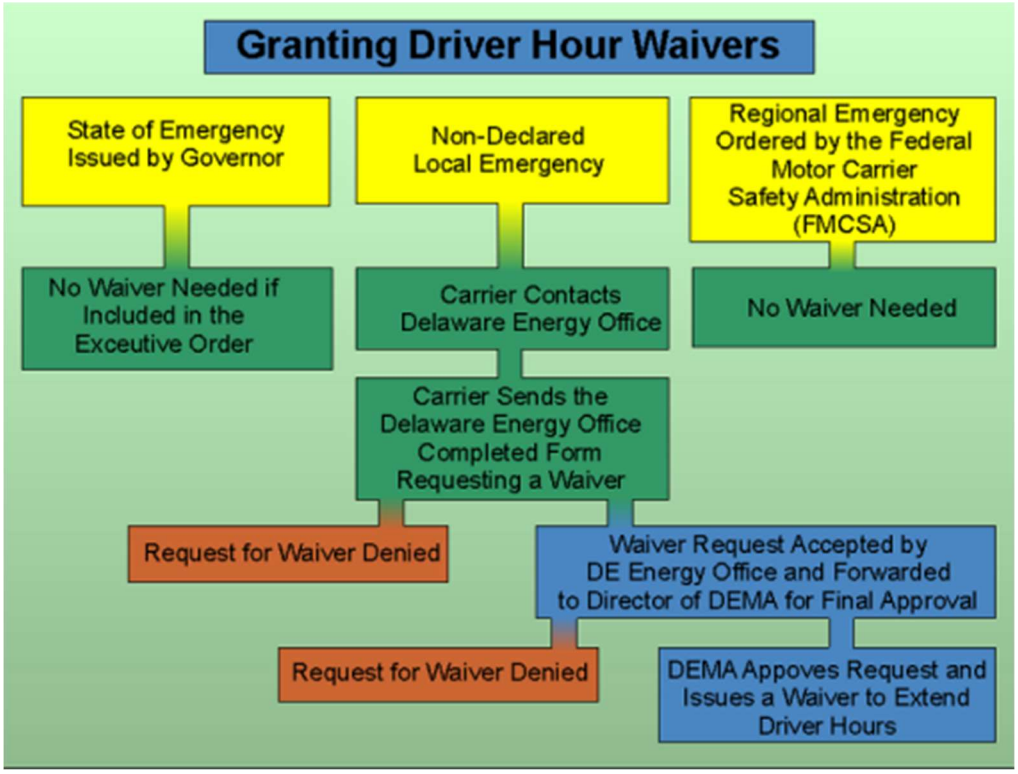
Once a decision has been made that specific state government action is necessary to assure the health, welfare, and safety of citizens, and the continued economic well-being of the State, Phase III activity begins. This includes:

- Implementing programs to maximize available supplies and/or to minimize existing demand levels and monitoring these activities to determine their effectiveness;
- Increasing the level of communication among state agencies and others;
- If the nature of the problem involves multiple states, information and mutual aid sharing among state energy coordinators, using the EEAC website, should begin; (the password-protected Energy Emergency Assurance Coordinators website through which authorized state energy emergency coordinators may access valuable energy security information, including daily news summaries, emergency situation reports, lessons learned from other states, links to outage and curtailment information, and the ability to email messages to colleagues in other jurisdictions).
- Convening emergency planning and response organizations to consider actions that might be taken by the various state departments and agencies;
- If implementation of voluntary programs or other emergency deterrent actions fail to mitigate the emergency, begin implementing additional actions;

- If the situation continues to deteriorate, recommending that a State of Energy Emergency be declared (usually by the Governor). The Governor may also be called upon to declare a State of Disaster. State legislation regarding State of Energy Emergency and/or State of Disaster will dictate further action and assign responsibility among pertinent parties; and
- If it appears that all other options available to the state prove inadequate, the next level of mobilization is to request federal assistance.

Federal assistance would generally be available in the case of a national/international energy emergency. The emergency planning agencies and representatives from other state departments, as appropriate, would be responsible for coordinating and monitoring federal programs; Federal assistance may be requested sooner without a declaration of a national emergency to provide the following;

- Waiver federal driver hour requirements;
- Waiver vehicle fuel air quality standards;
- Request Coast Guard to intensify ice breaking (if Delaware River is frozen hampering barge movement; and Request Strategic Petroleum Reserve (SPR) or the Northeast Heating Oil Reserves.



The table below describes the specific activities associated with Phase III and the lead and support agencies responsible for these activities. It also describes the actions that should be taken to inform and educate the public about the emergency.

PHASE III: RESPONSE ACTIVITY-PROPANE FUEL SHORTAGE		
Actions To Take	**Lead**	**Support**
Increase monitoring and analysis of propane stocks, product deliveries, consumption patterns and prices, including maintaining regular contact with suppliers and distributors regarding adequacy of propane product. Continue consultations and meetings with members of the propane industry.	DEMA Staff DE Energy Response Team ESF-12 Group	DEMA Staff

Implement public information program and issue public appeals for voluntary conservation. See this section for Propane Conservation Measures and formatted Propane Public Announcements.	DEMA Staff DE Energy Response Team ESF-12 Group	DEMA Staff
If propane fuel situation worsens, DE Energy Response Team and the DEMA Director may recommend to the Governor that the State escalate to Emergency Phase III. DEMA will notify all in-state and out-of-state agencies and companies of the escalation.	DEMA Staff DE Energy Response Team ESF-12 Group	DEMA Staff State Departments Schools & Businesses
If propane fuel shortage is forecast to diminish and start to return to normal, DE Energy Response Team and the DEMA Director may recommend to the Governor a de-escalation back to Verification Phase I. Notify all in- state and out-of-state agencies and companies of the de-escalation.	DEMA Staff DE Energy Response Team ESF-12 Group	DEMA Staff State Departments Schools & Businesses
During a severe or prolonged shortage of propane, it may be necessary to open temporary shelters for individuals or families that have run out of fuel.	DEMA PIO DEMA Staff	Red Cross Delaware VOAD
PHASE III: PUBLIC INFORMATION-PROPANE FUEL SHORTAGE		
Actions To Take	**Lead**	**Support**
The same public information principles applicable to Phase II are also applicable to Phase III. The difference is that the situation is graver and more severe. In addition, the conservation measures imposed are mandatory. Public information announcements will convey non-alarming tone. They will be informative and not cause panic buying of product and hoarding. The public will be informed not only of the measures themselves, but also of the method of enforcing implementation of the conservation measures.	DEMA PIO DEMA Staff	Local Media DEMA Staff
The Governor requests, through DEMA and the media, voluntary conservation in residences by lowering thermostats or other controls to between 60 and 65 during the time the space is occupied during the day and evenings; between 55 and 60 at night; and to 50 in unoccupied facilities (see governor's press release Chapter 11).	DEMA PIO DEMA Staff	Local Media DEMA Staff
The public is carefully informed of the fully inform the public of the propane shortage and that the State is in Pre-Emergency Phase III. Public information announcements in must be extremely conscious of not being alarming in the tone of the announcements. They should be informative; but not cause panic buying of product and hoarding.	DEMA PIO DEMA Staff	Local Media DEMA Staff

7.9.9 Phase IV Review Lessons Learned

In Phase IV, as emergency operations are phased out, responding state agencies should evaluate the emergency preparedness programs and activities that were implemented and report the results to interested parties such as the Governor's Office, cabinet level officers, legislative committees, and energy policy councils. Evaluation activities should include:

- Reports describing the nature of the energy emergency and a chronology of the actions taken to respond to it;
- Evaluation of mitigation actions results and of the effectiveness of specific actions taken to respond to the emergency; and
- Critical reviews of the overall performance of the state energy emergency plans in addressing the emergency
- It should be noted that movement from one phase to another is as much a matter of judgement as it is a matter or objective definition.

APPENDIX H. COAL SHORTAGE EMERGENCY

7.10 Coal Overview

Delaware Updated Quick Energy Facts Click Here!

7.10.1 Fuel Usage(s)

Although coal once supplied over two-thirds of Delaware's electricity generation, that numbers has dropped dramatically over the past decade as natural gas-fired generation has increased. As of 2019, natural gas accounted for nearly nine-tenths of the state's electricity generation while coal only accounted for 2%.[64] Almost all the coal consumed in Delaware is used by a single remaining coal-fired power plant.

7.10.2 Fuel Source and Supply

Delaware does not have any coal resources. Coal is supplied to the state arrives by rail, mostly from Pennsylvania.[65] A small amount of coal is delivered to industrial consumers comes from Kentucky.

7.10.3 Fuel Delivery

Coal is delivered to end use customers by rail. The Maryland and Delaware Railroad operates on three distinct segments of track throughout the Delmarva Peninsula.

7.10.4 What Can Go Wrong?

A coal emergency could occur due to a possible disruption in the supply system to include a mix of the following factors:

- Interruptions in rail networks due to an accident, poor track maintenance, natural disaster, terrorism, or other cause.
- Coal trains run low on fuel requiring refueling by fuel delivery trucks
- Coal piles become frozen, shortage of coal for power plants
- Shortage due to labor strikes
- Imbalance in supply and demand

7.10.5 Coal Emergency Response Phases

The section below describes the Delaware energy emergency response phases and activities associated with a coal emergency. Each phase describes an appropriate level of mobilization required to address a potential or developing emergency situation.

7.10.6 Phase I Monitor and Alert Activities

Phase I involves the normal ongoing energy supply, demand, and price monitoring. State agencies regularly monitor data and information as it becomes available through energy supply reporting systems (see Appendix H) and pay special attention to supply and distribution problems.

PHASE I: RESPONSE ACTIVITY-COAL DISTRIBUTION SHORTAGE		
Official Actions To Take	**Lead**	**Support**
Monitors international and domestic events	ESF-12 Group Energy Response Team Electric Utility Companies	DEMA Delaware Public Service Commission (PSC)
Train appropriate Delaware Energy Office staff.	ESF-12 Group Energy Response Team Electric Utility Companies	DEMA State Departments DEMA PIO
Attend exercises to establish and test emergency protocols.	ESF-12 Group Energy Response Team Electric Utility Companies	DEMA State Departments DEMA PIO

[64] https://www.eia.gov/state/analysis.php?sid=DE#40
[65] Ibid

Updates and maintains a network of public and private sector contacts. Prepares Internal memos.	ESF-12 Group Energy Response Team Electric Utility Companies	DEMA EOC State Departments DEMA PIO

7.10.7 Phase II Assess and Determine Action

In Phase II, having noticed early signs of what might become an energy emergency; responding agencies intensify data and information collection efforts and ensure that the most recent information is available. This information is analyzed to evaluate potential outcomes and assess possible courses of action.

- Appropriate contacts throughout state government should be informed of the results of this assessment.
- Appropriate action can then be determined. If no action is required, monitoring and evaluation continue, and further updates are made as changes occur.

PHASE II: RESPONSE ACTIVITY-COAL DISTRIBUTION SHORTAGE		
Official Actions To Take	**Lead**	**Support**
Communicate with a network of contacts in private and public sectors to monitor local conditions in the electricity supply and distribution market.	ESF-12 Group Energy Response Team Electric Utility Companies	DEMA EOC Delaware Public Service Commission (PSC)
Prepare to implement Delaware government electricity emergency conservation program.	ESF-12 Group Energy Response Team Electric Utility Companies	DEMA EOC State Departments DEMA PIO
Prepare to implement reduced temperatures and operating procedures in state owned buildings and facilities.	ESF-12 Group Energy Response Team Electric Utility Companies	DEMA EOC State Departments DEMA PIO
Prepare to request all building owners and operators to reduce building temperatures and operating conditions.	ESF-12 Group Energy Response Team Electric Utility Companies	DEMA EOC State Departments DEMA PIO
Prepare to request employers to assist in electricity conservation efforts by modifying working hours and building temperatures.	ESF-12 Group Energy Response Team Electric Utility Companies	DEMA EOC State Departments DEMA PIO
Notify all other agencies, associations, and companies that have roles in the ESF-12 plan of the escalation to Verification Phase I.	ESF-12 Group Energy Response Team Electric Utility Companies	DEMA EOC State Departments DEMA PIO
If electricity shortage increases escalate to Pre-Emergency Phase III. Notify all city departments, agencies, and companies of the escalation.	ESF-12 Group Energy Response Team Electric Utility Companies	DEMA EOC State Departments Private Business Agencies
If electricity shortage improves de-escalate back to normal conditions. Notify all agencies and companies of the de- escalation.	ESF-12 Group Energy Response Team Electric Utility Companies	DEMA EOC State Departments DEMA PIO
PHASE II: PUBLIC INFORMATION-COAL DISTRIBUTION SHORTAGE		
Official Actions To Take	**Lead**	**Support**

The DEMA PIO will provide information to newspapers and radio and television stations for consumers on how to conserve electricity. The public must be informed as to what it can do to voluntarily conserve electricity. As staff deems certain mitigation measures appropriate, existing formatted public information announcements must be edited to describe the specific, current situation. The public will be apprised of the situation and must be given specific voluntary conservation measures to implement. In order for the public to cooperate in conservation measures, it must be fully informed on the gravity of the situation and must be given specific instructions on the conservation measures it is requested to implement.	ESF-12 Group Delaware Energy Response Team Electric Utility Companies DEMA PIO	DEMA EOC State Departments DEMA PIO

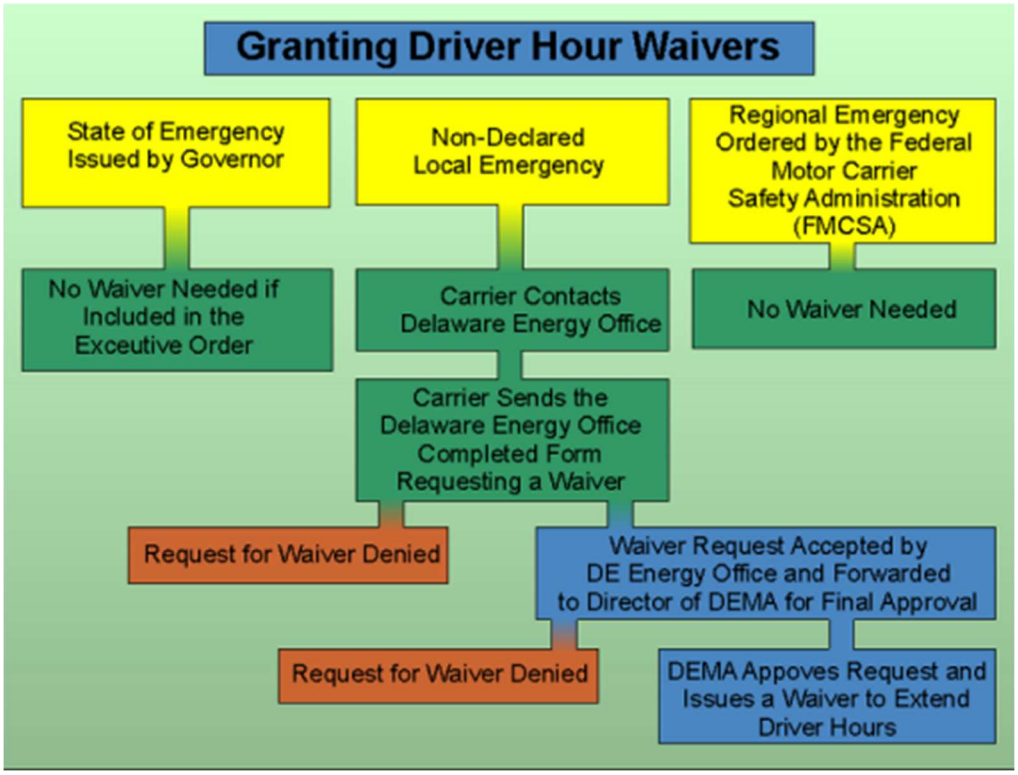
7.10.8 Phase III Actions and Feedback

Once a decision has been made that specific state government action is necessary to assure the health, welfare, and safety of citizens, and the continued economic well-being of the state, Phase III activity begins. This includes:

- Implementing programs to maximize available supplies and/or to minimize existing demand levels and monitoring these activities to determine their effectiveness;
- Increasing the level of communication among state agencies and others;
- If the nature of the problem involves multiple states, information and mutual aid sharing among state energy coordinators, using the EEAC website, should begin; (the password-protected Energy Emergency Assurance Coordinators (EEAC) website through which authorized state energy emergency coordinators may access valuable energy security information, including daily news summaries, emergency situation reports, lessons learned from other states, links to outage and curtailment information, and the ability to email messages to colleagues in other jurisdictions). More info
- Convening emergency planning and response organizations to consider actions that might be taken by the various state departments and agencies;
- If implementation of voluntary programs or other emergency deterrent actions fail to mitigate the emergency, begin implementing additional actions;
- If the situation continues to deteriorate, recommending that a State of Energy Emergency be declared (usually by the Governor). The Governor may also be called upon to declare a State of Disaster. State legislation regard the State of Energy Emergency and/or the State of Disaster will dictate further action and assign responsibility among pertinent parties.
- If it appears that all other options available to the state prove inadequate, the next level of mobilization is to request federal assistance.

Federal assistance would generally be available in the case of a national/international energy emergency. The emergency planning agencies and representatives from other state departments, as appropriate, would be responsible for coordinating and monitoring federal programs. Federal assistance may be requested sooner without a declaration of a national emergency to provide the following;

- Waiver federal driver hour requirements more info;
- Waiver vehicle fuel air quality standards;
- Request Coast Guard to intensify ice breaking (if Delaware River is frozen hampering barge movement; and Request Strategic Petroleum Reserve (SPR) or the Northeast Heating Oil Reserves.



PHASE III: RESPONSE ACTIVITY-COAL DISTRIBUTION SHORTAGE		
Official Actions To Take	**Lead**	**Support**
Implement public information program and issue public appeals for voluntary electricity conservation.	ESF-12 GROUP Energy Response Team Electric Utility Companies	DEMA EOC Delaware Public Service Commission (PSC)
Implement state energy emergency conservation program. Advise state departments to alter temperature and operating conditions in city buildings and facilities.	ESF-12 GROUP Energy Response Team Electric Utility COMPANIES	State Departments City/County Agencies
If electricity shortage worsens escalate to Emergency Phase IV. DEMA will notify all agencies and companies of the escalation.	ESF-12 GROUP Energy Response Team Electric Utility Companies	State Departments City/County Agencies
If electricity shortage is forecast to diminish and start to return to normal order a de-escalation back to Readiness Phase I. Notify all agencies and companies of the de-escalation.	ESF-12 GROUP Delaware Energy Response Team Electric Utility Companies	State Departments City/County Agencies
Implement state energy emergency conservation program. Advise state departments to alter temperature and operating conditions in city buildings and facilities.	ESF-12 GROUP Delaware Energy Response Team Electric Utility Companies	State Departments City/County Agencies
If electricity shortage worsens escalate to Emergency Phase IV. DEMA will notify all agencies and companies of the escalation.	ESF-12 GROUP Delaware Energy Response Team Electric Utility Companies	State Departments City/County Agencies
If electricity shortage is forecast to diminish and start to return to normal order a de-escalation back to Readiness Phase I. Notify all agencies and companies of the de-escalation.	ESF-12 GROUP Delaware Energy Response Team Electric Utility Companies	State Departments City/County Agencies

PHASE III: PUBLIC INFORMATION-COAL DISTRIBUTION SHORTAGE		
Official Actions To Take	**Lead**	**Support**
The same public information principles applicable to Phase II are also applicable to Phase III. Public information announcements will convey non-alarming tone. They will be informative and not cause panic buying of products and hoarding	ESF-12 Group Delaware Energy Response Team Electric Utility Companies DEMA PIO	Local Media
The DEMA PIO will provide information to consumers through newspapers and radio and television stations on how to conserve electricity. As staff deems certain mitigation measures appropriate, existing formatted public information announcements must be edited to describe the specific, current situation.	ESF-12 Group Delaware Energy Response Team Electric Utility Companies DEMA PIO	Local Media

7.10.9 Phase IV Review Lessons Learned

In Phase IV, as emergency operations are phased out, responding state agencies should evaluate the emergency preparedness programs and activities that were implemented and report the results to interested parties such as the Governor, cabinet level officers, legislative committees, and energy policy councils. Evaluation activities should include:

- Reports describing the nature of the energy emergency and a chronology of the actions taken to respond to it;
- Evaluation of mitigation actions results and of the effectiveness of specific actions taken to respond to the emergency; and
- Critical reviews of the overall performance of the State's energy emergency plans in addressing an emergency.
- It should be noted that movement from one phase to another is as much a matter of judgment as it is a matter of objective definition.

APPENDIX I. AVIATION FUEL SHORTAGE EMERGENCY

7.11 Aviation Fuel Overview

Delaware Updated Quick Energy Facts Click Here!

7.11.1 Fuel Usage(s)

Aviation fuels, both aviation gasoline and jet fuels, are refined petroleum products used to fuel aircrafts. There are 11 aviation facilities located in Delaware, most of which concentrate on business and recreational flights by individual or corporate owners. Click here to view the DELDOT Airport Directory The majority of aviation facilities in Delaware are private airports, but New Castle Airport, Sussex County Airport, Delaware Airpark, and the Dover Air Force Base Civil Air Terminal are publicly-owned aviation facilities. In recent years, New Castle Airport accounted for almost half of the non-military flight activity in the state, and up to 63% of the flights were private business-related. Most commercial passengers continue to fly out of nearby Philadelphia International Airport or Baltimore-Washington International Airport.

7.11.2 Fuel Source and Supply

Aviation fuels, both aviation gasoline and jet fuels, are refined petroleum products. They are supplied to Delaware by the same supply and distribution system that applies to all petroleum products entering the state for retail and wholesale distribution. Some refined oil is transported by ship into the gulf region. Additionally, oil enters the region by pipeline, rail tanker car, and by truck.

7.11.3 Fuel Delivery

The Delaware City Refinery supplies petroleum products to regional markets and is connected to a distribution network that includes pipelines, barges, tankers, trucks, and railroads. Additional petroleum products are supplied to Delaware retail / wholesale locations via transport trucks loaded at the Port of Wilmington storage facility and also via trucks located at marine supplied terminal facilities along the Delaware River in Pennsylvania and New Jersey; and also from inland terminals supplied via private and common carrier pipeline networks.

7.11.4 What Can Go Wrong?

An aviation fuel emergency could occur due to a disruption in the supply system to include a mix of the following factors:

- The unloading facilities and/or other marine transport facilities become inaccessible due to hurricanes, severe winds, or ship accident in the channels.
- Delaware has one operating refinery. Some of the fuel is used at local airports. However, when local aviation unloading facilities become inoperable due to weather or accident it may not be available.
- Local truck transport becomes constrained due to ice or snow.
- Shortage due to labor strikes.
- Extended cold snap combined with just-in-time inventory management.
- Product shortage due to high export rate.
- Imports reduced for political or economic reasons.
- A supply and demand Imbalance.
- Cyber or physical attacks.

7.11.5 Aviation Fuel Emergency Response Phases

The section below describes the Delaware energy emergency response phases and activities associated with an aviation fuel emergency. Each phase describes an appropriate level of mobilization required to address a potential or developing emergency situation.

7.11.6 Phase I Monitor and Alert Activities

Phase I involves the normal ongoing energy supply, demand, and price monitoring. State agencies regularly monitor data and information as it becomes available through energy supply reporting systems (see Appendix H) and pay special attention to supply and distribution problems.

PHASE I: RESPONSE ACTIVITY-COAL DISTRIBUTION SHORTAGE		
Official Actions To Take	**Lead**	**Support**
Monitors international and domestic events	ESF-12 Group Energy Response Team Electric Utility Companies	DEMA Delaware Public Service Commission (PSC)
Train appropriate Delaware Energy Office staff.	ESF-12 Group Energy Response Team Electric Utility Companies	DEMA State Departments DEMA PIO
Attend exercises to establish and test emergency protocols.	ESF-12 Group Energy Response Team Electric Utility Companies	DEMA State Departments DEMA PIO
Updates and maintains a network of public and private sector contacts. Prepares Internal memos.	ESF-12 Group Energy Response Team Electric Utility Companies	DEMA EOC State Departments DEMA PIO

7.11.7 Phase II Assess and Determine Action

In Phase II, having noticed early signs of what might become an energy emergency; responding agencies intensify data and information collection efforts and ensure that the most recent information is available. This information is analyzed to evaluate potential outcomes and assess possible courses of action.

- Appropriate contacts throughout state government should be informed of the results of this assessment.
- Appropriate action can then be determined. If no action is required, monitoring and evaluation continue and further updates are made as changes occur.

PHASE II: RESPONSE ACTIVITY-COAL DISTRIBUTION SHORTAGE		
Official Actions To Take	**Lead**	**Support**
Communicate with a network of contacts in private and public sectors to monitor local conditions in the electricity supply and distribution market.	ESF-12 Group Energy Response Team Electric Utility Companies	DEMA EOC Delaware Public Service Commission (PSC)
Prepare to implement Delaware government electricity emergency conservation program.	ESF-12 Group Energy Response Team Electric Utility Companies	DEMA EOC State Departments DEMA PIO
Prepare to implement reduced temperatures and operating procedures in state owned buildings and facilities.	ESF-12 Group Energy Response Team Electric Utility Companies	DEMA EOC State Departments DEMA PIO
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If electricity shortage increases escalate to Pre-Emergency Phase III. Notify all city departments, agencies, and companies of the escalation.	ESF-12 Group Energy Response Team Electric Utility Companies	DEMA EOC State Departments Private Business Agencies
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7.11.8 Phase III Actions and Feedback

Once a decision has been made that specific state government action is necessary to assure the health, welfare, and safety of citizens, and the continued economic well-being of the state, Phase III activity begins. This includes:

- Implementing programs to maximize available supplies and/or to minimize existing demand levels and monitoring these activities to determine their effectiveness;
- Increasing the level of communication among state agencies and others;
- If the nature of the problem involves multiple states, information and mutual aid sharing among state energy coordinators, using the EEAC website, should begin; (the password-protected Energy Emergency Assurance Coordinators (EEAC) website through which authorized state energy emergency coordinators may access valuable energy security information, including daily news summaries, emergency situation reports, lessons learned from other states, links to outage and curtailment information, and the ability to email messages to colleagues in other jurisdictions). More info
- Convening emergency planning and response organizations to consider actions that might be taken by the various state departments and agencies;
- If implementation of voluntary programs or other emergency deterrent actions fail to mitigate the emergency, begin implementing additional actions;
- If the situation continues to deteriorate, recommending that a State of Energy Emergency be declared (usually by the Governor). The Governor may also be called upon to declare a State of Disaster. State legislation regard the State of Energy Emergency and/or the State of Disaster will dictate further action and assign responsibility among pertinent parties.
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Federal assistance would generally be available in the case of a national/international energy emergency. The emergency planning agencies and representatives from other state departments, as appropriate, would

be responsible for coordinating and monitoring federal programs. Federal assistance may be requested sooner without a declaration of a national emergency to provide the following;

- Waiver federal driver hour requirements more info;
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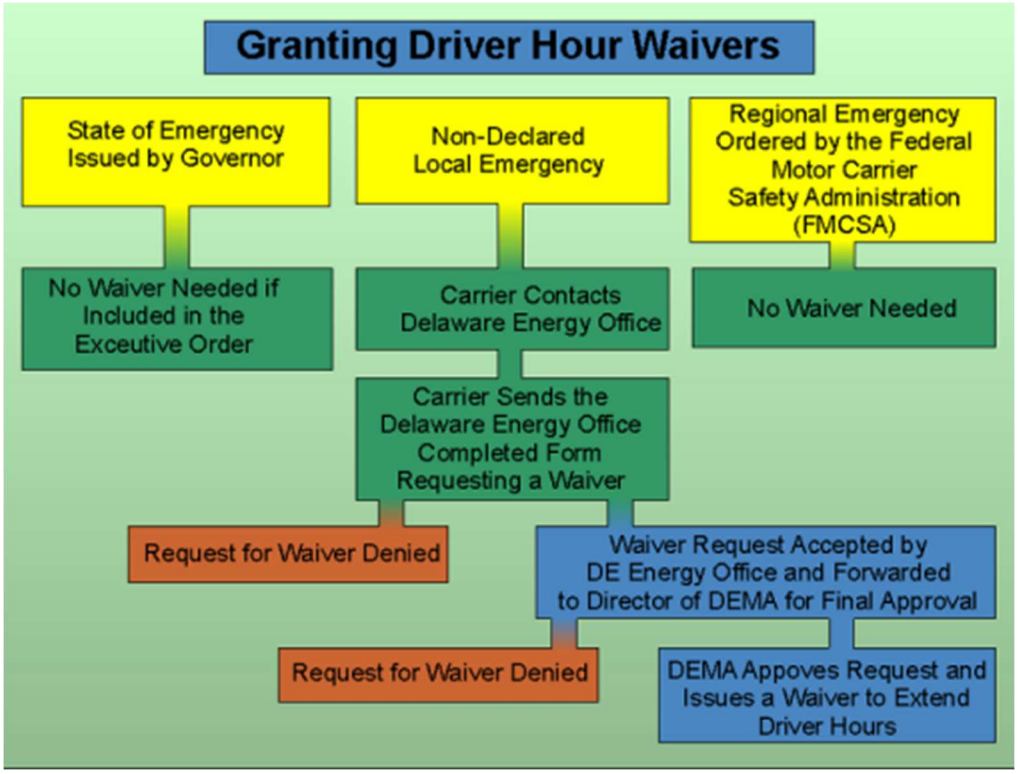

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Official Actions to Take	**Lead**	**Support**
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If electricity shortage is forecast to diminish and start to return to normal order a de-escalation back to Readiness Phase I. Notify all agencies and companies of the de-escalation.	ESF-12 GROUP Delaware Energy Response Team Electric Utility Companies	State Departments City/County Agencies

Implement state energy emergency conservation program. Advise state departments to alter temperature and operating conditions in city buildings and facilities.	ESF-12 GROUP Delaware Energy Response Team Electric Utility COMPANIES	State Departments City/County Agencies
If electricity shortage worsens escalate to Emergency Phase IV. DEMA will notify all agencies and companies of the escalation.	ESF-12 GROUP Delaware Energy Response Team Electric Utility Companies	State Departments City/County Agencies
If electricity shortage is forecast to diminish and start to return to normal order a de-escalation back to Readiness Phase I. Notify all agencies and companies of the de-escalation.	ESF-12 GROUP Delaware Energy Response Team Electric Utility Companies	State Departments City/County Agencies
PHASE III: PUBLIC INFORMATION-COAL DISTRIBUTION SHORTAGE		
Official Actions To Take	**Lead**	**Support**
The same public information principles applicable to Phase II are also applicable to Phase III. Public information announcements will convey non-alarming tone. They will be informative and not cause panic buying of products and hoarding	ESF-12 Group Delaware Energy Response Team Electric Utility Companies DEMA PIO	Local Media
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In Phase IV, as emergency operations are phased out, responding state agencies should evaluate the emergency preparedness programs and activities that were implemented and report the results to interested parties such as the Governor, cabinet level officers, legislative committees, and energy policy councils. Evaluation activities should include:

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- Critical reviews of the overall performance of the State's energy emergency plans in addressing an emergency.
- It should be noted that movement from one phase to another is as much a matter of judgment as it is a matter of objective definition.

APPENDIX J. STATE SET- ASIDE/ FUEL ALLOCATION PROGRAM

• Introduction

The state's set-aside program is designed to interfere minimally with the market, using set-aside volumes that are sufficient only to satisfy hardship and emergency cases. The set-aside program makes no attempt to reduce or inhibit the market price of fuels. All fuel delivered through the program will be purchased at the market price, and whenever possible, through the usual supplier.

• Purpose

The purpose of the Petroleum Fuels Set-Aside Program Chapter B is to provide a working description of all aspects of the program, including staff operations and procedures for approvals, appeals, audits, and reports to the governor and legislature. The program augments the policy and program concepts contained in the Delaware State Energy Security Plan (SESP).

This Chapter provides a description of the application process. The Chapter explains the eligibility for each program element, how to apply for each program element, instructions for completing the application forms, and procedures for appeal if the application is denied.

Percentage of Products Set-Aside

The monthly set-aside percentages applicable to prime suppliers and brokers for petroleum products subject to the set-aside program shall be as follows:

Gasoline	5 percent
Diesel	4 percent
Low Sulfur Diesel	4 Percent
High Sulfur Diesel (Red Dye)	4 Percent
Kerosene	4 percent
#2 Fuel Oil (Heating Oil)	4 percent
Aviation Gas	5 percent
Jet Fuel	5 percent
Propane	3 percent

Figure B.1

• Description

There are four elements in the fuels set-aside program: basic set-aside; community hardship; assignment of prime supplier and adjustment of supply volume; and certification for emergency services. To achieve maximum flexibility in the set-aside program, the individual elements within the program are implemented only as directed by the Fuel Contingency manager (FCM) or the Emergency Support Function ESF-12 Advisory Group; they will not automatically become effective when the set-aside program is implemented. In addition, some parts of the program will be implemented only if the federal government institutes price and allocation controls.

Basic Set-Aside Element

The Basic Set-Aside Element redistributes fuel supplies to bulk consumers who are considered priority users and who are experiencing difficulty obtaining sufficient fuel supplies at any price.

Community Hardship Element

The Community Hardship Element allows for distribution of fuels to qualified fuel-short areas. A community may request fuel supplies from the state set-aside when it is experiencing an emergency or hardship caused by a shortage of fuel, or is receiving less than 80 percent of the allocation fraction. A community is defined as either a city or county, or a geographic area of five square miles but containing ten service stations, or a military base exchange. Community hardship is the only element of the program whereby retail service stations may be eligible for a set-aside allocation.

Essential Priority Users

(a) agricultural production
(b) energy production
(c) emergency police, fire or medical services
(d) Military
(e) public utility service sanitation services
(f) health care facilities
(g) telecommunication services
(h) marine shipping (commercial shipping on navigable state waterways)
(i) aviation ground support vehicles and equipment
(j) passenger transportation services (including ride-sharing vehicles such as carpools arid vanpools)
(k) cargo, freight and mail hauling by truck

Figure B.2

Assignment & Adjustment Element

The Assignment and Adjustment Element is primarily intended for use only after the federal government institutes a price and allocation control program. Those bulk purchasing end users who have not established a record of fuel deliveries for the base period may request that they be assigned a prime supplier. Those end users who have substantially increased their fuel use since the time of the base period may apply for an adjustment of supply volume to increase the amount of their supplies. The fuels allocation officer may extend assignments and adjustments on a month-to-month basis, or for a maximum of a 90-demand period. This assignment automatically expires at the end of the designated period, at which time the applicant may request an extension.

Certification Element

The Certification Element of the program allows priority end users who provide emergency, health, safety, or essential services to apply for certification of need to receive their needed supplies. They must provide justification for a request that exceeds their base period volume. This element is designed to help ensure that emergency services are not interrupted or threatened due to inadequate fuel supplies. The certification, once approved, will remain valid as long as this element of the program in operational.

Set-Aside Priority System

When certain critical services and industries are unable to obtain adequate supplies of fuel through the existing market, these bulk purchasers can apply to the State Energy Office (Delaware DEMA - Energy Response Team) for additional fuel through a priority distribution system. Each application will be reviewed and evaluated by the Delaware DEMA - Energy Response Team as to the justification for the request.

Unused Set-Aside Volume

Maximum flexibility in the release of the unused portion of the monthly set-aside volume is achieved by balancing public benefit with logistical and administrative efficiency. The fuel allocation officer may choose either to release to the supplier unused portions of the set-aside no later than the 20th of each month, or to hold any unused volume until the first of the following month. This unused set-aside volume shall not be counted in computing the subsequent month's set-aside volume, but must be distributed the following month. Whichever option the Fuel Allocation Officer selects, all suppliers are required to conform, thus ensuring uniformity in the release of supplies. If there continues to be unused volume in the set-aside each month, this is an indication that the percent used to calculate the volume is too high.

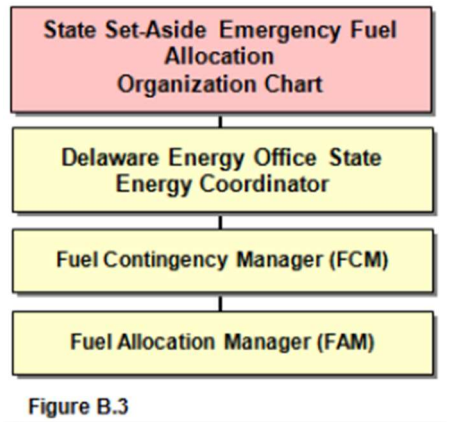


Figure B.3

• Operating Guidelines

The success of the Delaware State Energy Emergency Response Plan depends upon its management and the degree of preparedness of the individuals involved in its implementation. To the extent that the staff is trained, understands the plan, and carries out the duties of their positions, the plan will become operational at the critical time. Operating guidelines providing a checklist of specific duties and responsibilities follow for each position shown on the organization charts. The Operating Guidelines are in the contingency plan.

The Fuel Contingency Manager (FCM) will direct the State Set-Aside Emergency Fuel Allocation Program. The specific management of the program will be the responsibility of the Fuel Contingency Manager (FCM) and the Fuel Allocation Manager (FAM). The Operating Guidelines for the fuel contingency manager follow.

Set-Aside Contingency File

The set-aside contingency file contains the historical record of Delaware's past fuels set-aside operations plus the proposed operational instructions and procedures for future use of the program. The historical records document set-aside office activity, descriptions of programs, policies, and reports. These records are intended to serve as a reference to aid in any future activation of the program

The contingency file contains operational instructions and procedures needed by Delaware DEMA - Energy Response Team staff to activate a fuels set-aside program. Although these instructions and procedures will be updated periodically to remain current, it is anticipated that in order to appropriately respond to the circumstances, they may need to be modified at the time of a future energy shortage.

The FCM, together with the FAO, will use the contingency file, along with their perceptions of the seriousness of the shortage, to determine the appropriate staffing level, office and equipment needs, and funding requirements. The FAO will use the Contingency File to aid in determining involvement needed from other Delaware State Emergency Function Group 12 (ESF-12) staff and state agencies (e.g. Department of Motor Vehicles and Delaware Office of Emergency Management) who need to be notified early in the implementation of the set-aside program.

Contingency File Contents

- Descriptions of office positions and duty statements audit and appeal process, application login, and tracking process.
- Procedures for selecting potential audit candidates and criteria for defining abuse.
- General office forms for coordinating office activity.
- Set-aside forms, including application forms, appeal forms, appeal review forms, and instructions for completion.
- Guidelines and procedures for requesting fuel through each individual element of the program and eligibility criteria for the approval of applications.
- Public information system procedures to inform the public that the set-aside program is in place and provide a description of the application and appeals process, plus a copy of the User's Guide.

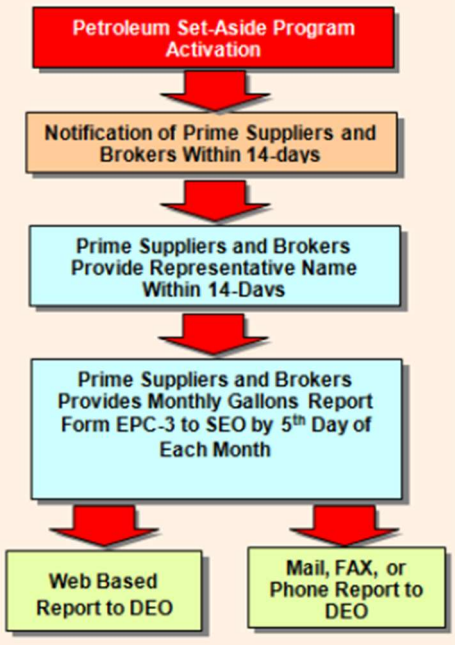


Figure B.4

- Computer programs, documentation and user instructions for the computer model that performs all fuel application demand processing. It contains a description of a simulated test of the computer program, and caveats of the program. It contains copies of notification letters printed by the computer for prime suppliers, distributors, and applicants.

Appeal Process

If the FCM denies the application or grants less fuel than requested, the applicant may file a written appeal. The appeal must be filed within 15 demands after the decision. The applicant must fully explain the objection to the decision by the FCM, and why the particular situation constitutes a hardship or emergency.

An appeals unit is independent of the State Energy Office. This unit will review applications for all program elements whose applicants are protesting the decisions of the FCM.

The appeals unit must act on the appeal within 15 demands after the appeal has been received by the PUC. The appeals unit will first send a letter to the appellant acknowledging the receipt of the appeal. Next the appeals unit will notify and meet with the FCM to reconsider the application. Following the reconsideration process, the appeals unit will take one of three possible steps:

- Reverse the prior decision and grant the requested fuel;
- Reverse the prior decision and grant an increase in the amount of fuel originally allocated; or
- Affirm the prior decision and deny the application with cause.

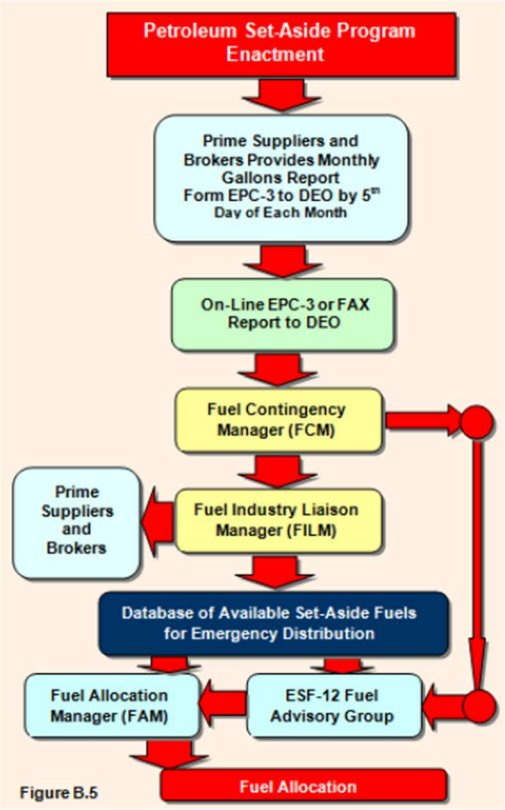


Figure B.5

The FCM will send the applicant a notification of decision within 15 demands, indicating whether or not the appeal has been approved. If approved, the applicant will be issued a request order, authorizing the assignment of fuel. A duplicate copy of the request order will also be sent to the supplier that is designated the prime supplier. The applicant must make arrangements with the supplier for delivery of fuel.

Audit Program

The set-aside program shall contain provisions for the auditing of approved applications to discourage and prosecute those who would abuse the set-aside program. The audit is intended to prevent misrepresentation of facts, or use of the fuel for a purpose other than as stated, or resale of the fuel. It is the task of the fuel contingency manager to identify suspected fraud. It is the task of the fuel contingency manager to conduct the audit. The FCM will use three criteria for selecting applications to audit: (1) suspicion of abuse; (2) public complaint; and (3) random selection.

Suspicion of Abuse. Applications that are approved will be entered into a computer program having the capability to screen for discrepancies and possible abuse. The following four situations may suggest possible abuse:

- **Duplicate Application**. A single applicant has filed more than one application for the same fuel type in the same month.
- **Large Increase in Requested Volume**. An applicant is requesting a much larger volume of fuel than in the previous month.
- **Change in Fuel Delivery Address**. The applicant reports a different delivery address than was

indicated in previous months.

- **Change in Priority Class**. The applicant reports a different end use for the fuel than was indicated in previous months.

Public Complaint. If the FCM receives a public complaint, particularly if accompanied by a written report, the application will be reviewed for possible audit.

Random Selection. At the discretion of the FCM, the computer for audit may randomly select applications, with preference given to those requesting more than 10,000 gallons of fuel. If the FCM, by using any of the three above criteria, finds suspicion of fraud, the FCM will make referral to the Attorney General.

Penalties. Any person who knowingly violates the rules and regulations of the set-aside program is guilty of (to be determined by law).

Reports

The Fuel Contingency Manager (FCM) shall prepare monthly status reports for distribution to the ESF-12 Group. The reports shall contain a compilation of the number and volume of applications, by fuel type. The Fuel Allocation Manager (FAM), in consultation will designate the set-aside volume up to a maximum of five percent of the total monthly supply of each fuel type available within the state. The percent volume will be determined according to the severity of the supply shortage.

Set-Aside Program Staff Descriptions

Economic Assistance Coordinator

The Economic Assistance Coordinator (ECM) will assist the ESF-12 Group. The ECM will inform the appropriate members of the Multi-Agency Task Force of the possible need for augmentation of assistance to low-income households. The coordinator will provide information concerning the potential extent and duration of economic impacts on low-income households caused by the energy supply disruption. The coordinator shall advise the energy office and ESF-12 Group of the need of additional funding for economic assistance programs. Offer proposals for increased funding and identify potential funding sources. The coordinator is responsible for briefing the task force and the FCM on implementation of the programs and success in securing additional funding. The coordinator will prepare public announcements of program availability and the application process for the Public Information Officer and the Joint Information Center at DEMA.

Fuel Contingency Manager Non-Emergency Management Tasks

To meet needs and concerns of affected parties, all goals, objectives, and policies under consideration should be thoughtfully assessed in light of their impacts on each other as well as on currently established goals and policies. It is likely that potential conflicts will be identified during the process, necessitating the establishment of priorities for various services and functions and the determination of acceptable compromises among the range of existing and prospective goals, objectives, and policies. Specific goals and actions to be accomplished by the FCM are:

- Reduce the impact of an energy emergency on Delaware citizens, institutions, and private enterprise.
- Protect public health and safety during an emergency
- Distribute the burden of a shortage equally.
- Maintain “vital” activities.
- Minimize economic impact of the shortage.
- Cooperate with other states, with local and federal governments and with the energy industry and private business.
- Keep the public informed and advised about proper energy emergency response.

Plan Development - The fuel contingency manager (FCM) is responsible for development and coordination of the State Energy Security Plan (SESP). This also includes assessment of personnel and financial resources.

Plan Maintenance/Revision - Because of the constant changes in this country's energy situation, responsibility for ensuring that the SESP remains current and that its contents and responses reflect effective means of dealing with an emergency. The FCM has provisions for revising the plan after the president declares an energy emergency, to make the plan reflective of the particular nature of the emergency. The FCM will stay in contact with the Delaware Energy Response Team and maintain a current list of contact personnel (call-up) for emergencies.

Monitoring - Crises often arise without advance warning; continuous monitoring of the state's energy situation is a necessity for reduction of the impacts of sudden emergencies. This is an ongoing program by the Delaware Energy Response Team staff.

Public Information - In an emergency, the existing energy conservation public information programs and accompanying communication networks will be expanded to encourage voluntary compliance with conservation measures.

Fuel Contingency Manager (FCM) Emergency Management Tasks

Task areas identified for non-emergency management will be expanded by the FCM or transferred to other organizational entities in order to efficiently manage an energy emergency. Additional tasks may be needed, requiring assignment to appropriate agencies.

- **Technical Assistance** - Scattered throughout the state's organizational structure are agencies, offices, and individuals responsible for providing and utilizing training programs, technical information, workshops, and other subject-specific technical assistance on a regular basis. Such programs will assist in further development of an emergency communication network.
- **Essential Services** - Coordination with state agencies and offices that are responsible for overseeing, administering, distributing, and/or regulating public services at both state and local levels are identified and included in the long-term planning process.
- **Local Coordination** – Coordinate with offices responsible for developing, implementing, enforcing, and monitoring local/regional plans are included in the organizational framework and communication network.
- **Simulated Emergency Exercises** - In planning for other types of emergencies it has been valuable to test the response plan and organization.
- **Plan Activation** - The governor is designated as having authority for activating the EAP; the FCM is the individual responsible for implementing the plan itself. Criteria for declaring an emergency are specified in the plan.
- **Coordination and Communication** - All entities identified in the EAP as having tasks during the energy emergency are aware of each other and have an acknowledged means of communication with each other. This formally sanctioned network clarifies roles, improves coordination, facilitates verbal communications, and permits the addition of peripheral but important groups such as industry or the news media.
- **Monitoring and demand Analysis** - During an emergency, daily monitoring, collection, and analysis of demand about the changing fuel situation and results of implementing the plan's measures will require constant attention, perhaps shifting or expanding the non- emergency functions of monitoring.
- **Public Information Programs** - It is likely that the public information efforts required in an emergency will be expanded or altered from those used during normal operations.
- **Measure Implementation** - Each measure may be implemented by a different agency, although the

FCM will be responsible overall, with a variety of others accountable for enforcement.

- **Impact Assessment** - Monitoring social, economic, and environmental impacts is the responsibility of the FCM so that scope, depth, and interrelationships of impacts may be observed systematically. Impact assessment, however, will require a diversity of expertise and personnel.
- **Measure-Generated Crisis Identification** - Responsibility for dealing with hardships created by government actions will be considered along with impact assessment.
- **Measure-Generated Crisis Mitigation** - Identifying specific methods for reducing these crises is the responsibility of the FCM and other agencies at local levels. This responsibility includes implementing, enforcing, and monitoring the response efforts.
- **Plan Deactivation** - The FCM is responsible for determining when the emergency is over and how emergency actions are to be phased out.
- **Post-Emergency Assessment** - The FCM is responsible for developing the plan, and a task force representing all the agencies involved in carrying out an emergency plan may produce the assessment.

Fuel Industry Liaison by Delaware DEMA- Energy Response Team

The Delaware DEMA - Energy Response Team performs many activities relevant to emergency situations on an ongoing basis. The ongoing normal operations for the fuel industry liaison involved in the pre-emergency planning will be expanded during emergency operations. The fuel industry liaison has a trusted relationship with petroleum industry personnel in critical positions who can assist in describing the seriousness and length of any interruption in fuel supply to Delaware. This special liaison and relationship with petroleum industry personnel will allow the fuel industry liaison special consideration in obtaining fuel information during emergency situations. It must be noted that most all of the reports including raw material and background information must remain confidential and cannot be made a matter of public record in order to maintain the ongoing working relationship with the petroleum industry. The tasks of the fuel industry liaison are described below and placed within the existing organizational structure so that expansion in an emergency situation can occur with a minimum of disruption. Specific tasks include researching, recording, and preparing periodic reports of significant trends in Delaware regarding the petroleum industry for the FCM. They will enable the FCM to have an early warning capability of a potential fuel crisis affecting Delaware. This information is derived from:

- Researching and recording monthly demand on crude oil imports, finished product imports, refinery production and refinery capacity for total United States.
- Keeping track of and secure publications from National Association of Refiners on specific refinery operations including closing, remodeling, and mothballing of specific refineries.
- Obtaining dealer cost prices on gasoline on a specific demand each month and obtaining a street survey of major and independent service station prices to arrive at dealer margins on each grade of gasoline for both self-service and full-service offerings.
- Researching and recording monthly sales of gasoline and gallons in Delaware.
- Recording and recapping lifting from pipelines and Delaware refineries plus neighboring state refineries that truck in any significant amounts of gasoline.
- Recording and reporting Delaware Department of Transportation (DOT) taxable gallons and 90% of gasohol gallons monthly.
- Providing information to citizens regarding the availability of petroleum products and complaints needing explanation of marketplace functions.
- Maintaining custody of materials used historically in functions of fuel allocations during shortages.

Fuel Industry Liaison Reports

Again, it must be noted that all reports including background information must remain confidential and cannot be made a matter of public record in order to maintain the relationship with the petroleum industry.

- Prepare a continuing 12-month moving total demand curve report that compares with the total United States demand curve. The information for this report is obtained from the Department of Energy reporting sales into Delaware.
- Record and prepare lifting numbers from pipelines and Delaware refineries plus neighboring state refineries that truck in any significant amounts of gasoline.
- Periodically prepare trends analysis reports.

Set-Aside Program Implementation

The success of the Set-Aside Program depends upon its management and the degree of preparedness of the individuals involved in its implementation. To the extent that the staff is trained, understands the plan, and carries out the duties of their positions, the plan will become operational at the critical time.

Operating Guidelines

A set of Operating Guidelines was developed for each position on the SESP emergency response organization chart. Each phase of the SEAP has a complete set of operating guidelines, providing a checklist of specific duties and responsibilities.

Emergency Waiver of Commercial Motor Vehicle Hours

Key Positions General Descriptions

The Fuel Contingency Manager (FCM) will direct staff to proceed with specific elements of the plan. Using the demand and analysis provided by staff, the FCM may present recommendations to the ESF-12 Advisory Group. The Fuel Allocation Manager (FAM) is responsible for supply monitoring, demand collection, program implementation and maintenance of a log of all activities. The public information staff (JIC) schedules briefings for the press and coordinates with the Delaware DEMA - Energy Response Team. The public information staff is also responsible for disseminating accurate information to the general public, advising them on the status of the situation and providing guidelines encouraging emergency energy demand reduction. If an energy emergency is proclaimed, the Delaware DEMA - Energy Response Team implements the energy emergency response programs.

Fuel Industry Liaison Manager (Film)

The fuel industry liaison performs many activities relevant to emergency situations on an ongoing basis. The ongoing normal operations for the fuel industry liaison involved in the pre- emergency planning will be expanded during emergency operations. The fuel industry liaison has a trusted relationship with petroleum industry personnel in critical positions who can assist in describing the seriousness and length of any interruption in fuel supply to Delaware. This special liaison and relationship with petroleum industry personnel will allow the fuel industry liaison special consideration in obtaining fuel information during emergency situations. It must be noted that most all of the reports including raw material and background information must remain confidential and cannot be made a matter of public record in order to maintain the ongoing working relationship with the petroleum industry. The tasks of the fuel industry liaison are described below and placed within the existing organizational structure so that expansion in an emergency situation can occur with a minimum of disruption. FILM tasks include researching, recording, and preparing periodic reports of significant trends in Delaware regarding the petroleum industry for the FCM. They will enable the FCM to have an early warning capability of a potential fuel crisis affecting Delaware. This information is derived from:

- Researching and recording monthly demand on crude oil imports, finished product imports, refinery production and refinery capacity for total United States.

- Keeping track of and secure publications from National Association of Refiners on specific refinery operations including closing, remodeling, and mothballing of specific refineries.
- Obtaining dealer cost prices on gasoline on a specific demand each month and obtaining a street survey of major and independent service station prices to arrive at dealer margins on each grade of gasoline for both self-service and full-service offerings.
- Researching and recording monthly sales of gasoline and gallons in Delaware.
- Recording and recapping lifting from pipelines and Delaware refineries plus neighboring state refineries that truck in any significant amounts of gasoline.
- Recording and reporting Delaware Department of Transportation (DOT) taxable gallons and 90% of gasohol gallons monthly.
- Providing information to citizen inquiries regarding the availability of petroleum products and complaints needing explanation of marketplace functions.
- Maintaining custody of materials used historically in functions of fuel allocations during shortages.

Fuel Industry Liaison Reports

Again, it must be noted that all reports including background information must remain confidential and cannot be made a matter of public record in order to maintain the relationship with the petroleum industry.

- Prepare a continuing 12-month moving total demand curve report that compares with the total United States demand curve. The information for this report is obtained from the Department of Energy reporting sales into Delaware.
- Record and prepare lifting numbers from local fuel suppliers, pipelines, plus neighboring state refineries that truck in any significant amounts of gasoline.
- Periodically prepare trends analysis reports.

APPENDIX K. FUEL REDUCTION MEASURES

• Voluntary Measures

During the early phases of a petroleum shortage the Governor, through DNREC, may issue a request for voluntary reductions in fuel consumption. Utilities also will sponsor media announcements addressing emergency energy demand reduction. The announcements suggest guidelines and energy saving tips. The specific voluntary demand reduction programs as being most effective are listed below.

8. ***Rideshare Program*** – Delaware DA - Energy Response Team along with other state agencies may initiate an energy emergency rideshare program.
9. ***Mass Transit*** – Delaware DA - Energy Response Team, along with local government officials, will encourage greater use of mass transit facilities. Delaware DA – Energy Response Team will maintain regular contact with transit officials in the state to act as liaison in the collection and dissemination of ridership information.
10. ***Bicycle Lanes*** – Delaware DA - Energy Response Team will encourage commuters who live within bicycling distance of their places of employment to use their bicycles. For this program to be successful, local governments and employers may need to provide more bicycle racks or secured parking areas for employees.
11. ***Changes in Work Patterns*** – Delaware DA - Energy Response Team will encourage the use of flexible work hours for both short- and long-term demand reduction, improvement in fuel efficiency, and reduction in traffic congestion. Flexible hours can be instituted for ongoing cumulative transportation energy savings, or developed, held ready, and brought online quickly in the event of an energy shortage. This program allows employees to stagger their commute hours, while still working during core hours, usually from 10:00 am to 2:00 p.m. This program reduces peak hour congestion, improving fuel efficiency.
12. ***Initiatives for State Employees*** – Delaware DA - Energy Response Team will direct state agencies to encourage employees to reduce commute trips by greater use of ridesharing, mass transit and flexible work schedules.

• Odd-Even Distribution

Description

In a moderate shortage situation, the need for a method to alleviate the long lines at retail service stations may arise. To avoid the hardship and inconvenience to the motoring public often associated with long lines at the pumps, and to assure the equitable distribution of gasoline to all potential users, the Governor, through an emergency declaration, may authorize the Energy Response Team to implement an Odd/Even Distribution Measure. 821,618 vehicles were registered in the state of Delaware as of May 1, 2005. Delaware's License plates are neither embossed nor de-bossed. They are created with a silk-screening process and are flat. License plates in Delaware feature up to six numbers. Prefixes indicated what type of vehicle or license plate.

Purpose and Objectives

This measure is designed to assist in the equitable allocation of gasoline to consumers. It may additionally encourage the conservation of fuel by causing trips to be better planned. Minimizing waiting lines may also reduce consumption by saving fuel that is used while idling.

Implementation Procedures

Under this plan, gasoline may be purchased or sold only in accordance with the following procedures:

- On odd/numbered days of the month, gasoline should only be sold to and purchased by the operator of a vehicle bearing license plates of which the last number is odd. Most Delaware license plates end with three numbers. License plates odd numbers may purchase fuel on odd days.

- On even-number days of the month, gasoline should only be sold to and purchased by the operator of a vehicle bearing Delaware license plates with even license plates numbers. Personalized license plates will follow ending letters of A - M on odd days and N - Z on even days. (Note: Personalized license plates ending in numbers will follow the schedule for license plate numbers.
- This plan should be implemented in accordance with the Minimum Fuel Purchase Measure.

Exemptions

Exemptions to the Odd/Even Measure will be made for the following vehicles:

- Vehicles used in agriculture
- Police, fire, ambulance, or other emergency vehicles.
- Vehicles operated as common carriers or contract carriers.
- Energy production and distribution vehicles.
- Vehicles rented for less than thirty days.
- Telecommunications vehicles.
- Sanitation services vehicles
- Motorcycles, scooters, and mopeds.
- Vehicles operated by or on behalf of the handicapped or disabled.
- Vehicles used in authorized vanpools and carpools.
- Such other vehicles as the Delaware Energy Response Team Fuel Allocation Manager may determine.

The Delaware Energy Response Team Fuel Allocation Manager will have responsibility for review and approval of applications for exemption from this measure. The Delaware Energy Response Team Fuel Allocation Manager may exempt from the application of Odd/Even and Minimum Purchases Measures any person or class for whom participation would result in a severe, immediate, and continuing danger to the health, safety or welfare of one or more persons or rendering impossible the actual performance of any trade, occupation or profession by such person or class.

Application for such exemptions from this measure should be made through the Delaware Energy Response Team. Prior to granting any exclusion, exemption, the Delaware Energy Response Team may require such documentary evidence and supporting material as is deemed necessary, including: Pertinent statistical information relating to the consumption of gasoline; Business, medical, governmental or social services records, as required on a case-by-case basis; Business, medical, governmental or social services certification setting forth specific facts showing that the exemption is warranted under the criteria set. Upon approval by the Delaware Energy Response Team, applicants will be issued a special permit exempting them from the above procedure. The permit must be shown upon the purchase of gasoline, and must be renewed every 60 days.

Requirements for Retail Gasoline Outlets

No hours of operation are imposed on retail gasoline sales outlets in this measure. However, operators of retail gasoline sales outlets are encouraged to continue the sale of motor gasoline a prudent manner, while attempting to pace the sales so that the available fuel is not exhausted prior to the end of the month. Retail sales outlets in the same general area are encouraged to stagger the days or hours they will close. In order to minimize inconvenience to motorists caused by weekend closings, all retail having ales volume in excess of 100,000 gallons annually will be encouraged to participate in the following voluntary system for ensuring staggered hours of operation among stations located in the same area:

- Those retail service stations having a sales tax number ending in an even digit shall remain open and pumping gasoline on Saturday.

- Those retail service stations having a sales tax number ending in an odd digit shall remain open and pumping gasoline on Sunday.
- All participating stations would be asked to remain open and pumping gasoline for at least four hours on their respective day of weekend operation. However, no service station would be required to sell more than one-sixth of its weekly allocation. Service stations would be required to post their days and hours of operation clearly and prominently. In addition, the Delaware Energy Response Team may encourage the adoption of a flag system to indicate availability of various services. A green flag would indicate selling of gas; the red flag would mean station closed, and the yellow flag would mean the gas station is open for service only.by weekend closings, all retail having ales volume in excess of 100,000 gallons annually will be encouraged to participate in the following voluntary system for ensuring staggered hours of operation among stations located in the same area:

Alert Levels and Phases at Which Measures are Implemented and Types of Compliance (Figure C-1)

Measures	Readiness Phase I	Verification Phase II	Pre-Emergency Phase III	Emergency Phase IV
Public Information	●	●	●	✱
Odd/Even Gasoline Purchase			●	✱
Minimum Purchase			●	✱
Maximum Fuel Purchase			●	✱
Extended Purchase Measure			●	✱
Speed Limit Enforcement			●	✱
Parking & Alternative Transportation	●	●	●	✱
Promotion of Bicycle Riding	●	●	●	✱
Employer-Based Travel Program		●	●	✱
Compressed Workweek		●	●	✱
School System			●	✱
Ride Sharing and Van Pooling	●	●	●	✱
Vehicle Maintenance Program	●	●	●	✱

Advantages and Disadvantages

There are a number of advantages to using the Odd/Even Distribution Measure. An important advantage is that this measure helps to space purchases of gasoline and aids in its equitable distribution. The measure has the potential effect of shortening lines at gasoline retail outlets by cutting in half the number of customers that may attempt to get gasoline on any given day.

As far as the public is concerned, this measure probably is the most familiar and the easiest to understand. The Odd/Even Distribution Measure may also provide a psychological benefit by reducing uncertainty regarding fuel availability.

Delaware Energy Response Team will be required to implement the plan. The Odd/Even Measure combines minimum costs and easy implementation requirements. The expenses involve would be limited to the

administration of exemptions and the dissemination information. Implementation steps would be few and could usually be accomplished in about a week.

The major disadvantage to the Odd/Even Measures is that it does not directly save any calculable amount of gasoline; it is designed as a distribution aid and not a conservation measure. This measure would be difficult for the Delaware Energy Response Team to enforce; the bulk of the enforcement responsibility rests with service station personnel. It is believed that service station personnel do not want to enforce this measure for fear that it might expose them to personal physical harm. Enforcement may also be difficult due to the large number of self-service and automatic gasoline pumps. These stations may find it hard determine if a customer is in compliance with the measure without changing their system of operation. The measure could potentially produce adverse psychological effects. There is the chance that it could increase the incidence of "tank-topping" and in this way complicate the shortage. The implementation of this measure may actually increase lines by having the public habitually purchase gasoline every other day.

A local problem may result where there is a high concentration of vehicles registered in other states. This would generally be limited to areas that contain major universities or military bases Out-of-state vehicles (except for those registered in contiguous states), although primarily driven in the local area or the state, would be exempt from the Odd/Even restrictions. This would give them an unfair advantage over other local consumers.

Estimated Energy Savings

The primary effect of an Odd/Even measure would be to distribute the available supply of gasoline in an equable manner among consumers and in so doing reduce the size of vehicle queues at the pump; it is not by nature a fuel-conserving measure. The effects of the Odd /Even Measure on the economy of Delaware would be due in large part to the allocation action that would be served by the measure. Restrictions on time an amount of gasoline purchase tend to reduce the number of trips made for various purposes and possibly overall travel. Their effects on various sectors of the state's economy would be roughly in proportion to the importance of the trip contemplated, which is, in turn, dependent on the priorities individuals would assign to possible trip purposes.

Private Sector Costs

The impact on the industrial, professional, and governmental sectors would be relatively minimal, with respect to both employment and productivity, and in the case of industry, the transport of goods. Travel to place of employment is generally considered a high-priority trip purpose. Therefore, the use of gasoline for work trips would likely take precedence over the use for other trip purposes. Impacts on the transport of goods would be small due to the fact that the measure makes allowances for commercial vehicles. It is not likely that the measure will appreciably affect the retail/commercial sector, since it contains no restrictions on the amount of fuel that could be purchased. Any impact on consumer purchases would probably be limited to a rearrangement or combination of trips, an act, which would not in any way affect actual sales.

The sector which would probably be most affected would be the recreation and tourism business. Relatively long travel distances and a relatively low priority ranking among consumers characterize recreational travel. The extent to which such travel would be affected is dependent on the perceptions of individual motorists regarding the availability of gasoline for a proposed trip. Uncertainty may compel a motorist to forgo pleasure travel rather than risk the possible inconveniences of long lines, frequent stops, or being unable to obtain gasoline in a particular area. On the other hand, if uncertainty could be reduced or eliminated in some manner, for example through a regulation requiring the staggering of operating hours of retail service stations, then the impact of the Odd/Even Measure on recreational travel would be minimal.

Delaware Energy Response Team Implementation

The Delaware Energy Response Team is responsible for implementation of the Odd/Even Measure. The Delaware Disaster Act authorizes the Governor to declare an energy emergency (fuel shortage) and to declare effective any emergency orders, rules and/or regulations as necessary. The affected retail facilities

shall be notified that the measure is in effect. The retailers must be informed of all requirements and provisions set forth in the measure, including the rules for allocation by license plate number, as well as the plan for staggering weekend operating hours among stations in the same area on the basis of sales tax numbers. It should be reiterated that weekend operation on a staggered basis is to be recommended, but not required. The Delaware Association of Retail Marketers could assist in the above tasks.

Enforcement and Compliance

Violation of the regulations of the Odd/Even Measure will constitute a misdemeanor punishable in accordance with Delaware General Statutes. State, county and municipal law enforcement agencies will have the authority to issue citations for any violation of the provisions of this measure. Any appeals of citations will make to the Delaware Energy Response Team.

Problems are likely to arise in the enforcement of the measure, one being the added burden that will be placed on law enforcement agencies. If additional law enforcement personnel are hired to assume the added responsibility, this will be costly. These costs should be estimated and provisions made for allocating additional funds to local law enforcement agencies (under the Delaware Disaster Act). Citations for violation of the Odd/Even Measure would only increase the already excessive load on the courts. Thus, under normal circumstances, a warning notice will first be issued upon discovery of violation of this or other components of the emergency program.

Technical Assistance Provided by the Delaware Energy Response Team

The Delaware Energy Response Team shall provide assistance necessary for implementation and administration as outlined in this plan.

• Implementation

Implementation Procedures

The primary function of the minimum purchase requirement is to allocate the sale of gasoline and reduce or minimize gasoline lines by discouraging the making of frequent but small gasoline purchases by consumers.

In this measure, each motorist may be required to purchase a specified minimum amount of gasoline per visit to a retail fuel sales facility.

Exemptions:

This measure shall not apply to:

- Vehicles used in agriculture.
- Police, fire, ambulance, and other emergency vehicles.
- Vehicles operated as common carriers or contract carriers.
- Energy production and distribution vehicles.
- Van pool vehicles as designated by the exemption procedures.
- Sanitation service vehicles.
- Telecommunication vehicles.
- Passenger transit or Para-transit vehicles (Para-transit Service for individuals with disabilities that prevent them from riding the fixed route buses).
- Vehicles rented for less than thirty days.
- The filling of portable containers
- Such other motor vehicle classifications as the Delaware Energy Response Team may determine.

In addition to the exemptions listed above, vehicles used routinely and primarily in the conveyance of handicapped persons and vehicles determined to be essential to community wellbeing and health will be exempted from the plan, upon application to and approval by the Delaware Energy Response Team. In

addition to the exemptions listed, vehicles used routinely and primarily in the conveyance of handicapped persons, and vehicles determined to be essential to community well-being and health, will be exempted from the plan, upon application to and approval by the Delaware Energy Response Team.

Stage of Implementation

Minimum fuel purchase is considered a mandatory measure and would be implemented during a Phase II or III emergency. This conservation measure should be implemented in conjunction with the Odd/Even Distribution Measure.

Advantages and Disadvantages

The primary advantage of the Minimum Purchase Measure is that of discouraging tank topping. Thus, it is useful in reducing gasoline queues, preventing the additional consumption of gasoline that results from waiting in a queue. Another advantage of the Minimum Purchase Measure is its low cost and ease of implementation relative to odd-even conservation. One major disadvantage of the Minimum Purchase Measure is the difficulty of effectively enforcing the measure, especially at self-service facilities. Service station personnel are particularly likely to be unwilling to demand compliance from customers. Another negative aspect of the measure is that it places an inequitable burden on low-income drivers and drivers of vehicles having relatively small fuel tank capacities.

Estimated Energy Savings

The primary advantage of the Minimum Purchase Measure is that of discouraging tank topping. Thus, it is useful in reducing gasoline queues, preventing the additional consumption of gasoline that results from waiting in a queue. Another advantage of the Minimum Purchase Measure is its low cost and ease of implementation relative to odd-even conservation. One major disadvantage of the Minimum Purchase Measure is the difficulty of effectively enforcing the measure, especially at self-service facilities. Service station personnel are particularly likely to be unwilling to demand compliance from customers. Another negative aspect of the measure is that it places an inequitable burden on low-income drivers and drivers of vehicles having relatively small fuel tank capacities.

Private Sector Costs

The effects of the combined Minimum Purchase and Odd/Even Measures on the economy of the state would be due in large part to the allocation function that would be served by the measure. Restrictions on time and amount of gasoline purchase tend to reduce, if not overall travel, the number of trips made for various purposes. Their effects on various sectors of the city's economy would be roughly in proportion to the importance of the trip contemplated, which is, in turn, dependent on the priorities individuals would assign to possible trip purposes.

The impact on the industrial, professional, and governmental sectors would be relatively minimal, with respect to both employment and productivity, and in the case of industry, the transport of goods. Travel to place of employment is generally considered a high-priority trip purpose; therefore, the use of gasoline for work trips would likely take precedence over its use for other trip purposes. Impacts on the transport of goods would be small due to the fact that the measure makes allowances for commercial vehicles.

Some impact on the retail and commercial sector could occur since discretionary travel, which includes shopping trips, is more flexible than home-to-work travel, and travel reductions could be more feasibly made in this category. Even so, the significance of this impact is questionable, as consumer response might simply be to rearrange or combine trips, rather than eliminate them outright. Probably some consumers affected would be those in which the consumer purchase decision was spontaneous or unplanned; such sales probably make up only a small percentage of total retail sales. The minimum purchase aspect of the measure could conceivably stimulate sales by encouraging motorists to make nonessential trips on gasoline purchase days for the purpose of reducing gasoline in the tank to a level, which would permit.

The sector which would probably be most affected would be the recreation and tourism business. A fair

amount of travel within the state is for the pursuit of leisure or vacation activities. Relatively long travel distances and relatively low priority ranking among consumers characterize recreational travel. The extent to which such travel would be affected is dependent on the perceptions of individual motorists regarding the availability of gasoline for proposed trip. Uncertainty may compel a motorist to forgo pleasure travel rather than risk the possible inconveniences of long lines, frequent stops, or being unable to obtain gasoline in a particular area. On the other hand, if uncertainty could be reduced or eliminated in some manner, for example, through a regulation requiring the staggering of operating hours of retail service stations, then the impact of the Minimum Fuel Purchase - Odd/Even Measure on recreational travel would be minimal.

Delaware Energy Response Team Implementation

The responsibility for implementation of the Minimum Fuel Purchase Measure will be a process of an energy emergency declaration by the State of Delaware References:

State: The state's authority for preparing the plan is sections Title 20, Delaware Code, Chapter 31, 3101, 3102, 3107, and 3115 that govern the state energy emergency response activities. Article IV, Constitution of the State of Delaware; entitled the "Executive Department"

Federal: Title VI of PL 93-288, as amended, The Robert T. Stafford Disaster Relief and Emergency Assistance Act.

Upon declaration of an energy emergency by the Governor, the Delaware Emergency Management Agency (DEMA), and the Delaware Energy Response Team shall notify all affected retail facilities that the plan is in effect and shall inform them of all requirements and provisions set forth in the measures. This will include the smallest allowable minimum purchase amount that the retailer may set, as well as the action of staggering of weekend operating hours among stations in the same area, on the basis of sales tax numbers. It should be reiterated that weekend operation on a staggered basis is to be recommended, but not required.

• Maximum Fuel Purchase Measure

Purposes and Description

The Maximum Fuel Purchase Measure (MFPM) is intended as a means of ensuring that, in the event of a shortage of gasoline and/or diesel supplies, some gasoline will be available to all motorists located or traveling through the state. The rationale behind the measure is that limiting the amount of gasoline that one motorist can purchase during a particular visit can be expected to prevent the supply of gasoline allocated to a particular retailer from being exhausted prematurely.

Procedure

Under the MFPM, each purchaser will be restricted to a certain maximum quantity of gasoline upon each visit to a service station. The maximum purchase quantity will be set by the Delaware Energy Response Team and may be set lower at the discretion of the retailer. Market forces may act in such a way to compel service station and other gasoline retailers to set maximum purchase limits on their own in the event of a gasoline/diesel shortage. It is suggested that the restriction be based on quantity of gasoline/diesel rather than purchase price in order to eliminate the need for continual revision of limits to reflect price increases. This measure is intended to be implemented on a voluntary basis but in a severe emergency could be implemented as a mandatory measure.

Exemptions

This measure shall not apply to:

- Vehicles used in agriculture.
- Police, fire, ambulance, and other emergency vehicles.
- Vehicles operated as common carriers or contract carriers.
- Energy production and distribution vehicles.

- Van pool vehicles as designated by the exemption procedures.
- Sanitation service vehicles.
- Telecommunication vehicles.
- Passenger transit or Para-transit vehicles (Para-transit Service for individuals with disabilities that prevent them from riding the fixed route buses).
- Vehicles rented for less than thirty days.
- The filling of portable containers
- Such other motor vehicle classifications as the Delaware Energy Response Team may determine.

In addition to the exemptions listed, vehicles used routinely and primarily in the conveyance of handicapped persons and vehicles determined to be essential to community well-being and health will be exempted from the plan, upon application to and approval by Delaware Energy Response Team.

Stage of Implementation

Maximum Fuel Purchase should only be implemented under conditions of a moderate or severe shortage (Phase II or III). A significant disadvantage of the measure is the difficulty involved in monitoring compliance and enforcement, if implemented as a mandatory measure. Service station operators are likely to be unwilling to enforce the measure, and few if any law enforcement agencies have the staff or resources necessary to ensure a high rate of compliance.

Estimated Energy Savings

For the purpose of considering possible energy savings, the MFPM will be combined with an Odd/Even Measure, which follows essentially the same form as the Odd/Even Measure being treated individually for this plan. There is a potential for gasoline savings inherent in a combined Maximum Purchase - Odd/Even Measure in that it would limit both the quantity of fuel that could be purchased and the amount of time during which a purchase could be made. However, skepticism and uncertainty on the part of the motorist regarding gasoline supplies and operating hours of individual stations may encourage tank-topping, particularly in cases where the motorist wants to be certain of having an adequate supply of fuel stored in the tank going into a non-purchase day.

Private Sector Costs

The effects of the combined Maximum Purchase - Odd/Even Measure on the economy of Delaware would be due in large part to the distributive function that would be served by the measure. Restrictions on time and amount of gasoline purchase tend to reduce, if not overall travel, the number of trips made for various purposes. Their effects on various sectors of the state's economy would be roughly in proportion to the importance of the trip contemplated, which is in turn, dependent on the priorities individuals would assign to possible trip purposes.

The impact on the industrial, professional, and governmental sectors would be relatively minimal, with respect to both employment and productivity, and in the case of industry, the transport of goods. Travel to place of employment is generally considered a high-priority trip purpose. Therefore, the use of gasoline for work trips would likely take precedence over its use for other trip purposes. Impacts on the transport of goods would be small due to the fact that the measure makes allowances for commercial vehicles.

The impact on the retail and commercial sectors could be expected to be slightly greater since travel in this instance is more of a discretionary nature. The actual extent to which sales would be affected is dependent on whether consumers choose simply to combine or rearrange trips or to eliminate them altogether under a Maximum Purchase - Odd/Even restriction. Even so, the only sales likely to be affected are that made to consumers whose decision to purchase is spontaneous or unplanned. Such sales probably make up only a small percentage of total retail sales.

The sector which would probably be most affected would be the recreation and tourism business. A fair

amount of travel within the state is for the pursuit of leisure or vacation activities. Relatively long travel distances and relatively low priority ranking among consumers characterize recreational travel. The extent to which such travel would be affected is dependent on the perceptions of individual motorists regarding the availability of gasoline for a proposed trip. Uncertainty may compel a motorist to forgo pleasure travel rather than risk the possible inconveniences of long lines, frequent stops, or being unable to obtain gasoline in a particular area. In the case of a maximum purchase amount restriction, the prospect of having to make frequent stops on a long trip may be particularly influential on the motorist's decision. On the other hand, if uncertainty could be reduced or eliminated in some manner, for example through a regulation requiring the staggering of operating hours of the retail service stations, then the impact of the Maximum Purchase - Odd/Even Measure on recreational travel would be lessened.

• Extended Purchase Measure

Purpose and Objectives

The Extended Purchase Measure (EPM) may be implemented to aid in the equitable distribution of motor fuels to consumers, to alleviate the long lines at retail service stations, or in the event that the Odd/Even Distribution Measure does not mitigate these conditions. Most likely, EPM will be implemented in a severe emergency as an extension of the Odd/Even Measure. In addition, it may encourage the conservation of fuel by exemplifying to consumers the severity of the situation.

This measure operates in many ways like the Odd/Even Measure in that it is designed to allow for the equitable allocation of motor fuels to consumers. With the implementation of EPM, motor fuel purchases would be restricted to every fourth day based on the vehicle's license plate number

Implementation Procedures

Under this plan, motor fuels may be purchased or sold only in accordance with the following procedure:

- On odd/numbered days of the month, gasoline should only be sold to and purchased by the operator of a vehicle bearing license plates of which the last number is odd. Most Delaware license plates end with three numbers. License plates odd numbers may purchase fuel on odd days.
- On even-number days of the month, gasoline should only be sold to and purchased by the operator of a vehicle bearing Delaware license plates with even license plates numbers. Personalized license plates will follow ending letters of A - M on odd days and N - Z on even days. (Note: Personalized license plates ending in numbers will follow the schedule for license plate numbers.)
- Vehicles used in agriculture.
- Police, fire, ambulance, and other emergency vehicles.
- Vehicles operated as common carriers or contract carriers.
- Energy production and distribution vehicles.
- Van pool vehicles as designated by the exemption procedures.
- Sanitation service vehicles.
- Telecommunication vehicles.
- Passenger transit or Para-transit vehicles (Para-transit Service for individuals with disabilities that prevent them from riding the fixed route buses).
- Vehicles rented for less than thirty days.
- The filling of portable containers
- Such other motor vehicle classifications as the Delaware Energy Response Team may determine.

In addition, vehicles in Delaware that are licensed in contiguous states are not exempt from this measure. In the event this measure is implemented, the Delaware Energy Response Team should coordinate its efforts

with other state energy offices to make them aware of the provisions of this measure since it would apply to contiguous states and cities vehicles coming into Delaware. Service station operators would be required to serve any vehicle not licensed in Delaware, regardless of plate number or day of the month. The Delaware Energy Response Team shall waive responsibility for review and approval of applications for exemption. Prior to granting any exemption, the Delaware Energy Response Team shall require such documentary evidence of pertinent information relating to the consumption of motor fuels.

Requirements for Retail Motor Fuels Outlets

No hours of operation are imposed on retail motor fuels sales outlets in this measure. However, operators of retail motor fuels sales outlets are encouraged to continue the sale of motor fuels in a prudent manner, while attempting to pace the sales so that the available fuel is not exhausted prior to the end of the month. Retail sales outlets in the same general area are encouraged to stagger the days or hours they will close.

In order to minimize inconvenience to motorists caused by weekend closings, all retail stations having sales volume in excess of 100,000 gallons annually will be encouraged to participate in the following voluntary system for ensuring staggered hours of operation among stations located in the same area. This includes retail service stations having a sales tax number ending in an even digit shall remain open and pumping motor fuels on Saturday. Retail service stations having a sales tax number ending in an odd digit shall remain open and pumping motor fuels on Sunday.

All participating stations would be asked to remain open and pumping motor fuels for at least four hours on their respective day of weekend operation. However, no service would be required to sell more than one-sixth of its weekly allocation. Stations may be required to post their days and hours of operation clearly and prominently.

• Speed Limit Enforcement Measure

Purpose and Objectives

The overall goal of the speed limit enforcement measure is to achieve maximum energy savings through increased compliance with existing speed limits and to make use of the conservation potential of further reductions in driving speeds by trucks, buses, and autos. After the OPEC oil embargo of 1973-1974, the Congress enacted, in January 1974, the Emergency Highway Transportation Act (Public Law 93-239), which required each state to adopt and enforce a 55 mile-per-hour (MPH) speed limit law. States, which failed to enforce the law to achieve designated levels of compliance, faced the loss of funding for federal highway construction. As a result, all states adopted this 55 MPH speed limit during 1974-1975 (see —Backgrounder on Highway Speeds on Appendix E-3).

After passage of the law by the states, average speed reductions across highway types were evidenced, particularly on the Interstate system. The average speed reductions led to corresponding savings in fuel. However, these fuel savings have been eroding somewhat over time, as average highway speeds have been gradually climbing (National & and Highway Traffic Safety Administration, 55 MPH Fact Book, 1978), although not to pre-embargo levels.

Thus, the idea behind this measure is to regain this source of energy savings by an increased level of enforcement activity to assure targeted levels of compliance. Most of the state and federal publications dealing with this issue have set the target at 70 percent compliance across all road types. Because of the extremely low probability of apprehension even with increased enforcement manpower, it is felt that the 70 percent goal is reasonable. Full compliance is probably not achievable, and the enforcement costs associated to achieve such a target would almost certainly render this degree of compliance non-cost-effective.

Implementation Procedures

Operating Agencies: If the decision is made to implement this Speed Limit Measure, either by the state or by the federal government, then Delaware is in a position to act positively and quickly. Because of the

state's many miles of rural paved roads, the great majority of the 55 MPH enforcement responsibility would revert to the Delaware State Police (DSP). Most of the necessary manpower would already be in place. Increased effort by local government police departments could also assist in the measure. Additional Considerations are:

- Increase the penalties for violating the speed limit laws, either in terms of points assessed against e driver record or amount of fine, or both. If penalties are increased, they should be kept in proper perspective so that the DSP and local government police departments and the courts are willing to enforce the measure.
- Impose no constraints on the DSP and local government police departments insofar as use of the most modern enforcement tools or techniques is concerned.
- Clarify or streamline state laws to allow for rapid and equitable prosecution of the increased number of violators that will likely arise. With court dockets already extremely burdened, this is no small issue.

Public Information and Education: Along with all of the above, it is imperative that the public be kept completely informed of the changes that are to take place, especially in regard to enforcement levels and techniques and any changes in the penalties associated with speed limit violation. However, it is hoped that the thrust of any public information and education (PI&E) campaign would focus on the seriousness of the fuel shortfall and what can be gained through compliance, rather than on the sanctions that will be imposed. As an example, the benefits of reducing motoring costs and reduced number of accidents should be cited. The DSP is well equipped to handle such a public information effort, since the DSP, the Office of Highway Safety (OHS), and the Delaware Department of Transportation (DELDOT) all have components that engage regularly in this activity. In addition, these agencies regularly use a variety of media, such as television, radio, newspapers, billboards, etc., to carry their messages.

Exemptions

This measure should be viewed as equitable, since it affects nearly everyone using the roadways in Delaware. Thus, individuals and businesses are treated alike. Those most diversely affected are the people who routinely travel long distances as function of their work, such as salesmen, truck driver, since Delaware and the nation have had considerable exposure to the 55 MPH speed limit law in effect for several years without the granting of any exemptions, it would be unnecessary and indeed counter-productive to grant any exemptions as a result of an increased enforcement activity.

Advantage: - The law enforcement mechanism is already in place. Accidents will be reduced through lower speed limits.

Disadvantages: - Although the extent of reduction is difficult to predict, various projections indicate that the savings are not great. Considering the system costs necessary to increase speed limit enforcement, including the burden on both law enforcement and the court system to handle the increased citations and prosecution, it is questionable whether the overall effort would be cost effective. The public would likely be discontented with such an approach, unless a very effective public information campaign was instituted. Many would likely feel that more of their individual liberties were being infringed on. Transportation costs could increase to industries involved in cargo hauling (i.e., increased vehicle-miles). Drivers paid on the basis of vehicle-miles rather than hours of operation would be particularly affected. On the positive side, truck mileage figures would improve. Loss of productivity would result for those workers whose work requires large amounts of travel, since longer travel time to and from work sites would detract from regular productive time.

Estimated Energy Savings

Projections of energy savings, whether for the Speed Limit Enforcement Measure or others, are not easily made. One of the reasons for this is the type and quality of data needed to make some of the calculations.

Examples of needs include speed limit compliance data, the distribution of vehicle miles of travel (VMT) by road type and travel speed, the reduction in fuel demand resulting from full compliance, etc. A task force of state and local enforcement agencies would be needed to compile this data.

Private Sector Costs

Impacts on Importing Gasoline

Highway fuel used in Delaware comes from two refineries (Delaware City, CO and Marcus Hook, PA) or by pipelines pumping finished products to unloading facilities. A more detailed description is contained in the fuel supply Chapter 4 Motor Fuel Supply and Management. Increased compliance with the 55 MPH speed limit could affect the amount of fuel imported in Delaware.

Impacts of the Measure on the State and Local Economy

- The Speed Limit Enforcement Measure could result in both positive and negative impacts to the State's overall economy.
- Moving toward targeted energy savings can certainly result in some beneficial changes. Savings cause less demand, and less demand could certainly lower the price at the pump as gasoline stations attempt to sell allocations. This has previous been demonstrated in Delaware. Lower gasoline prices should bring more purchasing power to the consumer, which can obviously be used in a variety of ways. One result might be an increase in sales of new automobiles, especially those that are energy-efficient.
- Highway safety effects related to increased 55 MPH compliance are hard to quantify accurately, in that many other interacting variables simultaneously.

Social Impacts

- The Speed Limit Enforcement Measure is generally viewed as being equitable, in that all individuals and businesses are required to comply. However, the measure has a greater effect, both economically and socially, on those who routinely travel long distances in their jobs.
- There is probably some general annoyance associated with longer travel times. For example, more time spent driving means less time for leisure. Nonetheless, opinion polls have indicated public acceptance of the 55 MPH maximum speed limit.

• Parking and Alternative Transportation Management Measures

Purpose and Objectives

The Parking and Alternate Transportation Management Measure includes an intensified public information and training campaign to induce travelers to shift from low-occupancy vehicles to higher-occupancy vehicles such as car pools, van pools and to mass transit. The activities introduced in this measure are intended to complement the Employer-Based Travel Measure, and would be implemented at an earlier stage of a gasoline shortage. It would be suggested if this measure were implemented, that businesses and employers institute a strategy which involves:

- Increasing the cost of parking through increased rates.
- Replacing subsidized, low-cost, or free parking provided by employers to their employees with parking charges at prevailing commercial rates.
- Offering car and van pools reduced rates or preferential treatment.
- Allocating the most conveniently located spaces in employer-provided lots for multiple- occupancy vehicles.
- Reducing availability of on-street parking for local government employees.

Implementation Procedures

The parking management and transit strategies are supportive efforts to increase the number of people

using car and vanpools, implementation of increased parking rates and restrictions would closely parallel the Employer-Based Travel Measure.

Exemptions

Because of the difficult task of enforcing employer-based rate increases, parking restrictions, and preferential parking in a large number of small firms, these measures may be considered applicable only to public and private organizations employing 100 or more people at one site, and to government employment locations with more than 50 people. Small firms may use parking facilities jointly; many provide no parking at all.

Several Delaware local governments are served by public transit. In these cities, public transportation is good and parking rates increases for single-occupant vehicles may increase transit rider-ship and car-pooling. Therefore, parking strategies combined with other energy conservation measures (ridesharing programs, transit service improvements) can result in a reduction in vehicle miles traveled greater than the sum of the individual measures.

Stages of Implementation

Preferential parking for car and van pools, provided through prime location or reduced price, reinforces other ridesharing incentives. Therefore, it should continue to be encouraged during the pre-emergency stage where efforts to increase vehicle occupancy are underway. Intensified parking management should be implemented in a Phase II motor fuel shortage. Increased parking rates and restrictions on available parking may result in reduced sales by businesses.

Advantages and Disadvantages

The primary advantage of the Parking and Alternative Transportation Management Measure is in its supportive action for other ridesharing incentives, resulting in increased ridesharing, increased transit rider ship, and gasoline savings in private motor vehicles. Other indirect benefits are modest improvements in traffic congestion, air quality, and traffic safety. Measures to restrict on-street parking can be particularly effective in improving peak-hour vehicle capacity and traffic flow patterns. Parking controls are relatively quick and easy to implement and to dismantle when the need for them diminishes. Their administrative mechanisms already exist and little or no hardware is needed.

However, the Parking and Alternative Transportation Management Measure may have little impact on transportation fuel usage when implemented without complementary car and vanpool programs. Efficient, alternative modes of transportation are needed to gain full benefit from the disincentive to single-occupant vehicle travel which parking controls provide. Another disadvantage may be that the choice of mode of travel to work is insensitive to measures, which make parking more expensive or inconvenient. Therefore, a more severe but long-term strategy of limiting the number of parking spaces may prove necessary.

If parking restraints are severe, vehicle miles of travel (VMT) may be increased by workers riding to work with a family member who then drives home, returning to the work place at the end of the day for the trip home - thus doubling the number of daily round trips - or by an increased use of taxis. This behavior would consume more gasoline and create more air pollution than before.

• Employer-Based Travel Measures

Purpose and Objectives

Potentially one of the most fruitful and desirable ways of reducing gas demand is by increasing average vehicle occupancy rates. In that way more travel (in terms of person-miles) can be accomplished with fewer vehicle-miles and therefore less fuel consumption. The appeal of this approach is in its great demand reduction potential, and its relatively painless nature.

The great demand reduction potential of this approach derives from the fact that current auto occupancy rates are very low (overall nationwide they are 1.7 persons per vehicle trip). These rates are particularly low for travel to work (average occupancy of 1.2 per auto), which is precisely when and where the physical and

economic opportunities for ridesharing and alternative transportation are the greatest. Furthermore, commuter travel represents a very significant proportion of all gas consumption (estimated at over 30 percent of the total). By focusing on increasing the average vehicle occupancy of the work trip, therefore, it should be possible to obtain significant reductions in gasoline demand. The relatively painless nature of increased vehicle occupancy is its second favorable feature. Increased vehicle occupancy does involve significant changes in travel behavior because it calls for a change in the mode of some travel from single-occupant auto to shared-ride, public transit, or Para-transit modes. However, this change in travel behavior involves minimal, if any, loss in mobility since travel itself (person trips) need not be reduced. It is this maintenance of mobility, with all the personal, social, and economic benefits it entails, that makes increasing vehicle occupancy such an attractive demand reduction approach. This is not to say that there are not obstacles involved in changing occupancy rates, for any travel behavior change is difficult to achieve, especially on a permanent basis.

The Employer-Based Travel Measure would involve state and local government officials working with companies that employ large numbers of workers at individual sites in the state, with the objective of increasing vehicle occupancy rates and/or cases on the job as well. Employer- based plans could involve local transportation planners working formally with selected large employers.

Implementation Procedures

The Employer-Based Travel Measure allows for a great deal of flexibility to affected employers. The measure's flexibility makes it a good candidate for implementation at any or all stages of fuel shortfall. Several Delaware local governments are operating a number of programs that would fall under the category of Employer-Based Travel Measures. These programs are being conducted on a voluntary basis in a non-shortage situation. These efforts should be continued and promoted. Other efforts to increase vehicle occupancy through employer-based actions on a voluntary basis should be encouraged by the city at this time. As the severity of the motor fuel shortage increases, the continued encouragement of the voluntary efforts will intensify. The general procedures for this measure are as follows:

Affected Organizations and Individuals: The Employer-Based Measure will apply to all employers operating with 100 or more persons employed at one site. Also subject to the measure will be all schools at post-secondary level (colleges, universities, and technical schools) with a total commuting student-faculty-staff population of 100 or more persons.

State, county, and municipal organizations may also be encouraged to participate in the plan, at all sites where 50 or more persons are employed. For this purpose, —employer" will be defined as any level of government (i.e., state or local) rather than the particular agency. Employees of one government level will be counted with the group with which they are listed for payroll purposes, even though they may be supported with grant funds from a higher government level. In addition, all smaller employers, private and public, will be requested to comply voluntarily with the measure to the maximum extent possible.

Plan Requirements: If mandatory requirements become necessary, employers who are subject to the plan will be required to develop for each applicable work site a program to reduce work- related travel by employees. In a severe shortage (Phase III), the local government officials may require employers affected by the measure to implement strategies according to the following formula:

- Large employers (300 or more employees at one site) would have to select a total of four strategies: either one strategy from Category I and three strategies from Category II; or, two from Category I and two from Category II.
- Mid-size employers (100 to 300 employees at one site, 50 to 300 for government employers) would have to select a total of 3 strategies: one from Category I, and two from Category II.
- Employers will be credited with travel reduction actions which they have undertaken prior to implementation of the measure and which meet the requirements of the measure (e g., an

employer who already operates a car pool program will not be required to institute another Category I action).

- With increasing severity of shortfall, the Delaware Energy Response Team may add to the mandatory requirements of the measure and may require affected employers to reduce employee travel to target level at which not more than 50 percent of all employees at the work site commute alone. Employers would be required to implement as many strategies from Table G.1 as are necessary for them to achieve the target level. Also, when the shortage is severe (Phase III), affected employers will be required to:
- Designate and publicize an "internal transit/paratransit coordinator," in charge of establishing a central source of information on transit and paratransit services available to employees.

Use internal communications media (e.g., newsletters and other house organs) as a tool to keep employees informed of the employer's efforts in providing or promoting alternative travel means, and to assist in the organization of car pools, van pools, charter buses, and the like. Employer- based travel actions must be developed and implemented within 30 days of a decision by the Governor to implement the plan. Employer efforts must be sustained for the duration of the emergency. No formal reporting requirements will be included in the Employer-Based Travel Measure. Instead, employer compliance with the measure may be monitored through voluntary web-surveys.

Exemptions

Exemptions may be granted to employers who can demonstrate to the Delaware Energy Response Team that complying with the requirement as stated would generate significant hardship for their employees, or would severely impair their firm's ability to do business, over and the effects of the fuel shortfall itself. In preparing request for exemption, specific reference must be made to each of the strategies listed in Figure D.6, and reasons for rejecting each strategy deemed unacceptable must be advanced. Qualifying employers will in most cases be granted only partial exemptions; i.e., allowances with respect to a reduced number of required actions, rather than blanket exemptions from all the measure s provisions. If exemptions are granted, employers will be expected to demonstrate good faith in complying, as far as is reasonably possible, with t se actions which are judged to be feasible.

Exemptions may also be granted to employers able to demonstrate to the satisfaction of the Delaware Energy Response Team that 60 percent of employees at an otherwise eligible site already commute by transit, pooling arrangement, and other energy-efficient modes. In this context, fuel-efficient modes are defined as: car pools, van pools, transit and paratransit services of all kinds, and human-powered modes (e.g., walking, cycling).

Stages of Implementation

The Employer-Based Travel Measure can be implemented to varying degrees of a motor fuel shortage. In the guarded phase of motor fuel shortage, voluntary ridesharing and parking management programs should be continued and promoted. In the early stages of a shortage (Phase II), the Delaware Energy Response Team should take the lead in the institution of appropriate employer-based travel actions as outlined in this measure.

As the fuel shortage situation worsens, city government may implement the mandatory forms of the measure. The Employer-Based Travel Measure allows enough flexibility so that the mandatory requirements can be molded to fit the severity of the crisis. Recommended examples of mandatory requirements were listed in sections above. Mandatory employer-based conservation actions should be implemented no sooner than in Phase II (moderate shortage).

Advantages and Disadvantages

It is estimated that travel to from work accounts for over 30 percent of personal vehicular travel in the U.S. More significantly, although business trips represent a trip purpose which is very amenable to various forms

of ridesharing, national average auto occupancy statistics show the lowest value for the work trips, 1.2 persons per vehicle, compared with 1.6 for shopping trips and 2.1 for social-recreational trips. Thus, increasing ridesharing will reduce demand without having a disruptive impact on the economy.

By focusing on work-related travel, the measure allows other kinds of travel to continue, thereby helping to maintain to ism, recreation, retail activities, and other key elements of the city's economy during a shortage. This represents a major economic benefit, which is the most important result of the Employer-Based Travel Measure. It does not impose direct costs, in the form of a loss, ultimately on consumers, as do measures, which mandate restrictions on individual travel. Largely because of this, the benefit-cost calculations performed for this sure show it to be among the most cost-effective of all the conservation measures considered.

Another advantage offered by this measure is the flexibility allowed, not only to the state, but also to the affected employers and ultimately to the commuters. The state has flexibility in implementing the measure either voluntarily or with various degrees of mandatory requirements. The employers have the opportunity to choose from a list of alternatives and mold a plan to fit their needs and capabilities. The commuters retain the ability to decide what mode of travel they will use to get to work in the event of a motor fuel shortfall. The plan also has an important symbolic value, and may stimulate long-term conservation behavior.

The Employer-Based Travel Measure can be implemented quickly depending on the scope and complexity of the measure an amount of preplanning and preparation done. A period of at least four to six weeks would be required to get services operating to a point where results would be significant.

The Employer-Based Travel Measure represents an equitable means of enlisting the support and cooperation of those employers most in need of, and most capable of supporting, auxiliary transportation in an emergency. The large employers singled out by the measure may find voluntary implementation of the measure advantage to their firms. Ridesharing efforts may reduce a potential loss of productivity that could result when employees are unable to get to work in motor fuel shortage.

Implementation

Flextime: Many companies have experimented with flexible-work-hour schedules in the past. Usually, the programs have been well received. The advantages are as follows:

- Ease of application and acceptance by workers
- More even peak-hour traffic flows, stimulating gasoline savings
- Support for the measure from organized labor, unless the stagger is imposed.
- Increase in productivity because many workers choose to work during hours they are more alert.

A major disadvantage is that decreased auto-highway congestion may make driving a more attractive alternative to more fuel-efficient modes.

Compressed Workweek: The imposed compressed workweek by government of any measures drastically affecting the daily living patterns of the citizenry is inherently controversial. The compressed workweek would alter the daily routine of most of the population. Therefore, its impact in social terms is extensive. The advantages of a compressed workweek include the following:

Rapid payoff in gasoline savings by reduced trips

Increased employee morale (already found in places where such measures have been experimented with).

- Easing of commuting problems.
- Increased time to devote to home-related activities.
- Possible decreases in heating and lighting, but also possibly offset by an equal increase in home use.
- Disadvantages include the following considerations:

- Because the 5-day week is deeply ingrained, the adjustment process can be expected to be difficult, particularly if the changes are mandated.
- Early experiments have indicated that the compressed workweek increases scheduling and communications difficulties and makes managers' work more difficult; these have been some of the reasons why some firms have dropped the idea.
- Productivity may decline due to increased fatigue, and industrial accidents may be expected to increase for the same reason.
- Changing work pattern may entail setup costs.
- The Compressed Work Week Measure could cause loss of income to some or all employees of the organizations due to closing were not made up in the balance of the week.
- A compressed work week initially may be disruptive to families. Coordinating the activities of various family members may prove difficult. Once adjustments are made, however, the additional day of leisure may benefit many families. A uniform closing day should minimize the disruption to families with children or working spouses.
- If a compressed workweek is promoted on a voluntary basis when supplies of motor fuel are less scarce, additional personal travel may result. However, under conditions calling for mandatory compressed workweek, motor fuel for such personal travel would be less available.
- This measure will be extremely difficult to enforce.

Acceptability

Public acceptance of a government program may not be assumed. In fact, it can be argued that a population faced with a serious crisis would prefer rather drastic corrective measures, even if the measures involved significant and immediate sacrifices or inconveniences, as long as it is convinced the measures will work. Public acceptance of the Compressed Workweek Measure as an emergency measure in the event of a national energy emergency could depend upon:

- The ability of the state to provide adequate and convincing information to the public.
- The absence of conflicting information.
- The public's trust in the government information and in the government efforts to ensure the effects of the program would be as equitable as possible.
- Organized labor generally does not support the 4-day, 40-hour workweek, but supports the 4-day, 32-hour week as long as there would be accompanying reduction in productivity.
- Employers are least enthusiastic about alternative work schedules for fear of a decline in productivity and a rise in overhead costs. Thus, for the measure to succeed on a voluntary basis would require that substantial tax benefits or other economic incentives be offered. However, since the measure will not be implemented under normal conditions, reactions of employers could be considerably different than expected.

Estimated Energy Savings

The estimated energy savings will require monitoring of the measure.

Private Sector Costs

It is difficult to separate the effects of a compressed workweek from the corresponding economic developments likely to arise from the fuel shortage emergency itself. Employment may even increase slightly if a decrease in productivity results from the energy shortage and additional workers are needed to maintain output levels. It is unlikely that the retail sector will experience a decrease in demand. A study done on the effects of "blue Laws" on aggregate retail sales has shown the total weekly retail companies are not affected by Sunday closings.

These results suggest that where patterns of consumption will change, overall demand will not decrease. An exception to this may be restaurants located in the downtown areas, where shortened lunch breaks and an additional day off for employees may decrease/business in establishments catering to lunchtime traffic. Costs to employees such measure might be as follows:

- Costs in child care arrangements for those exempt from the compressed workweek
- Costs to workers who normally receive over-time or additional pay for working night shifts.
- Costs to individuals whose income depends on second jobs that would be reduced because of longer working hours.
- It has been suggested that productivity may decline when the workday is lengthened resulting substantial costs employers. There may also be costs associated with the rescheduling of employees and materials. Although employers may incur costs in rescheduling their operations, these costs may be offset by increased employee morale resulting in reduced absenteeism and reduced turnover rates among their employees.

Local Government Responsibilities

Implementation

The Delaware Energy Response Team will be the primary agency responsible for administering all actions within this measure and will act as coordinator of all activities associated with its implementation.

In addition, each agency/company covered by the measure will be responsible for setting up a plan for day-to-day implementation of a compressed workweek, as well as coordination with other area employers and area transit authorities to promote flexible work hours.

Phase III Fuel Shortage: Because of the legal issues involved, the potentially disruptive social and economic effects, and the need for careful consideration of equity issues, the planning phase of this measure is of the utmost necessity. In the event of a Phase III Fuel Shortage, additional planning effort is needed in the planning of this. New local and/or state legislation may be required.

Major legal concerns are laws and labor contracts requiring overtime pay for hours worked beyond specific daily maximums. State and/or local laws/ordinances concerning days of the week businesses may operate also must be examined. The fuel management coordinator specific duties during **Phase II** of a fuel shortage may include:

- Prepare a list of companies that are included in an exempt from the measure.
- Compile a list of area transit authorities to be distributed during Phase II of the fuel emergency, to promote coordination between employers and area transit authorities in scheduling flextime hours for employees.
- Work closely with city and state department directors to classify government services into nonessential, essential and critical, to provide the basis for implementation of a city employee compressed workweek.
- Begin employer workshops to better define the measure and what may be required of employers. Workshops in Phase II should emphasize coordination of employers and transit authorities to set up flextime schedules.
- Develop a specific plan for implementation of mandatory compressed workweek with more detailed guidelines.
- Conduct surveys that will assist the city in a Phase III fuel emergency to collect data to be used in analyzing the measure.
- Determine more precisely the potential energy savings from a compressed workweek.

Phase II Fuel Shortage: At a Phase II level of emergency the Delaware Energy Response Team will continue

with activities unfinished in Stage I as well as:

- Intensify efforts to convince employers of the benefits of staggered work hours and voluntary implementation of a compressed workweek. (Implementing the employer workshops organized in Phase II will do this.)
- Inform the city and concerning informational requirements, the appeal procedure and reporting.

Phase III - Fuel Management Coordinator Duties:

- Respond to questions from employers in their area.
- Explain the measure and appeal procedure to individuals in their area.
- Begin organizing recruitment of city personnel and procedures for training city personnel.

Phase IV Severe Shortage: At a Phase IV-Severe Shortage the city fuel coordinator will continue unfinished duties from Phase I and Phase II well as:

- Oversee the implementation of a mandatory compressed workweek.
- Handle problems and questions
- Handle exemptions and appeals.
- Assist in the exemption and appeals process.
- Provide necessary reports.
- Instruct employers on methods of gathering data on the effects of the measure and provide additional reports to employers on experiences with the measure.
- Answer questions as they arise.

Data Collection and Analysis Required For Evaluation

In order to evaluate the effects of the measure, it may be necessary to obtain further cooperation from the affected employer employees. It is hoped that flextime hours will reduce gasoline demand by stimulating greater use of mass transit and reducing peak-hour traffic congestion. To obtain data analyzing the effects of this measure, it may be necessary to survey employees on changes in their habits of getting to and from work and changes in their consumption of motor fuel.

It is hoped that a compressed workweek will decrease miles traveled weekly to work. It has been suggested that the additional free day will actually increase miles traveled. Therefore, employees may be surveyed not only on changes in their work miles traveled, but also on what was done in their free time. In addition, if employers express concern that a compressed workweek will decrease productivity and incur additional operation costs it must be considered. Therefore, employers also need to supply survey information. To carry out data collection, the city may surveys to be distributed to employers in the area. Employers could furnish the surveys to their employees. The fuel management coordinator may compile reports analyzing the data received. Although these methods will require further effort on the part of the employer, they are essential so the city can assess fairly the impacts and costs of implementing the measure. These efforts will also help in future fuel management planning.

School System Conservation Measures

Purpose and Objectives

The purpose of the School System Conservation Measure is to reduce the consumption of gasoline by reducing the number of trips made to and from school and/or by better planning school activities and transportation services. It also encourages students to ride to school only in car pools or other ridesharing modes of three persons or more.

General Procedures and Status of Current Programs

A variety of modifications can be made in school schedules and activities depending on the extent of the

motor fuel (diesel and gasoline) shortage. Today, most school districts are continuously assessing methods of reducing fuel costs. This appendix is designed as a way to promote conservation activities in schools.

Transportation

- Training bus drivers in energy-efficient driving techniques.
- Replacing fuel tank caps on school buses with locking caps. Optimizing school bus scheduling and routing for fuel savings.
- Discouraging students driving cars to school unless they are needed for vocational activities.

Reducing Fuel Use for Special Events

- Measures to reduce fuel use by athletic officials include using the most efficient size vehicles for trips, conducting local school fuel saving clinics, promotion of carpooling among officials to local association meetings, assignment of officials from same area so that they can ride together and determining better meeting locations.
- Rescheduling of athletic events to reduce fuel used, including examining the possibility of reinstating the activity period and athletic practice during the school day. This would involve changing current athletic regulations restricting interscholastic school practices to after-school hours.
- Stress energy education in schools.
- In addition, this plan suggests the schools consider rescheduling all after-school activities, not only athletic events.
- More drastic schedule changes, i.e. the four-day school week; will be implemented only in a severe energy emergency and in conjunction with the compressed workweek. Education hours lost on the fifth day will be spread equally over the four days (with provisions made for additional exercise breaks during the school year), or, if it appears fuel shortages will be temporary, school schedules may be modified so that during the shortage, schools will operate an eight hour/four-day week, with lost time being made up during vacation periods.

Stages of Implementation

Local schools are encouraged to continue energy conservation planning. During a mild shortage (Phase II), at the discretion of the schools, many of the above suggestions will undoubtedly be implemented. During a severe shortage (Phase III), pupils will be restricted from traveling to school in their own cars unless they can present reasons to the principal for doing so. Also, a compressed school week will be implemented, subject to the condition of prior or simultaneous implementation of a compressed workweek.

Advantages and Disadvantages

The advantages of the School System Conservation Measure include the following:

- There would be a rapid payoff in terms of reduced consumption of fuel for school buses and transportation for school personnel.
- The measure is easy to implement and enforce.
- The disadvantages of the school schedule modification aspect of the measure include the following:
- Modification of school schedules could adversely affect learning. Longer school days could fatigue students and teachers, decreasing amount learned and increasing discipline problems.

Curriculum Changes

- Schools provide many services, such as meals for children from low-income families and training for handicapped children, which might be reduced by schedule modification.
- The economic impact on parents exempt from compressed workweek could be adverse. This

includes lost work time and/or cost of childcare for working parents.

- Some high school students who work after school may have to give up their jobs if a longer school day was mandatory.
- Undoubtedly, most high school students who drive will protest not being allowed to drive their own vehicles to school.
- A longer school day in winter might necessitate some students leaving for and/or returning from school in the dark.
- Extracurricular activities would be disrupted by implementation of any of the variations of the measure. The impact of this loss needs to be evaluated.
- Restrictions on students driving to school may increase busloads to the extent that additional buses will have to be operated.
- The plan considers only fuel savings. Overall savings are uncertain and will depend on what students do with their free time.

Estimated Energy Savings

The implementation of current suggestions could possibly reduce fuel consumption by 20 percent. The schools are encouraged to collect data and supply accurate estimate savings as they occur.

Shortening the school week and making up lost days during scheduled vacation periods would not achieve energy savings on a long-term basis. This measure could be used during a short- term energy emergency to shift energy consumption to a later period of the same school year. Gasoline consumption for students and employee travel during the reduced school week period would follow the pattern described below. National estimates have been made of savings of 37,000 bbl/day of gasoline by closing the schools one day per week.

Private Sector Costs

In assessing the private sector costs of a four-day school week and/or curtailment of after school activities, it is important to keep in mind that these measures will be implemented only in the event of a severe (Phase III) energy emergency and in conjunction with the compressed workweek. Therefore, private sector costs for a compressed school week will be less than might be expected.

The students will bear costs in the following ways: - Students may learn less because the school day is lengthened. This may also result in fatigue, especially among younger children. Going to school longer hours may result in students having to give up after school jobs. The impact on students from curtailing after-school activities will require more detail. Because the measure will be implemented with the compressed workweek, families should not be subject to severe adjustments. An exception will be those families whose members are exempt from the compressed workweek measures.

APPENDIX L. FUEL EMERGENCY RESPONSE PLAN

Introduction

Fundamentally, a fuel disruption is the result of an imbalance between the amount of fuel available and the demand for that fuel at the prevailing price. It may be the result of either 1) a rapid drop in fuel supply due to international disturbances, natural disasters, refining or pipeline problems, terrorist activity, or even labor disputes; or, 2) a sudden increase in demand caused by, for example, unseasonable weather conditions, The disturbance can be a short-term occurrence caused by transitory events, or, it can be of longer term, demanding changes in fuel use priorities.

The increase in the price of fuel, that usually accompanies a disruption, tends to establish new supply/demand equilibrium at the higher price. History has demonstrated that people adjust their behavior and reduce fuel consumption during fuel shortages, whether because of price increases or the difficulty and inconvenience of obtaining fuel. Thus, a fuel shortage is essentially a transition from one stable state to another.

While the fundamental objective of this document is to provide specific authority and procedures to appropriate personnel during the time of a fuel disruption in order to protect the interests and safety of Delaware citizens, a corollary purpose is to make the transition to a stable market as quickly as possible and to eliminate additional emergencies that could occur during the transition.

The document is designed to work in conjunction with the State of Delaware Emergency Response and Recovery Plan, as developed and implemented by the Delaware Emergency Management Agency (DEMA).

In summary, the objectives of this document are these:

- To provide a quick, unified and consistent statewide response to each fuel disruption and Emergency Classification Level (ECL) listed herein.
- To provide specific authority and procedures, to appropriate personnel, to accomplish the abovementioned objective, in order to protect the interests and safety of Delaware citizens.
- To provide direction and assistance to DNREC during any fuel disruption and ECL.
- To provide direction and assistance to the Delaware Emergency Management Agency (DEMA) during any fuel disruption and ECL.
- To foster clear communication relating to fuel disruptions between state and local government, industry, and citizens in advance of and/or during a fuel disruption.
- To encourage and facilitate changes in travel patterns and conservation of resources prior to, during, or as a result of a fuel disruption.
- To minimize adverse impacts on public health, safety, mobility, commerce, and the State's economy.

Legal Authority and References

U.S. Department of Energy (DOE) and Title 20, Delaware Code, Chapter 31, 3101, 3102, 3107 and 3115

The State EOP is designed to address the response to the consequences of any disaster or emergency situation that would affect the population and/or property within Delaware. The State EOP is applicable to natural disasters, such as floods, earthquakes, and tornadoes; man-made incidents, such as civil disturbances; and technological situations, such as hazardous materials (to include terrorism, power failures, nuclear power plant incidents, and national security emergencies). The State EOP describes the basic mechanisms and structures by which the State of Delaware would respond to potential and/or actual emergency situations. To facilitate an emergency response, the State EOP contains Emergency Support Functions1 (ESFs) designed to implement and sustain a functional approach to emergency response and assistance (see Chapter 1 - Figure 1.1). ESF-11 is assigned for a Public Service energy emergency response

(see Chapter 1 - Figure 1).

• Management System

Information and Communication Structure:

The Division of Climate, Coastal & Energy's staff shall monitor energy related issues and maintain communication with the petroleum industry, other state agencies, the Motor Fuel Working Group, , Delaware Emergency Management Agency (DEMA) and the federal Department of Energy (DOE), on an ongoing basis, in order to, as practicable, anticipate a fuel disruption of any magnitude.

The Division of Climate, Coastal & Energy staff may be the first to know of a given disruption or potential disruption, he or she will determine and designate the initial **Emergency Classification Level** (ECL) of a given disruption.

All events, or ECLs, will be communicated by the Division of Climate, Coastal & Energy to the Delaware State Energy Coordinator and the SEOC (if applicable). Also members of the States Motor Fuel Working Group will be alerted.

- **Level I Readiness** SHALL be communicated to the persons listed above; however, they SHALL NOT be communicated with the media so as not to unnecessarily cause alarm to the public.
- **Level II Incident** (Minor Disruptions) will be communicated to those persons listed above. If media notification is warranted all communications will be coordinated through the Division of Climate, Coastal & Energy.
- **Level III Alert** (Moderate Disruption) will be communicated to those persons listed above all media contacts will be coordinated by the Division of Climate, Coastal & Energy.
- **Level IV Emergency** (Major Disruption) - During the Emergency Phase, the DEMA, as provided within the State of Delaware Emergency Response and recovery Plan, is the lead agency, and the Division of Climate, Coastal & Energy and Motor Fuel Working Group will act as support during the course of the declared emergency.

• Communication Procedures

A. Internal (calling protocol)
    1. Pipeline Disruptions or Potential Pipeline Disruptions
        a. Pipeline companies contact DNREC, DEMA, PSC, and local emergency management.
        b. The DEMA Duty officer contacts the Division of Climate, Coastal & Energy and Division of Climate, Coastal & Energy (Upon receiving a voice mail message from the duty officer you must immediately return the duty officer's call to confirm receipt of the message)
        c. DEMA coordinates with the Division of Climate, Coastal & Energy regarding the issue at hand.
        d. Each agency contact is responsible for internal notifications for their respective agencies
        e. If industry notification comes to a team member outside of the 24-hour duty officer the team member will alert DEMA and the Division of Climate, Coastal & Energy.
    2. Other Motor Fuel Emergencies
        a. Industry or city and state agencies notify the Division of Climate, Coastal & Energy.
        b. Each agency contact is responsible for internal notifications for their respective agencies including the agency director and other executive staff.
        c. If notification of an incident comes to a team member other than the Division of

Climate, Coastal & Energy or DEMA, the team member will alert both DEMA and the Division of Climate, Coastal & Energy

B. External Communications

1. Audiences

a. industry

- refiners
- pipeline operators
- retailers
- jobbers
- industry associations
- warehouse-storage
- railroad transporters
- transporters
- truck drivers
- suppliers

b. non-industry stakeholders

- driver associations/organizations
- public transportation providers
- large employers

c. media

d. general public

e. governmental entities

- Municipalities
- Counties
- Neighboring states energy contacts.
- Federal entities
  - ◊ U.S. Department of Energy
  - ◊ U.S. Environmental Protection Agency
  - ◊ c. U. S. Department of Transportation – Office of Pipeline Safety

(Message/Communication to external audiences range from normal demand and conservation (Level I and II) to encourage public transportation and demand extreme conservation (Level III and IV).

Definitions:

"Emergency"- A sudden, urgent, usually unforeseen occurrence or occasion requiring immediate action.

Level I: Readiness encompasses the ongoing activities of the Division of Climate, Coastal & Energy staff under normal operating conditions. The staff routinely monitors Delaware regional, national and world events that have the potential to cause an energy supply disruption.

Level II: Incident a *minor disruption* caused by an existing condition that results in a realized shortage or disruption in fuel supply that may last up to one or two days.

Level III: Alert a *moderate disruption*, either localized or statewide, resulting in an obvious shortage of fuel that may last up to three days.

Level IV: Emergency *a major disruption* either localized or statewide, resulting in the need for immediate local law enforcement and initiations of public fuel conservation. Initiated if the disruption is anticipated to be greater than three days in length.

"State of Emergency"- Means the duly proclaimed existence of disaster or of extreme peril to the safety of persons or property within the State caused by air pollution, fire, flood or flood-water, storm, epidemic, riot, earthquake, or other causes, except those resulting in a state of war emergency, which are or are likely to be beyond the control of the services, personnel, equipment and facilities of any single county, city or town, and which require the combined efforts of the State and the political subdivision.

• Conservation Strategies

Public Awareness:

- Fuel Conservation:
- Alternative Fuels:
- Alternative and Public Transportation:
- Ridesharing Programs:
- Speed Limit Enforcement
- The Delaware Emergency Management Agency (DEMA) will institute a stepped-up program to enforce the posted highway, and roadway speed limits. The Division of Climate, Coastal & Energy may carry out a public awareness program in order to promote compliance with posted speed limits and their effect on fuel economy.

Printed Educational Material:

- Drive-Wise material for consumers
- Emergency measures for retail service station owners and operators (see E.5)

• Voluntary Contingency Measures for Industry

Drive-Up Window Closures: - The Governor may ask for voluntary restriction on operations of drive-up windows at banks, liquor stores, fast food and similar establishments. Exceptions may be made at facilities where only drive-up service is provided.

Maximum Motor Fuel Purchase Requirements: - No sale of motor fuel, during a single dispensing transaction, shall be made that is in excess of 25 gallons (or 95 Liters), per vehicle tank.

Maximum Purchase for Separate Containers: - Not more than two (2) gallons (or eight [8] Liters) of motor fuel shall be sold or purchased for delivery into a separate "safety approved" container, concurrent with the filling of a fuel tank of a vehicle, during a single dispensing transaction, This restriction shall not apply to containers to be used for a commercial purpose, such as for fueling commercial landscaping or construction equipment, electrical generators, etc.

Minimum Motor Fuel Purchase Requirements: - A specific minimum dollar, or volume, amount of motor fuel purchased at a retail service station, shall apply to a single vehicle, during a single transaction.

When the minimum amount specified, (by the Governor), is a whole dollar amount (e.g., $5), it shall include all applicable taxes.

If a vehicle's tank cannot hold the entire amount of fuel covered by the minimum dollar amount or volume, the retailer may collect the total amount of the required minimum sale,

Signs clearly detailing the minimum purchase requirement shall be displayed on each motor fuel dispenser at every retail service station, or otherwise communicated to consumers,

Odd-Even Motor Fuel Sales Restrictions: - At the retail level, motor fuel shall not be dispensed into any vehicle on an "odd-numbered day" of the month (15th, 3rd, 23rd, etc.) unless the last "numerical digit" on the

vehicle license plate of that vehicle is an "odd number" (1,3,5,7,9).

At the retail level, motor fuel shall not be dispensed into any vehicle on an "even-numbered day" of the month (2nd, 4th, 24th, etc.) unless the last numerical digit on the vehicle license plate of the vehicle is an "even number" (0, 2, 4, 6, 8).

The number "zero"; as identified above, will be considered an "even-number" for the purpose of the odd-even motor fuel sales restrictions.

In the event that there are no numerical digits, but only letters (e.g., as in some vanity plates), the license plate shall be considered "even‖ and, motor fuel shall be dispensed into that vehicle on "even-numbered days" of the month.

In the event that there are no license plates attached to a motor vehicle, (egg. as in newly purchased vehicles), the vehicle shall be considered "odd". And, motor fuel shall be dispensed into the vehicle on "odd-numbered days" of the month.

For any calendar month consisting of an "odd number of days" (31, or 29 for February in leap years), fuels sales made on the last day of that month will not be subject to the "odd-even" restrictions, and motor fuel may be dispensed, on that day, without regard to the license plate numbering.

Motor fuel purchases made at self-service Motor Fuel stations, whether payment is made by insertion of a card into a card-reading mechanism, by the use of coin-operated pumps, or by payment to a cashier, shall be governed by the same odd-even rules.

During a declared emergency situation, an attendant shall be present to verify the odd or even license plate number and compliance with these rules as applicable,

Motor fuel retailers shall not require the purchase of special goods or services such as car washes, tires, lubrication, or other goods and services, as a condition to the purchase of motor fuel. In addition, retailers shall not dispense motor fuel on a preferential basis such as by appointment or to preferred customers, friends, or relatives,

Prohibited Hours of Sale: - The dispensing of motor fuel by retailers may be prohibited during certain hours of operation in urban or congested areas in order to prevent congestion during peak hour traffic. For example, retailers may voluntarily agree to restrict dispensing of motor fuel may "between the hours of 7:00 a.m. and 9:00 Am., and from 4:00 pomp and 6:00p.m., Monday through Friday". This restriction may be implemented by city, by county, or statewide.

Retail Service Station Fuel Reserve Plan: - The main objective of the Retail Service Station Fuel Reserve Plan is to secure specific retail service stations for the exclusive use of emergency, fire department, law enforcement, and military vehicles. The Division of Climate, Coastal & Energy and the Motor Fuel Working Group will work with industry to identify potential service stations for participation that are strategically located statewide for this purpose and have agreed to voluntarily display a yellow flag, upon notification by the Division of Climate, Coastal & Energy, during times of fuel emergencies, as declared by the Governor.

Uniform Flag System for Motor Fuel Sales: - Motor fuel retailers shall indicate the availability of fuel supply at their facility by the display of a colored flag that is at least 20" in width and 20" in length, flown in such a manner as to be visible to the public from off of the premises. The flags shall bare the following colors for the Stated applicable situations:

- **GREEN FLAG**: Means that motor fuel is available for sale to the general public.
- **RED FLAG**: Means that motor fuel- IS NOT available and/or that the station is closed or open only for auto servicing; and
- **YELLOW FLAG**: Means that the service station is open for dispensing motor fuel to only clearly marked emergency, fire department, law enforcement and military vehicles, but that the service station is open for auto servicing,

If a retailer is out of a specific grade of motor fuel, but is otherwise dispensing other grades of motor fuel, the retailer shall attempt to the best of his or her ability to indicate, by means of signs, which grades are available.

- **Emergency Classification Levels:**

During a motor fuel shortage,[66] the activities prescribed in each Emergency Classification Level (ECL) intensify depending on the severity of the shortage. *The point of transition from one phase to the next is not an absolute.* To a large degree, it is qualitative; the implementation of each level is a Division of Climate, Coastal & Energy policy decision, recognizing public perception of the seriousness of a given event or emergency.

Level I – "Readiness"

Description: - A Level I-Readiness response is initiated in response to an event that has the potential to impact the supply of fuel, and could develop into a higher ECL. This is only an ALERT and should only be elevated to a higher ECL as warranted,

Communication and Response: The Division of Climate, Coastal & Energy will maintain close communication with local refinery staff to determine the severity of the closure and to better judge the length of time that the pipeline will be kept out of service. If it is determined, with confidence, that the pipeline will be repaired and returned to service within 24 hours, there will be no need to elevate to a higher ECL, The Level I event will be determined by the Division of Climate, Coastal & Energy and communicated to the Delaware Energy Coordinator, Motor Fuel Working Group members and the DEMA, but no media communication will be made.

If the Division of Climate, Coastal & Energy determines, with confidence, that the pipeline will be out of service for an undetermined time, perhaps greater than 24 hours, a Level II or higher ECL will be initiated, as applicable, and communicated to those listed above.

Measures to be implemented: None.

Level II – Incident

Description: A Level II-Incident (a minor disruption in fuel supply) response may be characterized by a potential (advanced knowledge) or a realized (occurring) event that may have, or is having, an impact upon supply of fuel to or at retail service stations, Regardless of the cause, the disruption is, or will, limit the transport of product to or from retail service stations temporarily.

Communication and Response: The Division of Climate, Coastal & Energy will maintain close communication with the local Delaware refinery, terminal managers, and fuel dealers in order to better understand the impact that the aforementioned events will have on the Delaware marketplace.

Based on the characteristics of the definition of the "minor disruption" above, the Energy Response Team shall initiate a Level II ECL. If and when it is determined, with confidence, that the pipeline has been returned to service, and that other refineries are diverting product to Delaware there will be no need to elevate to a higher ECL.

The Level II Incident marks the activation of a more formal communication network with the Energy Response Team, DEMA, other state agencies, industry, and the U.S. Department of Energy, as appropriate. Division of Climate, Coastal & Energy Staff will determine the nature, potential extent and duration of a perceived or impending fuel shortage. The Level II ECL will be communicated immediately to the Delaware Energy Coordinator, the Division of Climate, Coastal & Energy, Motor Fuel Working Group members and the

[66] For planning purposes, a —shortage‖ means an actual or potential loss of supply, which significantly affects the State's energy systems, and caused by a mechanical failure, natural cause, or Geopolitical events such as war, terrorism, civil disturbance or embargo.

DEMA.

The Delaware Division of Weights and Measures coordination with the Energy Response Team staff may seek data and information from industry regarding fuel supply including contacting motor fuel industry stakeholders to assist in assessing the severity of the situation. The Division of Climate, Coastal & Energy staff in consultation with DEMA staff will attempt to assess the potential impacts of an anticipated petroleum shortage on supply, and recommend further action to the Division of Climate, Coastal & Energy. If the Delaware Energy Coordinator, in consultation with the Motor Fuel Working Group, determines the existence of a protracted energy problem, he or she may recommend transition to Level III.

In addition, if requested, a news release statement outlining the details of the situation, with a request for the public's attention to suggested contingency measures, may be released by the Division of Climate, Coastal & Energy.

Measures to be implemented:

Recommendations Only:

Public:

- Clearly and firmly relay to the public that there is currently no need to panic.
- Encourage fuel conservation.
- Encourage ridesharing for the coming week.

LEVEL III - ALERT

Description: The Level III Alert response (a moderate disruption in fuel supply) may be characterized by a potential (advanced knowledge) or a realized (occurring) impact on supply to or from retail service stations that may be expected to persist for up to three days.

Regardless of the cause, the disruption may be characterized by limited transport of product to retail outlets, lack of product at retail outlets, and possibly the formation of "gas lines" at retail outlets as a result of public reaction to a perceived potential shortage. Depending upon the severity of the situation, a Level III ECL may quickly escalate into a Level IV ECL and could result in conditions that threaten public health and safety, and which would involve immediate coordinated efforts with DEMA.

Communication and Response: The Level III Alert response involves an increased level of government activity as the fuel supply disruption worsens. The Governor may ask the Motor Fuel Working Group to review the situation in more detail. The Working Group, composed of applicable state agencies, may seek input, data, and information from industry, and upon analysis of those data and information, recommend to the Governor a course of action, under the direction of the Delaware Energy Coordinator. The Division of Climate, Coastal & Energy staff and members of the Motor Fuel Working Group will assess the effectiveness of these voluntary demand reduction measures which are outlined below in **“**Measures to be implemented.”

Based on the characteristics of a —moderate disruption” the Division of Climate, Coastal & Energy shall immediately initiate a Level III ECL. If it is determined, with confidence, that the pipeline will be returned to service there is no need to elevate to a higher ECL nor need to implement additional state action, unless the federal government directs such action. If, however, the shortage becomes more severe and warrants implementation of a Level IV Emergency Phase ECL, the DEMA, as provided within the State of Delaware Emergency Response and Recovery Plan, becomes the lead agency, and Division of Climate, Coastal & Energy and Motor Fuel Working Group will act as support during the course of the emergency.

During a Level III Alert Phase a news release statement outlining the details of the situation and a request for the public's and state agency attention to suggested and mandatory contingency measures will be developed by the Division of Climate, Coastal & Energy and released by the Energy Response Team as soon as practicable.

As in the previous Levels the Energy Response Team is responsible for scheduling all briefings for the media during the alert Phase. The Energy Response Team will provide the Division of Climate, Coastal & Energy accurate information obtained from the Division of Climate, Coastal & Energy for dissemination to the public, advising them on the status of the situation and providing guidelines for energy demand reduction and mandatory programs. The Public Information Officer (PIO) in coordination with the Division of Climate, Coastal & Energy may deliver copies of Situation Reports to State Legislators; prepares briefing packages for the Governor and the State Legislature and answer inquiries from state and local elected officials.

Measures to be implemented:

Public:

- Clearly and firmly relay to the public that there is currently no need to panic.
- Require the observance of posted speed limits and increase enforcement.
- Encourage fuel conservation for the coming week,
- Encourage the use of alternative fuels and transportation.
- Encourage ridesharing for the coming week.
- Establish minimum and maximum fuel requirements to reduce "topping-off' behavior and "stockpiling" of fuel.

State Agencies:

- Implement restrictions on state employee travel.
- Direct state agencies to reduce fuel usage.

LEVEL IV - EMERGENCY

Description: The Level IV Emergency response (a major disruption in fuel supply) may also be characterized by a potential (advanced knowledge) or a realized (occurring) impact on supply to or from retail service stations that is expected to extend beyond three days. Regardless of the cause, the disruption may be characterized by limited or no transport of product to retail outlets, lack of product at retail outlets, and the formation of "gas lines" at retail outlets as a result of public reaction to a supply shortage.

Depending upon the severity of the situation a Level IV ECL could result in conditions that threaten public health and safety, and which would involve immediate coordinated efforts with the DEMA and perhaps assistance from FEMA and DOE.

Communication and Response: Level IV ECLs will be communicated immediately to the Division of Climate, Coastal & Energy and DEMA to be governed by the DEMA, under the State of Delaware Emergency Response and Recovery Plan, in consultation with the Division of Climate, Coastal & Energy." (During this level, the DEMA, as provided within the State of Delaware Emergency Response and Recovery Plan, is the lead agency, and the Division of Climate, Coastal & Energy and Motor Fuel Working Group will act as support during the course of the declared emergency.)

Disruption response and details of the events will be immediately communicated to the DEMA. In addition, a news release statement outlining the details of the situation and a request for the public's and state agency attention to suggested and mandatory contingency measures will be developed and released by the DEMA or the Division of Climate, Coastal & Energy as soon as practicable.

Measures to be implemented:

DEMA/Division of Climate, Coastal & Energy (as needed)

- Acquisition of product from alternative sources (Truck or rail).
- Odd-Even Motor Fuel Sales Restrictions
- Maximum Purchase for Separate Containers

- Minimum and Maximum Motor Fuel Purchase Requirements
- Posted Hours of Operation
- Prohibited Hours of Sale
- Retail Service Station Fuel Reserve Plan
- Uniform Flag System for Motor Fuel Sales
- Initiate Retail Service Station Fuel Reserve System

Public:

- Clearly and firmly relay to the public not to panic.
- Require the observance of posted speed limits and increase enforcement.
- Demand fuel conservation for an indefinite period of time.
- Demand the use of alternative fuels and transportation as possible.
- Demand ridesharing for the coming week.
- Demand adherence to ALL measure listed above.
- Establish minimum and maximum fuel requirements to reduce "topping-off' behavior and "stockpiling" of fuel.

State agencies:

- Implement restrictions on state employee travel.
- Demand state agencies to reduce fuel usage. Demand alternative work hours.
- Implement priority user system for access to DELDOT fuel stations located throughout the State.

• Operational Procedures

A. Agency

1. Division of Climate, Coastal & Energy - Level I – III Incidents

- The Division of Climate, Coastal & Energy shall be the lead agency during ―shortage situations‖, in consultation with the Delaware Division of Weights and Measures. DEMA, the Division of Climate, Coastal & Energy, and the Motor Fuel Working Group
- The Division of Climate, Coastal & Energy will communicate regularly with the U.S. Department of Energy (DOE) Office of Cybersecurity, Energy Security, and Emergency Response, and update DOE as to the status of a given energy shortage or emergency. The Division of Climate, Coastal & Energy staff will respond to DOE requests for information, including Situation Reports.
- Division of Climate, Coastal & Energy Energy Coordinator shall direct Division of Climate, Coastal & Energy staff to proceed with specific elements of the response plan. Using the data and analysis provided by staff, the GEO Director shall present recommendations to the Governor on how best to respond to the impacts of the motor fuel shortage.
- The Division of Climate, Coastal & Energy staff shall assist the GEO Director in briefing the DEMA and the Governor on the status of an energy shortage. They shall initiate multi-level communications with government and private industry and shall regularly brief the Division of Climate, Coastal & Energy Coordinator on the results of the staff's information gathering and analysis.

- The Motor Fuel Working Group shall monitor the situation, do impact analysis, prepare response plans and reports, and provide program implementation. The Working Group shall maintain a network of contacts with other government levels and private industry.
- The Division of Climate, Coastal & Energy is responsible for scheduling all briefings for the media. The Energy Response Team at the direction of the Division of Climate, Coastal & Energy shall disseminate accurate information, obtained from the Division of Climate, Coastal & Energy Staff, to the public, advising them on the status of the situation and providing guidelines for energy demand reduction and mandatory programs.
- The Division of Climate, Coastal & Energy Staff shall be responsible for situation monitoring, analysis of impacts, response planning, report preparation, and program implementation. The staff will maintain a network of contacts with other government levels and private industry.

2. Delaware Division of Weights and Level I – III Incidents
    - The DEMA may activate the Delaware Energy Emergency Response Plan when one or more of the three identified triggers are met.
        - ◊ Extended refinery shutdown
        - ◊ A major supplier shutdown
        - ◊ Independent supplier calls
    - The Division of Climate, Coastal & Energy Coordinator will authorize staff to begin collecting data including the following;
        - ◊ terminals
        - ◊ pipeline tickets
        - ◊ retail marketers, station inventories/closures
    - The Division of Climate, Coastal & Energy Coordinator will be able to supply answers to the following:
        - ◊ How much fuel is in the terminals
        - ◊ How much is expected in the near future
        - ◊ What is the historical demand
        - ◊ How many retail outlets are operational
    - The Division of Climate, Coastal & Energy Coordinator will initiate the internal communication plan to inform field personnel that routinely interact with service station personnel and the public.
3. Environmental Quality
    - At the Moderate Disruption Level, the Division of Climate, Coastal & Energy Coordinator, in consultation with the Division of Climate, Coastal & Energy and the Motor Fuel Working Group, may initiate preliminary contacts with the U.S. Environmental Protection Agency – Office of Enforcement and Compliance Assurance (OECA) about a possible request of a No Action Assurance decision. Such requests will adhere to the format prescribed in OECA‟s August 27, 2004 memorandum —Procedure and Framework for Reviewing Requests for No Action Assurance to Address a Temporary Fuel Supply „Shortage‖‖ (link).

4. Delaware Department of Transportation (DELDOT) - Level I – III Incidents
    - Assess current fuel inventory at each DELDOT fueling location
    - Work with fuel vendors on product delivery status
    - Implement Conservation Measures – (DELDOT ONLY)
    - Submit an information bulletin to departments and other agencies with information on fuel system status
    - Establish a fuel use priority list by agency/organization/vehicle emergency response vehicles etc.
5. Delaware Emergency Management Agency (DEMA) - Level I – IV Incidents
    - Participate in Governor's Motor Fuel Working Group
    - Maintain communication with Division of Climate, Coastal & Energy

Participating Agencies:

- Division of Climate, Coastal & Energy
- Delaware Department of Technology and Information
- Delaware Public Service Commission
- Delaware Emergency Management Agency (DEMA)
- Delaware Weights and Measures
- Delaware Attorney General's Office
- Delaware Department of Transportation

Cooperating Agencies:

- U.S. Department of Energy (DOE) Office of Cybersecurity, Energy Security, and Emergency Response (CESER)
- U.S. Department of Homeland Security (DHS) Cybersecurity & Infrastructure Security Agency (CISA)
- U.S. Environmental Protection Agency (EPA)
- Emergency Management Assistance Compact (EMAC)

Individual and Group Resources:

- Governor
- Division of Climate, Coastal & Energy
- Governor's Public Information Officer

General Resources:

- Statewide list of retail service stations participating in emergency fuel distribution
- State Emergency Operations Center

APPENDIX M. CYBER SECURITY AND THREAT OVERVIEW

• Cyber Within Energy

Energy systems (electric, oil and natural gas) within Delaware use computing technologies to manage business systems and to control and monitor the processes and transportation of energy from production/generation to end use. The energy sector relies heavily on both information technology (IT) systems and operational technology (OT) systems.

OT systems include industrial control systems (ICS) that consist of purpose-built hardware, software, and data networks developed specifically for industrial customers. These systems were designed and built using tools and technology created before the Internet and technology boom of the late 90s. While these older systems are still in use, they have evolved and adopted newer technologies, including IT technologies built to allow internet connections.

Today the energy sector is technology driven, and these changes have resulted in many benefits including improvements to efficiency, resiliency, and flexibility. However, cybersecurity vulnerabilities and the capabilities of malicious actors have also changed over the past 20 years. Cyber threats are not limited to personally motivated individuals. Threats also come from well financed criminal and nation-state groups focused on profit, political gain, or power. The skill level and ability of these groups to compromise Internet-connected, Internet-adjacent, or even traditional ICS assets that were never designed to connect to the internet continues to grow.

Delaware Department of Technology and Information (DTI)

The Delaware Department of Technology and Information (DTI) is responsible for Cybersecurity for all three branches of government and the entire K-12 public and charter school network. This department is to provide direct education and assistance to nearly all governmental and educational organizations. The DTI also includes implementing the Delaware Cybersecurity Advisory Council (DCSAC) as mandated in Title 29, Chapter 90C[67] of the state code.

The Delaware Public Service Commission has been conducting annual reviews and questionnaires of regulated utilities across cybersecurity categories since 2016. The Delaware PSC has determined through the utility interviews and public workshops, that the utilities are taking the actions they need to in order to continue ensuring safe, adequate, and reliable utility service to its customers. For additional information on the interview categories, questions, utility responses, please visit the website here.[68]

• Technologies

OT systems interact with the physical environment or manage devices that interact with the physical environment. These systems monitor or control physical devices, processes, and events. Examples include:

- Energy Management Systems and Supervisory Control and Data Acquisition (SCADA)
- Oil refinery, gas processing and electricity generation distributed control systems (DCS)
- Pipeline pump/compressor stations and electrical substations
- General industrial control systems used in energy processes

A key area of distinction between IT and OT systems is that a cyber incident within energy OT systems can result in a physical consequence in addition to potential losses of data or damage to an organization's reputation. Some differences in the possible consequences/impact of an attack on an IT system compared with an OT system are described in the table below.

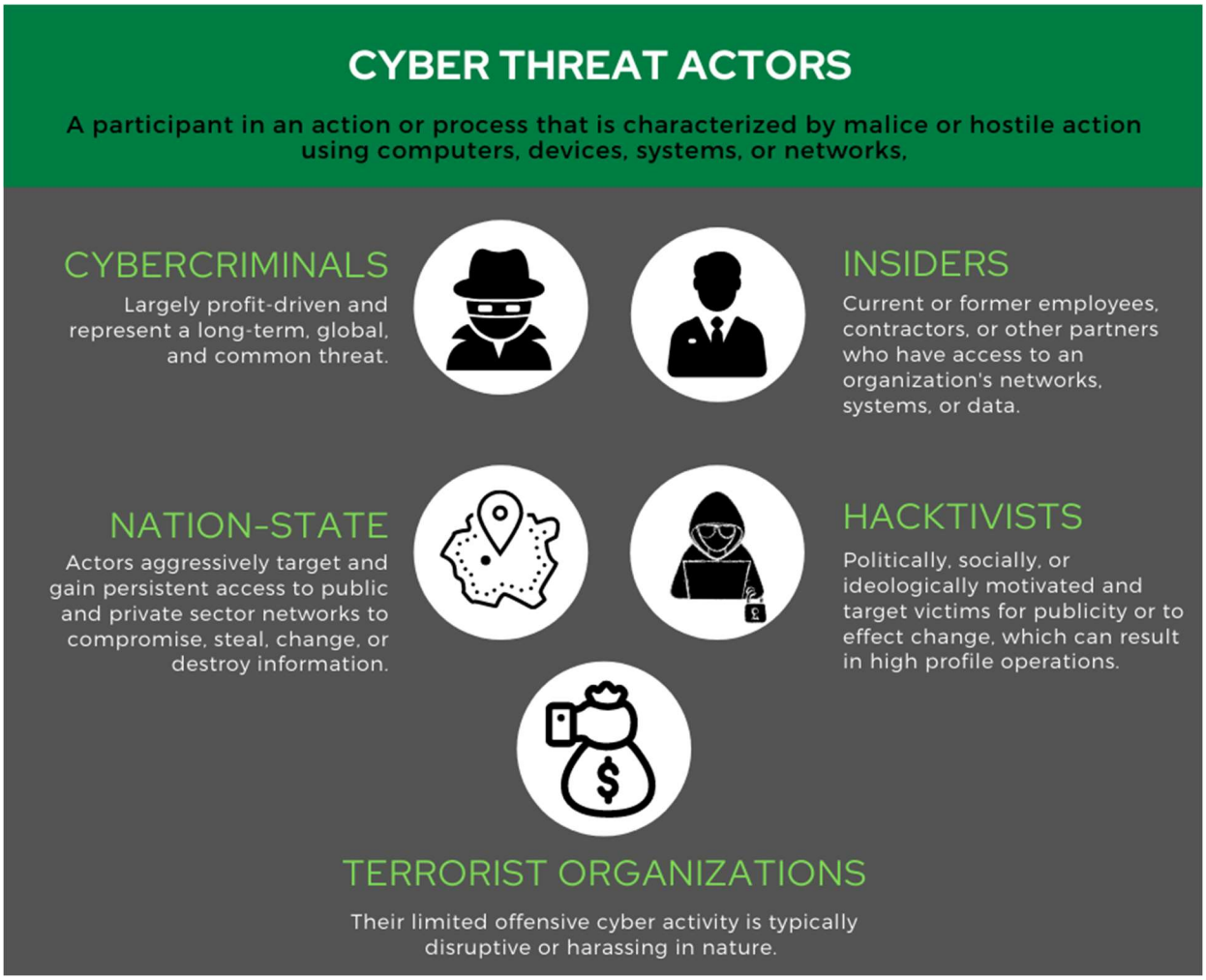
[67] https://delcode.delaware.gov/title29/c090c/sc03/index.html
[68] https://depsc.delaware.gov/cybersecurity/

	Information Technology	Operational Technology
Impacts	• Brand damage/ loss of confidence in company • Loss of personally identifiable information (PII) • Loss of business data • Customer/supplier payment issues	• Operator loses visibility into operations • Operator forced to switch to manual operations mode • Supply fails to meet demand • Disruption to basic daily activities – loss of power or access to fuel. • Health, safety, and economic impacts • Impacts from prolonged disruptions can cascade into larger consequences

A cyber-physical event can cause loss of power or access to fuel, initiate prolonged cascading impacts, create potential risks to health and safety, and result in economic impacts to not just the company but to the people and businesses that rely on that energy. For cybersecurity best practices for industrial control systems, CISA and DOE created an infographic outlining key areas of consideration.

• Cybersecurity Threats

The Annual Threat Assessment that the Office of the Director of National Intelligence (ODNI) released in 2022, emphasizes, as it has in the past, that cyber threats from nation states remain acute. ODNI's concerns are focused on Russia, China, Iran, and North Korea, all of whom currently possess the ability to remotely damage infrastructure in the US or compromise supply chains. We know that adversaries – whether politically, socially, or financially motivated – are targeting our nation's energy infrastructure and the digital supply chain. The graphic below shows categories of different kinds of threat actors.



The energy sector is uniquely critical because all of the other critical infrastructure sectors depend on power and fuel to operate. Unfortunately, this makes the Nation's energy infrastructure an attractive target for cyber attacks. The table below lists known cyber attacks that have impacted energy systems. All energy systems have vulnerabilities to cyber threats, 100% security is not possible. But many steps can be taken to harden OT systems to mitigate these threats.

Understanding the current and evolving threat landscape as well as possible consequences of a cyber-physical event can help state officials and energy owners and operators understand risks. Knowledge about risks can then be used to prioritize investments, such as purchases, staff resources, and training, based on the kinds of threats and vulnerabilities that pose the greatest risks to an organization. Investments can be focused on areas that can mitigate the highest risks. Because the majority of the nation's critical infrastructure is owned and operated by private companies, both the government and private sector have a common incentive to reduce the risks of disruptions to critical infrastructure. The National Infrastructure Protection Plan (NIPP) recognizes that public-private partnerships are vital to keeping critical infrastructure safe and secure, including from cyber attacks.

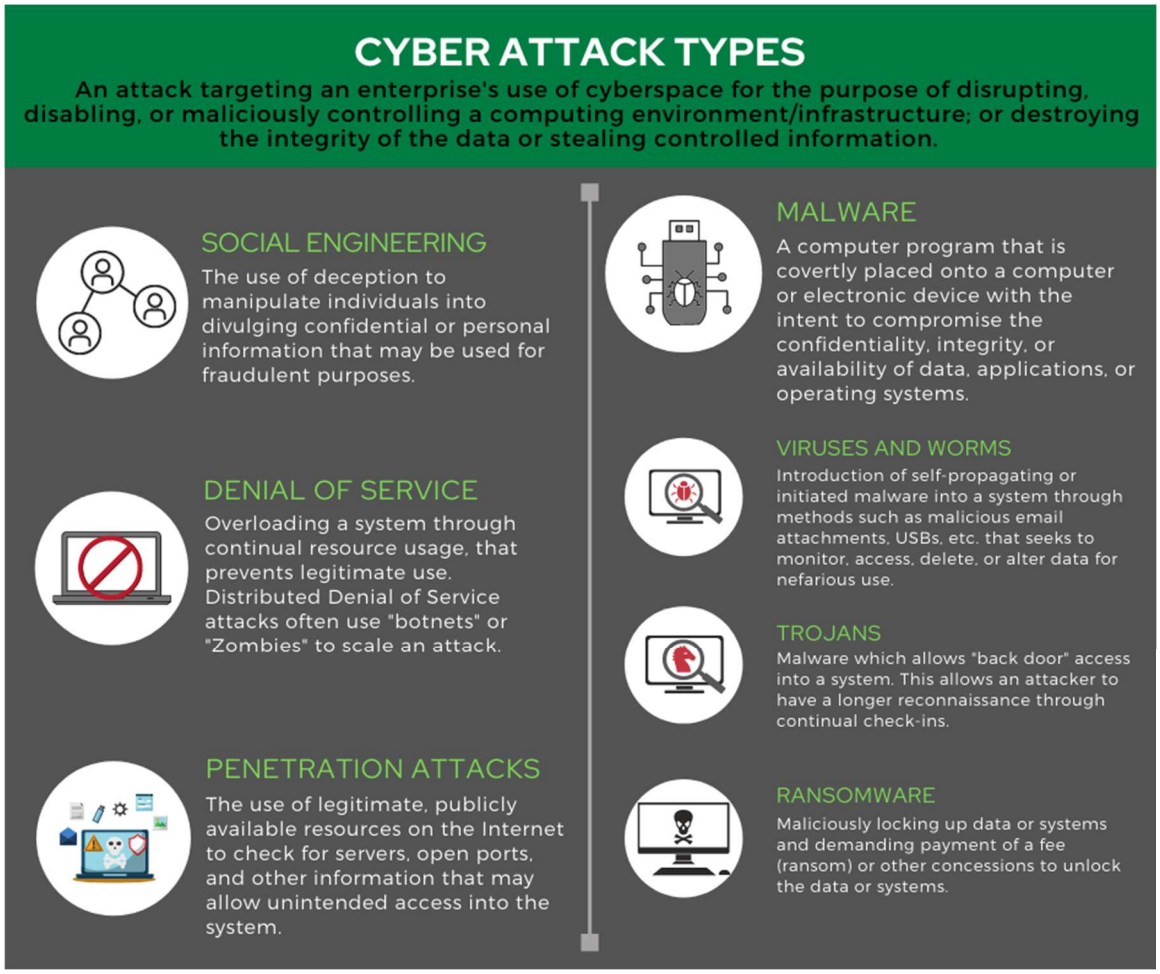
ICS Cyber Attack History / Examples

Attack Name	Physical Target	Method	Impact / Implication
Stuxnet (2010)	Nuclear Facilities (Iran)	Stuxnet was the first publicly known malware to specifically target control systems with the intent to damage physical infrastructure. The malware was especially notable due to its covert nature - presenting fake data to operators while hiding operations underway.	Proof that hardware is an equal threat vector and that ICS systems are targets.
BLACKENERGY 3 (2015)	Regional electricity distribution company (Ukraine)	The attackers likely spent an extended period of time doing reconnaissance before executing their final attack. Attackers used spear phishing emails, multiple variants of malware, and manipulation of documents as part of a broad campaign. After gaining initial access, they captured valid credentials and leveraged those credentials to access electric power SCADA systems. Successful penetration of the OT systems enabled them to shut down and disable portions of the distribution power grid.	Approximately 225,000 Ukrainian power customers lost power. Manual black start required.
CRASHOVERRIDE (2016)	Electrical substation (Ukraine)	Leveraged previous successful ICS attacks such as Stuxnet, Havex, and BLACKENERGY 3, as learning mechanisms to develop industrial system malware that could work on multiple infrastructures without a human operator (unlike BLACKENERGY 3).	Kiev, Ukraine experienced a one-hour power disruption. The attack failed to accomplish apparent goals, but it was a demonstration of the attacker's ability to accomplish automated cyber attacks on critical infrastructure.
Triton / Trisis (2017)	Petrochemical Facility (Saudi Arabia)	The first publicly known attack on a Safety Instrumented System (SIS), a system of last resort intended to protect lives by triggering emergency shutdowns of industrial processes if unsafe conditions are reached. Attacker gained access and deployed malware directly onto the SIS to gain *full access to the SIS without plant operator knowledge.* The malware installation triggered a failsafe that activated the SIS.	Shut down plant operations at a petrochemical facility, triggering a full investigation. Preventing safety mechanisms from performing their intended function can result in physical consequences.
Unnamed Attack (2019)	U.S. electric grid	A cyber attack temporarily created blind spots between a control center and a number of remote generation sites in the western U.S. by exploiting a vulnerability in a technology vendor's firewall.	Denied reliable communications between a control center and the power generation controlled
EKANS / Snake (2020)	ICS operations (Enel and Honda)	Ekans/Snake utilized popular ransomware attack methodology, but targeted control system processes instead of more common targets. This malware contains static lists to	First known ransomware that targeted ICS/OT. Manufacturing operations disrupted on 3 continents after victims decided to suspend ICS/OT operations.

		automatically kill known processes run by ICS.	
Colonial Pipeline Ransomware Attack	U.S. petroleum pipeline	Darkside Ransomware The cyber attack targeted Colonial Pipeline's IT network, prompting the company to proactively shut down pipeline operations as a precaution.	Fuel stopped flowing, affecting Southeast and MidAtlantic states who are heavily dependent on the Colonial Pipeline for their fuel. Limited alternatives to the pipeline. Consumer panic buying, further limited supply which was also exacerbated by tanker truck driver shortage

- ## Cyber Attack Types

In addition to understanding who cyber threat actors are, it is also important to understand the different methods those actors may use to compromise important systems, networks, and infrastructure. Common types of cyber attacks are listed in the graphic below.



APPENDIX N. ADDITIONAL INFORMATION PERTAINING TO FEDERAL AGENCY ASSISTANCE

• U.S. Department of Energy

DOE's energy emergency support responsibilities and capabilities are distributed among several elements within the Department. DOE sets forth the missions of the key elements as follows:

Office of Cybersecurity, Energy Security, and Emergency Response (CESER)

This Office plays a critical role in maintaining situational awareness, discovering and mitigating of cyber threats, and orchestrating response and recovery operations.

Established in 2018, the U.S. Department of Energy's Office of Cybersecurity, Energy Security, and Emergency Response (CESER) exists to provide

> *"Capabilities and support to energy sector partners to advance critical energy infrastructure security and resilience from all-hazards and manages key DOE authorities and responsibilities. These include serving as the Sector-Specific Agency (SSA) for the energy sector, as the coordinating agency for Emergency Support Function (ESF) #12-Energy under the National Response Framework."*

CESER's responsibilities are established through various authority statements passed down by both the executive branch and the DOE. CESER outlines five goals with multiple objectives which will structure its response to security issues nationwide. The goals and activities are:

1. Advance cyber discovery, vulnerability assessment, and rapid risk mitigation.
2. Pursue game-changing R&D and technology transition.
3. Build capacity in the energy sector to understand risks, assess priorities, and identify cost effective security and resilience improvements.
4. Enhance sector-wide situational awareness to inform decision-making in the energy sector.
5. Coordinate effective and efficient emergency response and recovery efforts.

CESER is tasked with addressing the increased frequency and sophistication of cyber threats. CESER is responsible for the Department's investing in research and development (R&D) by industry and the National Labs of the next generation of advanced technologies. CESER leverages the National Labs to test components and configurations based on feedback from industry. The Office also helps support continuous monitoring tools and capabilities for information systems and control networks and identifying best practices are also vital and supported by efforts such as CESER's Cybersecurity Risk Information Sharing Program.

DHS Cybersecurity and Infrastructure Security Agency (CISA)

This Agency leads the national effort to understand, manage, and reduce risk to our cyber and physical infrastructure. They stakeholders in industry and government to each other and to resources, analyses, and tools to help them build their own cyber, communications, and physical security and resilience, in turn helping to ensure a secure and resilient infrastructure for the American people.

Office of Policy

This Office is the principal advisor to the Secretary, Deputy Secretary, and Under Secretary on energy and technology policy issues, including the environmental consequences of energy use. This Office has primary responsibility for the formulation and development of national energy policy and for the conduct of policy analyses. It analyzes, develops, and coordinates departmental science and technology policy, environmental policy including global change policy, and economic policy. It is also responsible for advising the Department's senior management on issues related to the Department's environmental security and energy

emergency policies.

Energy Information Administration (EIA)

EIA was created by Congress in 1977. It is a statistical agency of the U.S. Department of Energy that provides policy-independent data, forecasts, and analyses to promote sound policy making, efficient markets, and public understanding regarding energy and its interaction with the economy and the environment. EIA distributes four types of information products: Energy data, analyses, forecasts, and descriptive information about our products. Many of the products, such as the Petroleum Supply Monthly, deal with specific industries.

Of particular value to a broad range of customers are products that contain data on all fuel types presented in an integrated manner. Some key releases of integrated information are the Monthly Energy Review, the Annual Energy Review, the Short-Term Energy Outlook, and the Annual Energy Outlook.

Most of the energy data are collected by EIA staff who design and send our statistical surveys to energy producers, users, transporters, and certain other businesses. Companies and households report directly to us. EIA also obtains energy data from other sources, such as trade associations and other government agencies.

EIA's analysis products are technical reports and articles that analyze issues about energy including economics, technology, energy production, prices, distribution, storage, consumption, and environmental effects. The Administration's forecasts cover all energy types, and include forecasts of supply, consumption, prices, and other important factors. There is a short-term forecast that goes out 6 to 8 quarters in the future, and a midterm forecast that goes out 20 years. Some of EIA's forecasting models are available on their Web site at http://www.eia.gov. Other EIA products are descriptions of information products that include directories of survey forms, lists of publications, electronic products and models, a guide to energy education resources, and complete lists of energy data contacts to call who have answers to energy questions.

Additional Activities

The following actions are taken in an emergency that requires activation of the Federal Response Plan and ESF-12.

- DOE Headquarters will establish the Headquarters Emergency Management Team (EMT) and assign personnel to temporary duty at the Federal Emergency Management (FEMA) Headquarters, Regional Operations Center, and Disaster Field Office as needed;
- The ESF-12 priority will be to save lives, protect property, and assist other ESFs by aiding in the restoration of damaged energy systems; and
- Within 24 hours of implementation of the Federal Response Plan or upon instruction from FEMA, DOE Headquarters will start submitting situation reports to FEMA Headquarters.

Emergency Management Assistance Compact (EMAC)

EMAC Role and Responsibility

EMAC is the first national disaster–relief compact since the Civil Defense and Disaster Compact of 1950 to be ratified by the U.S. Congress. Since ratification and signing into law in 1996 (Public Law 104-321), 50 states, the District of Columbia, Puerto Rico, Guam, U.S. Virgin Islands and the Northern Mariana Islands have enacted legislation to become EMAC members.

EMAC offers assistance during governor-declared states of emergency or disaster through a responsive, straightforward system that allows states to send personnel, equipment, and commodities to assist with response and recovery efforts in other states. Through EMAC states can also transfer services (such as shipping newborn blood from a disaster-impacted lab to a lab in another state) and conduct virtual missions

(such as GIS mapping).

The strength of EMAC and the quality that distinguishes it from other plans and compacts lie in its governance structure; its relationship with federal agencies, national organizations, states, counties, territories, and regions; the willingness of state and response and recovery personnel to deploy; and the ability to move any resource one state wishes to utilize to assist another state.

EMAC is implemented within the State Emergency Management Agency on behalf of the Governor of the State. This provides a consistent and coordinated response across the nation.

• Federal Emergency Management Agency and The Federal Response Plan

FEMA Role and Responsibility

Under the Stafford Act and Executive Orders 12148, Federal Emergency Management, and 12656, Assignment of Emergency Preparedness Responsibilities, the Federal Emergency Management Agency has been delegated primary responsibility for coordinating Federal emergency preparedness, planning, management, and disaster assistance functions. FEMA also has been delegated responsibility for establishing federal disaster assistance policy.

Federal Response Plan

FEMA has the lead in developing and maintaining the Federal Response Plan which describes the structure for organizing, coordinating, and mobilizing federal resources to augment state and local efforts under the Stafford Act and its implementing regulations that appear in 44 CFR 206. The FRP also may be used in conjunction with federal agency emergency operations plans developed under other statutory authorities as well as memorandums of understanding (MOU) among various federal agencies. The FRP is implemented through regional supplements developed by FEMA, and the regional offices of other federal agencies, that describe specific actions, operating locations, and relationships to address the unique needs of the region and states. From time to time, operations supplements to the FRP may be issued to address special events that merit advanced planning, such as the Olympics or Presidential inaugurations.

Organization of the FRP

The FRP consists of six sections, two of which are the Basic Plan and Emergency Support Function Annexes. The Basic Plan presents the policies and concept of operations that guide how the federal government will assist disaster-stricken state and local governments. It also summarizes federal planning assumptions, response and recovery actions, and responsibilities. Separate Emergency Support Function Annexes describe the mission, policies, concept of operations, and responsibilities of the primary and support agencies involved in the implementation of key response functions that supplement state and local activities. Energy is ESF-12.

State Assistance

Under the Stafford Act, a Governor may request the President to declare a major disaster or an emergency if an event is beyond the combined response capabilities of a state and affected local governments. Based upon the findings of a joint Federal-State-local Preliminary Damage Assessment (PDA) indicating the damages are sufficient to warrant assistance under the Act, the President may grant a major disaster or emergency declaration. No direct Federal assistance is authorized prior to a Presidential declaration. However, FEMA can use limited pre-declaration authorities to move Initial Response Resources (critical goods typically needed in the immediate aftermath of a disaster, e.g., food, water, emergency generators) and emergency teams closer to potentially affected areas. FEMA also can activate essential command and

control structures to lessen or avert the effects of a disaster and to improve the timeliness of disaster operations.

• Additional Assistance

Additionally, when an incident poses a threat to life and property that cannot be effectively dealt with by state or local governments, FEMA may request the Department of Defense (DOD) to utilize its resources prior to a declaration to perform any emergency work —essential for the preservation of life and property‖ under the Stafford Act. Following a declaration, the President may direct any federal agency to use its authorities and resources in support of state and local assistance efforts to the extent that provision of the support does not conflict with other agency emergency missions. A state must commit to pay a share of the cost to receive certain types of federal assistance under the Stafford Act. In extraordinary cases, the President may choose to adjust the cost share or waive it for a specified time period. The Presidential declaration notes any cost-share waiver, and a FEMA- State Agreement is signed further stipulating the division of costs among federal, state, and local governments and other conditions for receiving assistance.

• Energy Consequences

A natural disaster, such as an earthquake, may produce energy consequences such as pipeline ruptures disrupting petroleum transmission and natural gas or transmission tower collapses interrupting gas flow and electric transmission. Conversely, failure of a primary transmission line may result in an energy emergency in its own right.

APPENDIX O. MONITORING FUEL SUPPLIES

Energy supply monitoring should take place regularly. State Energy Offices and Public Utility Commissions keep track of energy developments pertaining to the state, its region, and the nation through industry contacts, trade publications, and statistical reports. The EIA web site http://www.eia.gov/ provides an abundance of reports and statistics on all types of energy, arranged in a variety of ways to make the data easy to find.

• Monitoring Electricity

General Information

Day-to-day electricity supply and demand are monitored on a routine basis by operating companies. Utilities generally prepare annual forecasts estimating demand for electricity and the means to satisfy it for the following five years. Other forecasted information includes:

- expected price for fuel and other necessary purchases;
- expected fuel and purchased power availability; and
- plant status and similar data.

Reporting to the DOE

Utilities are also required to report to the DOE Emergency Operations Center any of the following events:

- loss of firm system loads;
- voltage reductions;
- requests to the public to reduce usage;
- vulnerabilities that could impact system adequacy or reliability; and fuel supply emergencies (see Power System Emergency Reporting Procedures, May 1989, U.S. DOE).

Data Sources

ELECTRICITY SALES

Monthly sales of electricity are published by state, month, and sector by the EIA in the Electric Power Monthly found at https://www.eia.gov/electricity/monthly/

ELECTRICITY PRODUCTION BY FUEL SOURCE

This information is published in the EIA Electric Power Monthly. That includes, in English units (tons and barrels):

- the quantity of fuel used; kilowatt hour produced;
- fuel costs by state.
- the source of this information is the Monthly Report of Cost and Quality of Fuels for Electric Plants, FERC-423
- Levels Fuel Inventories Available for Generation Coal inventories and prices are published in the EIA Quarterly Coal Report lists the amount of coal consumed in each state and the price paid by each sector. Levels of fuel inventories will be estimated by each utility and reported by the number of days of supply on hand at each location for coal and oil-fired plants.

GENERATION CAPACITY AND PLANT AVAILABILITY

This information can be obtained from the EIA.

- https://www.eia.gov/electricity/data.php#gencapacity

REGIONAL SYSTEM RELIABILITY FORECAST

NERC publishes annual reports of regional system reliability. These reports assess regional reserve margins

by comparing net system availability with peak load projections and system-pool reserve availability.

COAL DISTRIBUTION

This data is published in the EIA Quarterly Coal Report and is a source of information regarding the origin and method of shipping coal.

COOLING AND HEATING DEGREE DAYS

Cooling and heating degree day data are available from the National Weather Service and National Oceanic and Atmospheric Administration (NOAA). This data may be used to describe extreme weather conditions that create peak loads on the electrical generation system.

CONTACT NAMES, ADDRESSES, AND TELEPHONE NUMBERS

It is important to maintain a list of key utility personnel involved with emergency operations at key locations.

Exercise caution when using and integrating data from these various sources. Direct communication with electric utilities and the state agencies will be helpful in avoiding inaccurate conclusions.

• Monitoring Natural Gas

Complexities In Monitoring Natural Gas

Natural gas markets have become more complex to monitor in recent years as a result of the direct purchase agreements between large users and wellhead producers. This decentralization has resulted in a significant decrease in available data. Adequate monitoring of natural gas requires information covering:

- the quantity of interstate deliveries to LDC;
- storage levels;
- gas injection rates into storage;
- projected system send-outs;
- spot market and contract prices;
- curtailment notices; and
- heating degree days.

Data Sources

INTERSTATE DELIVERIES TO LDC

Natural gas deliveries by sector are shown in the EIA Natural Gas Monthly that shows the amount of natural gas delivered into the state for sale.

- Storage Levels and Injection Rates State natural gas inventories are reported in the EIA Natural Gas Monthly
- From this information the percentage of storage capacity being used at any time can be calculated.

PROJECTED SYSTEM SEND-OUTS

Natural gas demand and supply projections are provided by the LDC as part of their annual GCR filings. These projections include storage field inventory balances. Potential shortages can be identified when long-term supply is inadequate to meet projected demand.

SPOT AND CONTRACT PRICES

Average city gate prices (price to the LDC as gas is received), and prices by sector, for each state are published in the EIA Natural Gas Monthly Price is an indicator of aggregate supply.

When short-term prices are lower than long-term contract prices, supplies are generally judged to be in excess of demand. Conversely, when long-term contract prices are lower, spot markets are assumed to be

tight, indicating that demand may be exceeding supply.

CURTAILMENT NOTICES

Interstate pipelines provide notices of curtailments to FERC. Notices of curtailment are early indicators of reduced supply. The supplementary supply required to offset the reduction in deliveries may need to be calculated and perhaps satisfied from other in-state supplies, depending upon the current levels of storage volumes, actual system send outs, and inter-tie exchanges.

HEATING DEGREE DAYS

Heating degree-day information is provided the National Weather Service on a daily and monthly basis

Statistics can often be obtained through local or regional weather stations. These values indicate periods of extreme cold weather that bring on increases in demand for natural gas for space heating.

CONTACT NAMES, ADDRESSES AND TELEPHONE NUMBERS

A list of individuals that are involved with emergency-related activities and planning in state government, at local distribution companies, and interstate pipeline companies is be needed in any plan (see Appendix A).

• Monitoring Petroleum

Monitoring Petroleum Markets

Petroleum markets are monitored continuously by marketers and commercial buyers. Statistical organizations such as the EIA maintain databases containing information used to determine recent market behavior and anticipate supply disruptions. The American Petroleum Institute (API) is another source of information. While it is relatively easy to obtain aggregate petroleum data, the nature of the petroleum market, and the lack of regulation, makes learning about individual companies relatively difficult. Following are some suggestions for working with the industry to obtain information.

LIAISON

To ensure proper interpretation of the data, contact is maintained with liaisons within the petroleum industry. Monitoring requires a variety of data, including:

- petroleum product use; Prices;
- Inventories; Production; and
- sources of crude oil.

PETROLEUM INFRASTRUCTURE

Petroleum supply infrastructure information is useful. Examples include:

- marine and pipeline terminals;
- locations of terminals;
- terminal capacity; and terminal product transfer capability (i.e., number of loading rack positions). Most important, monitoring also requires accurate and timely information about:
  - Inventories; and
  - production rates for state and regional refineries.

DECENTRALIZED DELIVERY NETWORK

Because petroleum is distributed through a decentralized network, there is no single source of information by which to assess or characterize emerging problems. Anti-trust laws also prohibit oil companies from sharing information regarding supply availability and price. Consequently, petroleum information is either published by a third party that can maintain the anonymity of sources or is confidential and not available. Therefore, the state's role in developing data and assessing supply is more critical for petroleum products than it is for electricity or natural gas, where utilities control supply and distribution within franchised

service territories.

ESTIMATING THE SEVERITY OF A SHORTAGE

The severity of a fuel shortage can be estimated by reference to various indicators, but to quantify a statewide shortage in terms of an accurate percentage of shortfalls is difficult. Further, due to the variety of supply arrangements, distribution systems, and local consumption patterns, some communities may experience a more serious shortfall than others. Therefore, it is not always useful to tie the phases of a flexible energy emergency plan to specific percentage shortage levels.

SUPPLY AND DEMAND

The following sources provide information useful in monitoring petroleum supply and demand

Motor Fuel Consumption (Gasoline)

The total number of gallons of gasoline used is provided on a monthly and annual basis of motor gasoline sales revenue by the Federal Highway Administration.

PETROLEUM PRODUCT DEMAND

Monthly deliveries of petroleum products to states by primary suppliers are reported in the EIA Monthly Report of Petroleum.

FORM EIA-782C.

This report contains actual deliver volumes for the proceeding month for each petroleum product supplied and projected deliveries for the upcoming month. This information is necessary in order to determine the severity of a petroleum shortage and to calculate the amount of petroleum product to be set aside for emergency hardships. Monthly historical sales of all petroleum products by state are also reported in the EIA C-007 Report, First Sales of Petroleum Products into States for Consumption.

FORM EIA-782C WHOLESALE AND RETAIL PRICES WHOLESALES

Wholesale and Retail Prices Wholesale and retail prices are available on the EIA web site at:

https://www.eia.gov/petroleum/data.php#prices The data include weekly and monthly prices such as the EIA Petroleum Marketing Monthly, that provides monthly information regarding wholesale and retail prices at the state-level and the Weekly Petroleum Status Report, that provides information on national and international prices and inventory information. In an emergency, more timely information is needed and may be obtained through industry publications such as Oil Price Information Service ’s OPIS-Alerts or the Oil Daily. Special state-conducted telephone surveys of petroleum distributors and retailers are also conducted.

INVENTORIES AND PRODUCTION

Inventory (stocks) and production data can be found on the EIA web site at:

Stocks: https://www.eia.gov/petroleum/data.php#stocks

Production: https://www.eia.gov/petroleum/data.php#crude

Data are presented weekly and monthly by region. Data are reported by regional areas known as Petroleum Administration for Defense Districts (PADD). State level monthly inventories are also published in this report. Weekly data are also available through API at PADD level aggregations.

INFRASTRUCTURE INFORMATION

Relevant information includes a listing of refineries serving the state, their production and storage capacities, the location and capacities of pipelines and terminals, and marine terminals. This information is compiled from various sources including state, industry and other private sources. A list of operable refineries can be found in EIA Petroleum Supply Annual at:
https://www.eia.gov/dnav/pet/pet_pnp_cap1_a_(na)_8O0_Count_a.htm

SOURCE OF CRUDE OIL

The source and volumes of crude oil supply used by regional refineries may be found in the EIA

Petroleum Supply Monthly

This information is needed to estimate the extent to which refiners may need to shift supplies if any given source of crude oil is disrupted. For example, when crude oil was embargoed from Iraq and Kuwait in 1990, the effects of this action on Midwest supplies was able to be determined.

HEATING DEGREE DAYS

Heating degree-day information is provided by the National Weather Service on a daily and monthly basis,

Statistics can often be obtained through local or regional weather stations. These values indicate periods of extreme cold weather, which bring on increases in demand for heating fuels for space heating.

CONTACT NAMES, ADDRESSES, AND TELEPHONE NUMBERS

This information is obtained directly from the oil companies or their various associations and is periodically updated. State petroleum and dealer associations are excellent sources for the names of jobbers and distributors involved with the sale and distribution of gasoline, distillate, LPG and other petroleum products (see Appendix A).

APPENDIX P. ENERGY PROVIDER QUESTIONS

• Spring 2024 Provider Meetings

The interview questions for meetings held in the spring of 2024 were designed to elicit insights into the following areas:

- Perceived risks and vulnerabilities faced by energy providers in Delaware, including natural disasters and cyber threats across energy infrastructure and cross-sector interdependencies.
- Risk mitigation approaches to enhance reliability an end-use resilience.

The following questions were provided to the energy providers as discussion points during the meetings:

General Questions:

1. Do you have an energy security plan?
    a. Can we receive a copy of it?
    b. Do any federal or state regulators require you to have one?
    c. Are there parts of the plan which are confidential?
    d. Is the plan primarily for acute emergencies related to weather, physical attack, cyber-attack,
2. fuel interruptions and shortages, etc.?
3. Do you have an assessment of risks focused on cyber threats and extreme weather events?
4. Do you have a long-term energy security plan that considers climate change, sea level rise in coastal Delaware, expansion due to growth, etc.?
5. Do you have an assessment of risks associated with all major types of energy infrastructure, such as threats/vulnerabilities, consequences, and frequency/likelihood?
6. Do you use GIS or other location mapping to identify risks or locate transmission or distribution networks? Is this information confidential?
7. Do you have any existing interdependencies, either within the state or with adjoining states? (i.e. the natural gas lines that supply generating facilities in Delaware)?
8. Do you participate in energy emergency exercises with DEMA as part of their Emergency Operation Center? Or federal, or other entities that may regulate you? Or with surrounding states. etc.?
9. Do you sponsor or participate in any internal exercises and/or drills?
10. In addition to what EIA may have, can you share any additional information or details on: utility area served, quantity of homes, businesses, any load or volume constraints, etc.?
11. How do you consider the impact of climate change in load forecasting?

Question for Natural Gas Suppliers:

1. Do you provide natural gas to electric utilities such as City of Dover or other generating assets? If so, is that arrangement regulated through PJM, or agreement with the electric provider? How is energy security handled arrangement?

Questions for Electric Providers:

1. Will you be applying for a 40101(d) grant through DNREC to assess risk and vulnerability, or mitigation strategies?
2. Do you have an assessment and mitigation strategy around “Blackstart” capabilities?
3. If you have an emergency plan, does it include cross and interdependencies (i.e. if you include

natural gas, oil, or generating electricity)?

4. Do you have a plan that considers energy security in the context of grid modernization to meet increased population and the transition to increased use of EVs, heat pumps, or general electrification? Does the plan include items distributed energy resources, solar, or offshore wind?
5. How do you incorporate reliability and resilience into your distribution planning?
6. Are you open to collaboration with the State Energy Office for a more coordinated approach to infrastructure planning, integrating distributed energy resources into the distribution grid, assessing the challenges of electrification, and identifying grid assets most susceptible to climate risks, sea-level rise, and general energy security issues?
7. Do you have an annual time-scale chart of the electricity generation and demand in MWh and MW?

Questions for PJM

1. Can you provide a list of generating assets in Delaware (natural gas, oil, coal (i.e. Indian River) and solar? More detailed than what is posted on sources such as EIA?
2. Do any federal regulators require you to have an energy security plan? Are there any elements that you can share?
3. Does PJM consider cross-dependencies and interdependencies (such as natural gas and electricity) in security planning or market planning?

Questions for Liquids Fuels, Gasoline, Heating and Cooking Fuels, etc. Suppliers

1. Does (DE City Refinery or Port of Wilmington) have an energy security plan?
2. Mid-Atlantic Petroleum Distribution Association (MAPDA) is a trade organization representing liquid fuels, etc. interests. Does the organization have an overall security plan, and/or do individual members?
3. Is there a plan in place to provide heating fuels, gasoline, etc. during emergencies related to weather, cyber-attack, physical attack, etc.? Can you share details of those strategies and mitigation measures?

• Summer 2024 Provider Meetings

The discussion questions for meetings held in the summer of 2024 were designed to focus on risk assessment and mitigation approaches and strategies.

DE SESP Utility/Provider Follow Up Questions

Introduction

The Infrastructure Investment and Jobs Act (IIJA)/Bipartisan Infrastructure Law (BIL), introduced a new requirement for states to submit State Energy Security Plans (SESPs).

State Energy Security Plans must assess the current energy security circumstances of the state and propose methods to strengthen energy security abilities of the state. Plans must include the following key elements:

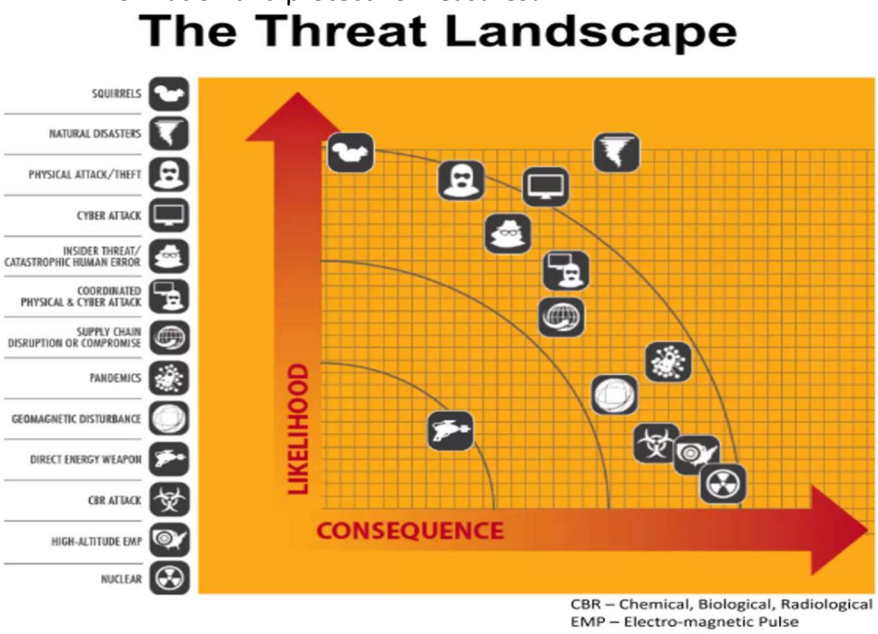
1. Address all energy sources and regulated and unregulated energy providers.
2. Provide a state energy profile, including an assessment of energy production, transmission, distribution, and end-use.
3. Address potential physical and cybersecurity hazards to each energy sector or system.
4. Provide a risk assessment of energy infrastructure and cross-sector interdependencies.
5. Provide a risk mitigation approach to enhance reliability and end-use resilience.

6. Address multi-state and regional coordination, planning, and response and coordination with Indian Tribes with respect to planning and response.

Discussion Goal: for the SEO to understand how you prevent, prepare for, and respond to emergencies.

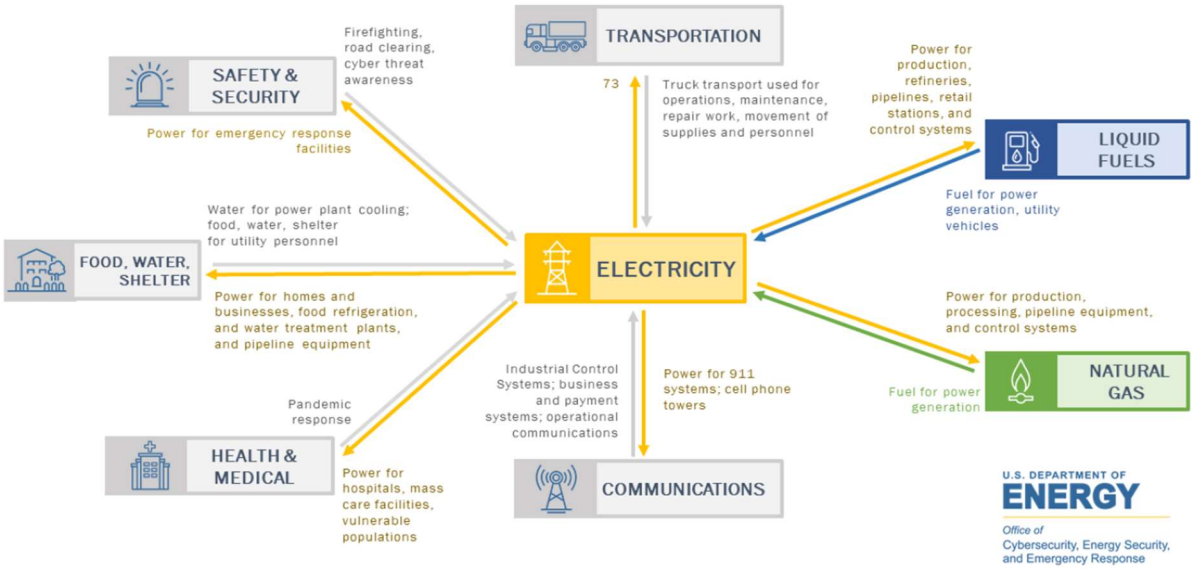
Risk Assessment Questions

I. Overview
   a. How do you think about risk to providing your service?
   b. What do you consider your number one risk?
   c. How do you prioritize by criticality?
   d. (How) do you communicate concerns about potential risks to asset owners? *[pjm]*
   e. How do you communicate concerns about potential risks to entities in your supply chain?
   f. How do you communicate with stakeholders and service providers to share updated threat information and protective measures?

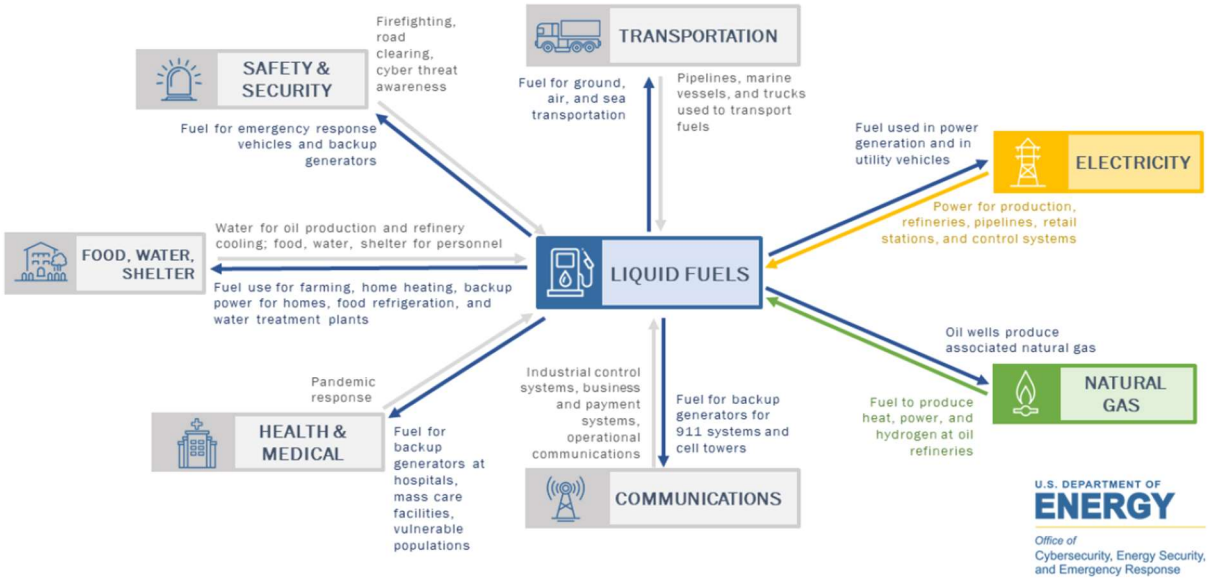


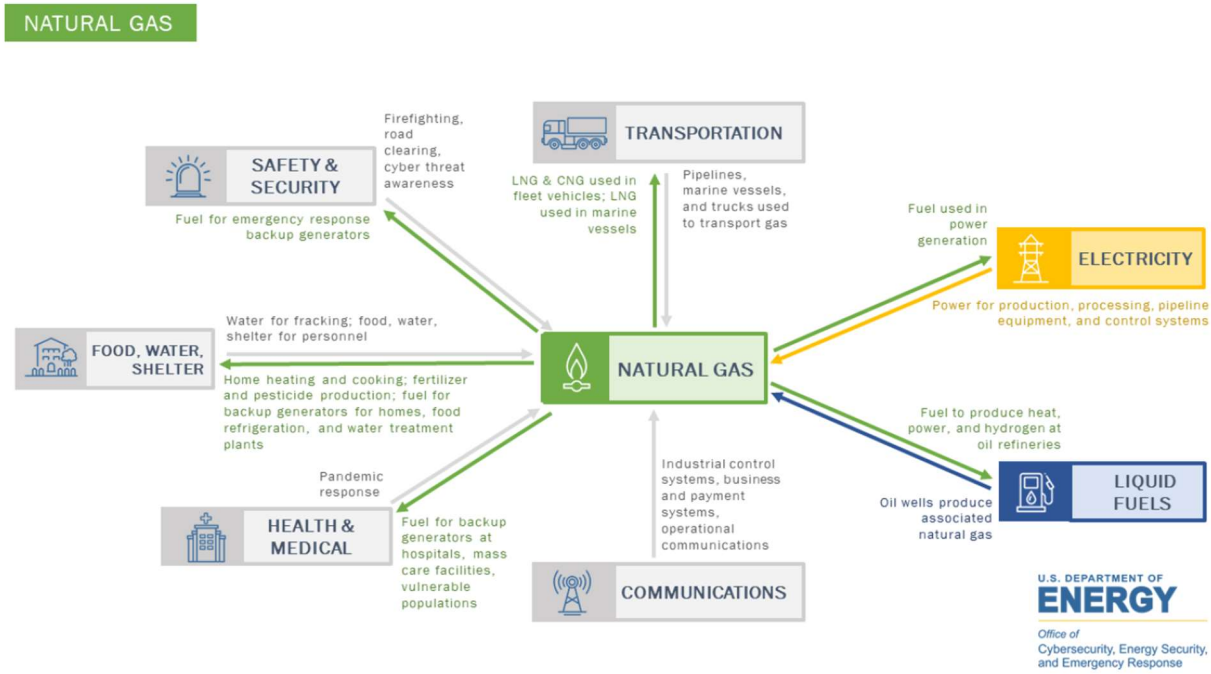
II. Cross Sector Vulnerabilities

ELECTRICITY



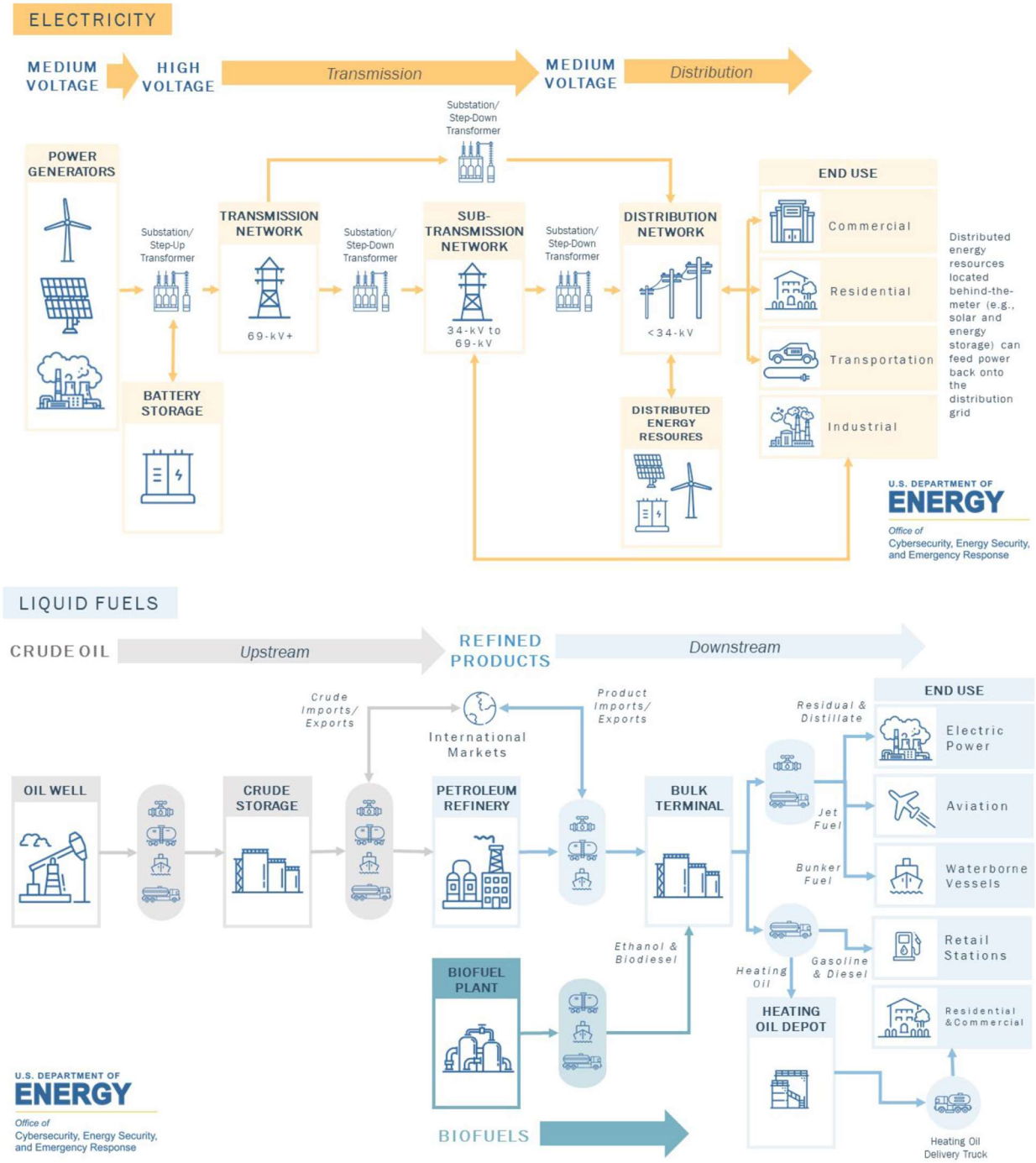
LIQUID FUELS

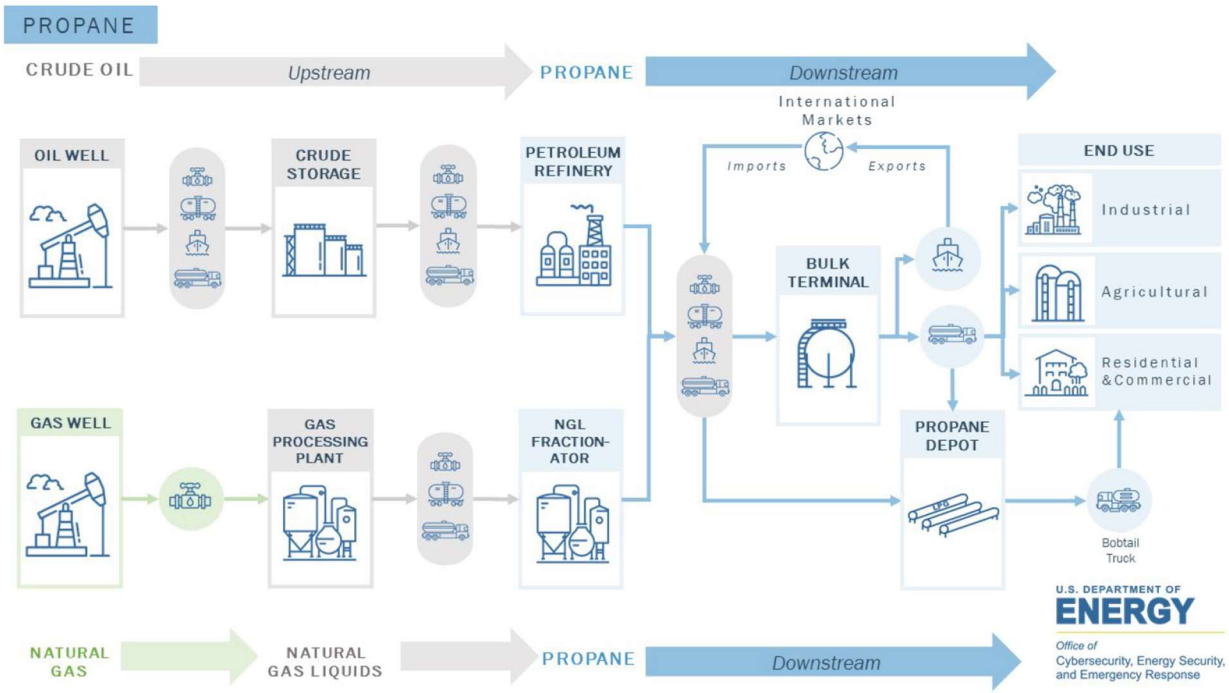




a. What cross sector vulnerabilities have you identified?
b. Do you have a contingency plan in the event of losing power to your facility? *[asset owners]*
c. Do you have a contingency plan in the event of losing inputs to your facility? *[asset owners]*
d. Transmission
    i. Do you have a plan for a significant event affecting large parts of the grid (e.g., the entire Delmarva Peninsula)?
    ii. Do you provide any assistance to your members when it comes to security planning?
e. Do you use a tailored threat and vulnerability assessment for each asset (e.g., each substation)? *[all asset owners]*

III. Supply Chain


ELECTRICITY
MEDIUM VOLTAGE
HIGH VOLTAGE
Transmission
MEDIUM VOLTAGE
Distribution
Substation/ Step-Down Transformer
POWER GENERATORS
Substation/ Step-Up Transformer
TRANSMISSION NETWORK
69-kV+
Substation/ Step-Down Transformer
SUB-TRANSMISSION NETWORK
34-kV to 69-kV
Substation/ Step-Down Transformer
DISTRIBUTION NETWORK
<34-kV
END USE
Commercial
Residential
Transportation
Industrial
Distributed energy resources located behind-the-meter (e.g., solar and energy storage) can feed power back onto the distribution grid
BATTERY STORAGE
DISTRIBUTED ENERGY RESOURCES
U.S. DEPARTMENT OF ENERGY
Office of Cybersecurity, Energy Security, and Emergency Response
LIQUID FUELS
CRUDE OIL
Upstream
REFINED PRODUCTS
Downstream
Crude Imports/ Exports
International Markets
Product Imports/ Exports
END USE
Residual & Distillate
Electric Power
Jet Fuel
Aviation
Bunker Fuel
Waterborne Vessels
OIL WELL
CRUDE STORAGE
PETROLEUM REFINERY
BULK TERMINAL
Retail Stations
Gasoline & Diesel
Heating Oil
Ethanol & Biodiesel
BIOFUEL PLANT
HEATING OIL DEPOT
Residential &Commercial
Heating Oil Delivery Truck
BIOFUELS
U.S. DEPARTMENT OF ENERGY
Office of Cybersecurity, Energy Security, and Emergency Response



a. What does your supply chain look like (where do you get your imports from? By what means of transportation?)
b. If you have a supply disruption, how long could you stay operational with the supplies you have in reserve?

<u>Risk Mitigation Measures</u>

I. Prioritization
   a. How do you prioritize mitigation measures?
   b. Do you have a resilience plan?

II. Robustness
   a. Do you practice system segmentation? (segmenting networks allows damaged areas to be isolated and less customers to be affected) *[all]*

III. Redundancy
   a. Are you aware of any microgrids in your service territory? *[electric]*
   b. Have you deployed or do you have near-term plans to deploy battery storage to provide backup power in your service territory? *[electric]*
   c. Do you have a plan or strategy in place designed to incentivize the use of storage in your service territory? *[electric]*
   d. Have you added or do you have near-term plans to add ties between gas distribution lines to diversify the transmission system where possible? For what percentage of the mains is this possible? *[gas]*
   e. What steps are you taking to ensure resource adequacy as generators retire? *[all]*

IV. Rapid Detection/Recovery
   a. Have you deployed or do you have near-term plans to deploy advanced distribution management systems to provide automated outage restoration and optimization? *[electric]*

b. Have you deployed or do you have near-term plans to deploy artificial intelligence analysis to prioritize transmission line operations, identify defects, and update asset management systems? *[all]*
c. Have you deployed or do you have near-term plans to deploy distribution automation (using digital sensors and switches with advanced control and communication technologies to automate feeder switching; voltage and equipment health monitoring; and outage, voltage, and reactive power management)? *[electric]*
d. Have you deployed or do you have near-term plans to deploy drones for asset inspection? *[all]*
e. Have you deployed or do you have near-term plans to deploy LiDAR (light detection and ranging) for vegetation management? *[electric]*
f. Have you deployed or do you have near-term plans to deploy remote-operated valves to more efficiently isolate systems during disruptions or peak event load management (e.g., temporarily disconnecting gas customers)? *[liquid fuels, gas]*
g. Have you deployed or do you have near-term plans to deploy advanced metering infrastructure (e.g., integrated smart meters, communications networks, and data management systems enabling bi-directional communication between utilities and customers. Smart meters provide near-real-time visibility into outages and help utilities allocate resources and restoration activities more efficiently)? *[electric]*
h. How do you plan for supply chain resilience? (Assessing supply chains and working with relevant stakeholders to strategically plan for the continuity and rapid restoration of supply chains after major disruptions improves resilience) *[all]*

V. Cold Weather Protection
a. Have you installed or do you have near-term plans to install fiberglass pipeline insulation to protect against freezing? Do you currently use or have near-term plans to use an electrical heating element to maintain or raise the temperature of pipes during cold weather? *[liquid fuels, gas]*
b. How do you manage your waterlines? (draining prevents rupturing from freezing, lines that cannot be drained can be set to drip) *[liquid fuels]*
c. How do you make use of thermal enclosures to ensure functionality and operational continuity during extreme cold? *[all]*

VI. Extreme Heat and Drought Resistance
a. What challenges have increased extreme heat and drought brought to your operations? What changes have you put in place to address these new stressors? *[all]*
b. Have you deployed or do you have near-term plans to deploy advanced water-cooling technologies? (e.g., recirculating cooling, dry cooling, and wet-dry hybrid cooling technologies) *[electric]*
c. Have you deployed or do you have near-term plans to deploy dry cooling? (Extreme heat can lead to water shortages or make the water used for cooling too warm, forcing power plant operators to curtail electricity output. Dry cooling uses air-cooled heat exchangers to reduce water use). *[electric]*

VII. Flood Protection
a. Have you taken steps to elevate equipment located in low-lying areas to protect from flooding? *[all]*

b. Do you actively support the preservation of certain kinds of natural habitats that provide a natural barrier to lessen the impact of storm surge? *[electric]*

c. Have you installed flood walls, gates, and/or barriers to protect essential equipment in flood prone areas from water intrusion? *[all]*

d. Have you relocated or considered relocating energy assets away from flood-prone areas to reduce or eliminate exposure to flooding and inundation? *[all]*

e. Do you employ stormwater pumps to remove flood water and help prevent equipment from being submerged? *[all]*

f. Have you modified or replaced equipment in flood-prone areas (e.g., underground power distribution systems) with equipment designed to continue functioning when subjected to flooding from water containing typical levels of containment (e.g., salt, fertilizer, motor oil, cleaning solvents)? *[all]*

g. Do you use a vent line protector to prevent gas regulator vent lines from encroaching water? (uses a float to seal the vent line shut if water enters via the VLP) *[gas]*

h. Do you use vented manhole covers to allow for the flow of excess water without dislodging the cover? *[electric]*

VIII. Wind Protection

a. Do you use breakaway service connectors? (Designed to disconnect when the power line attached is pulled by a falling limb or debris. Avoids damage to the meter receptable which leads to delays in service restoration) *[electric]*

b. Do you use dead-end towers/anchor towers/ancho pylons? (Self-supporting structures made with heavier material than suspension towers. Used at the end of a transmission line; where a line turns at a large angle; on either side of a major crossing; at intervals along straight segments to provide additional support. Dead-end structures can stop a domino effect from compromised suspension towers) *[electric]*

c. Do you have a strategy to incorporate stronger utility poles in your service territory? This can include reinforcing wood poles, replacing wood poles with concrete, or replacing wood cross-arms with fiberglass. *[electric]*

IX. Protection from Physical Threats/Physical Security Measures

a. What physical security measures do you have in place? What additional measures are you considering incorporating into your overall physical security approach? *[all]*

b. Substations

i. Control center
ii. Monitored entrances
iii. Intrusion detection systems on doors
iv. Shatter-resistant windows
v. Barred windows
vi. Ballistic shielding

X. Transmission

a. Do you provide any assistance to your members regarding prioritization or planning for mitigation measures?

b. How do you work to ensure/encourage/incentivize the expansion of interregional transmission lines?

c. What changes have you made to improve hardening standards?

d. What redundancies are you working to have in place (beyond reserve margins)?

e.

XI. Communication

a. What barriers do you face in communicating with stakeholders and partners in emergency situations? *[all]*
b. What barriers do you face in communicating with stakeholders and partners in resilience planning? *[all]*
c. In the event of an emergency, do you have a process in place for communicating needs to policy makers and other stakeholders/partners? *[all]*
    i. What bottlenecks exist in this process?