COMMONWEALTH OF VIRGINIA

Emergency Operations Plan

SUPPORT ANNEX
ENERGY SECURITY PLAN

VIRGINIA DEPARTMENT OF
EMERGENCY MANAGEMENT

VIRGINIA ENERGY

AUGUST 2024

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Table of Contents

Introduction

Energy security planning aims to ensure that Virginia's energy infrastructure is strong, secure, reliable, and resilient, even in the face of various hazards and potential disruptions. These hazards can include severe weather events like hurricanes, floods, tornadoes, earthquakes, wildfires, as well as failures in systems and infrastructures, pandemics, and deliberate physical or cyber-attacks.

While the primary responsibility for maintaining energy infrastructure lies with the owners and operators, state and local officials play a crucial role in collaborating with energy providers, stakeholders from other jurisdictions, government agencies, businesses, and related organizations. This collaboration is necessary to reduce the consequences of potential disruptions, ensure public safety, and facilitate rapid recovery.

In the short term, the focus is on emergency response and restoration efforts, including the development of contingency plans, coordination of resources, and effective communication. State and local officials need to work closely with energy providers and other relevant parties to mitigate risks, address vulnerabilities, and minimize the impact of potential disasters.

However, it is equally important to adopt a long-term perspective in energy security planning. This involves proactive measures to identify and mitigate risks and vulnerabilities in critical energy infrastructure. These efforts may include investing in infrastructure upgrades, diversifying energy sources, enhancing cybersecurity measures, promoting renewable energy development, and implementing strategies to reduce dependence on single points of failure.

By taking a comprehensive approach that combines emergency response planning, collaboration, risk mitigation, and long-term resilience building, the state and local governments can contribute to a more secure and reliable energy infrastructure that better withstands and recovers from various hazards and disruptions.

Purpose

Energy security planning promotes secure, resilient, and reliable energy infrastructure through an integrated emergency management and energy resilience approach that emphasizes prevention, protection, response, recovery, and mitigation efforts. The Energy Security Plan (ESP) is organized as a functional annex of the Commonwealth of Virginia Emergency Operations Plan (COVEOP) and is organized based upon the Department of Energy's Office of Cybersecurity, Energy Security, and Emergency Response (CESER) suggested structure. This ESP provides a practical and effective tool that will enhance State government energy assurance capabilities. The ESP is to be used by State energy officials as a tool for communicating and coordinating with energy stakeholders on energy disruptions, and for preparing for potential disturbances. Under the ESP, energy suppliers retain the role of executing remediation strategies in response to energy disruptions; the ESP functions as a mechanism to ensure that the aggregate efforts are complete and communicated accordingly. The ESP (referred to as the Plan) also leverages the resources in the Virginia Energy Plan. To ensure that the Plan fulfills all requirements as the Virginia ESP, the following additional elements have been included:

1. Assessment of the existing circumstances in Virginia.
2. Methods to strengthen the ability of Virginia energy partners to:

   • Secure the energy infrastructure of Virginia against physical and cybersecurity threats;

   • Mitigate the risk of energy supply disruptions to Virginia, and to enhance the response to, and recovery from, energy disruptions; and

   • Ensure that Virginia has reliable, secure, and resilient energy infrastructure.
3. Ways to respond to energy emergencies or disruptions.

Virginia recognizes that the energy sector is uniquely critical as all other critical infrastructure sectors depend on power and/or fuel to operate. An impact on critical energy infrastructure can directly affect the security and resilience within and across other critical infrastructure sectors – threatening public safety, the economy, and national security. The Commonwealth also recognizes that most critical infrastructure is owned and operated by private companies, and both the government and private sector have a mutual incentive to reduce the risk of energy disruptions. For the purpose of this plan, energy is defined as producing, refining, transporting, generating, transmitting, conserving, building, distributing, and maintaining energy systems and system components.

Scope & Applicability

Energy security and emergency management planning align well to ensure a reliable and resilient supply of energy through efforts to identify, assess, and mitigate risks to energy infrastructure and to plan for, respond to, and recover from events that disrupt energy supply. The Plan describes the Virginia energy landscape, people, processes, and strategy to build energy resilience, with attention to both steady state and potential energy emergency operations.

The COVEOP details the role of the Virginia Emergency Support Team (VEST) as the "whole of government" emergency management coordination framework for the Commonwealth of Virginia. Lead by the Virginia Department of Emergency Management (VDEM), the VEST is comprised of all Virginia executive agencies, the Virginia State Corporation Commission (SCC), which is an independent state agency, and includes key private sector and non-governmental organizations.[1] During steady state operations, including protection, prevention, and mitigation, the Plan supports efforts to minimize the risk of disruptive energy emergencies. In the event of an actual or potential disruptive energy emergency, the Plan supports decision making and strategy building based on two key premises:

1. VEST will coordinate the Commonwealth response to energy emergencies, leveraging the expertise of the energy sector stakeholders represented within Emergency Support Function 12 – Power and Fuel (ESF 12)

[1] Although the VEST represents a consolidated framework for emergency response and recovery activities, it is important to note that the agencies comprising the VEST perform important individual missions outside of such activations. Specific agency responsibilities within the VEST are aligned with their day-to-day operations and experience.

2. As private sector owners and operators, Virginia energy suppliers and distributors will have the primary responsibility in restoring services.

Beyond the response phase, however, the ESP details how Virginia, working with energy partners, can secure the Commonwealth's energy infrastructure against all physical and cybersecurity threats; mitigate the risk of energy supply disruptions to Virginia; enhance the response to, and recovery from, energy disruptions; and ensure that the Commonwealth has secure, reliable, and resilient energy infrastructure.

Virginia state and local officials recognize the responsibility to work with energy providers, across government agencies and with relevant stakeholders to reduce the risk, vulnerabilities, and consequences of an energy disruption or emergency and provide for rapid recovery. The annual state Threat and Hazard Identification Risk Assessment and Stakeholder Preparedness Review (THIRA / SPR) process includes participation from localities and state agencies. This process is used to recognize high priority risk, vulnerabilities, and capability gaps to include infrastructure as it relates to energy security. From a state perspective, the Commonwealth is subject to threats from a variety of natural and man-made disruptions to infrastructure such as flooding; winter weather; hurricanes; cyber-attacks; and complex coordinated attacks.

NAVIGATION TO IIJA ELEMENTS

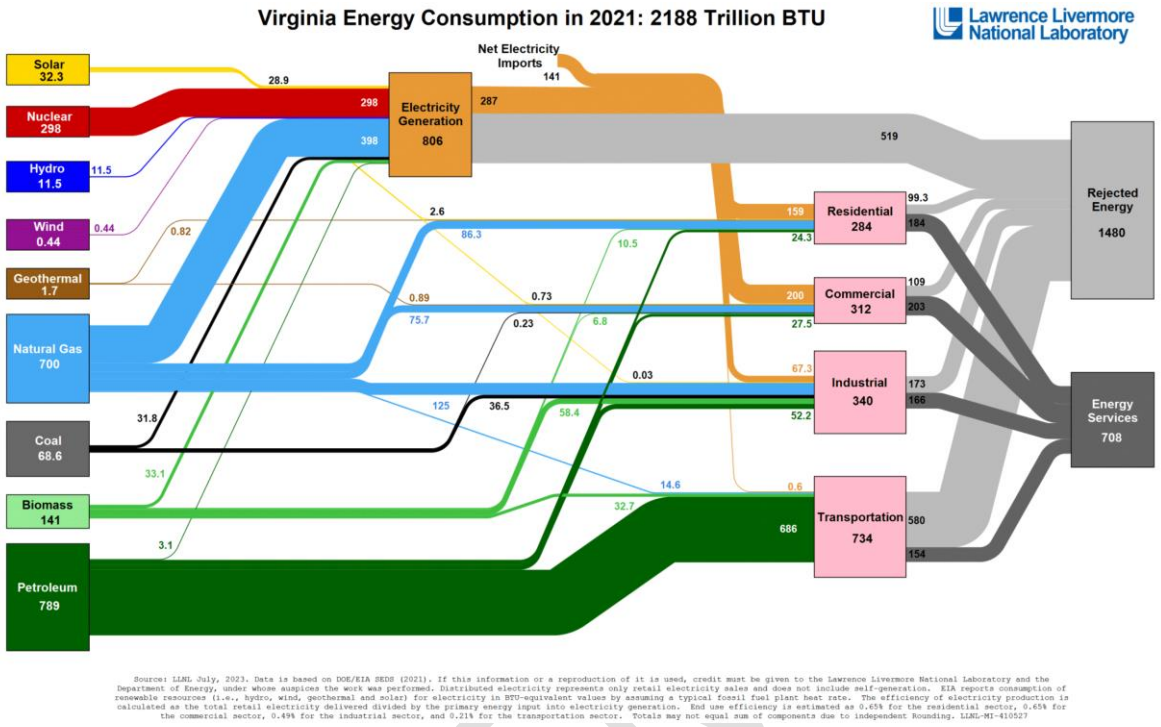
In support of these goals, the Plan includes useful data and operational context, threat and hazard information, and mitigation strategies that:

1. address all energy sources and regulated and unregulated energy providers;
2. include a Virginia energy profile, including an assessment of energy production, transmission, distribution, and end-use;
3. address potential threats and hazards to each energy sector or system, including physical and cybersecurity threats and vulnerabilities;
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
   - 6.1.1. multi-state and regional coordination, planning, and response;
   - 6.1.2. coordinate with tribal partners in planning and response; and
   - 6.1.3. encourage mutual assistance in cyber and physical security response plans.

Energy Profile

This state energy profile, developed in May 2024, provides baseline data, maps, charts, and other information on Virginia's energy markets and infrastructure for all energy sources.

Exhibit 1: Virginia Energy Consumption by Type and Sector



Source: Lawrence Livermore National Laboratory Energy Flow Charts

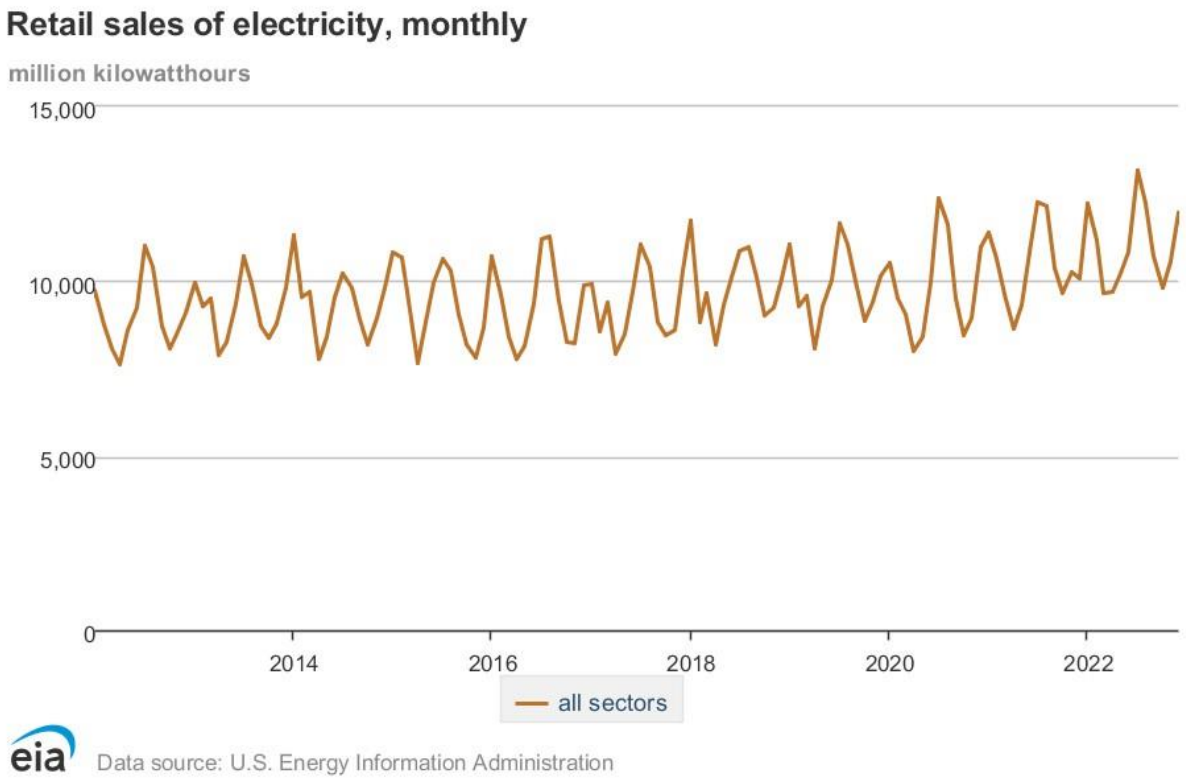
Virginia ranked twenty-eighth in overall energy consumption per capita in 2021. The state's transportation sector accounts for 30% of Virginia's total energy consumption, across ground, air, and marine transport. Natural gas and nuclear accounted for most of Virginia's in-state electricity net generation in 2022.[i]

Electricity

ELECTRICITY CONSUMPTION

In 2022, Virginia consumed approximately 132 terawatt-hours (TWh) of electricity, or about 15,000 kilowatt-hours (kWh) per person, higher than the U.S. average of 11,800 kWh per person electricity consumption.[ii] Exhibit 3 shows that the residential and commercial sectors consume most of the electricity in Virginia, accounting for nearly 87% of total electricity demand in 2022. The state's hot temperatures in the summer causes peak use with increased home air conditioning, shown in Exhibit 2.

Exhibit 2: Monthly Retail Sales of Electricity in Virginia, 2012-2022

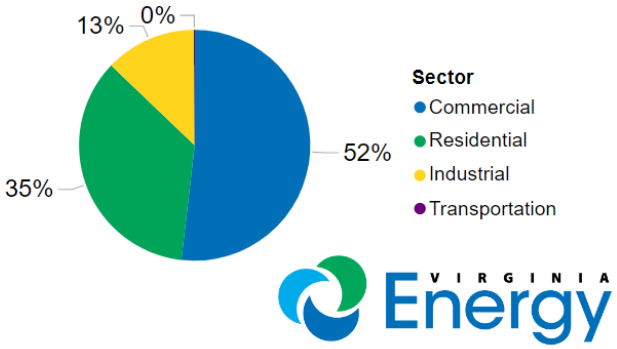


Source: EIA Data Browser

Exhibit 3: Virginia Electric Energy Consumption by Sector, 2022

Virginia Electricity Sales (Consumption) by Sector - 2022

Sector	Sales (MWh)	% Share
Commercial	68,556,082	51.83%
Residential	46,717,547	35.32%
Industrial	16,861,186	12.75%
Transportation	129,802	0.10%
Total	**132,264,617**	**100.00%**



Sources: EIA-861 Report

Electric Utilities

Virginia has three investor-owned utilities (IOUs), 13 electric cooperatives, and 16 municipal utilities, plus independent merchant plants and Combined Heat and Power (CHP) systems. The SCC regulates IOUs, and the independent providers manage the power they sell, while PJM supervises and directs all the dispatched power.

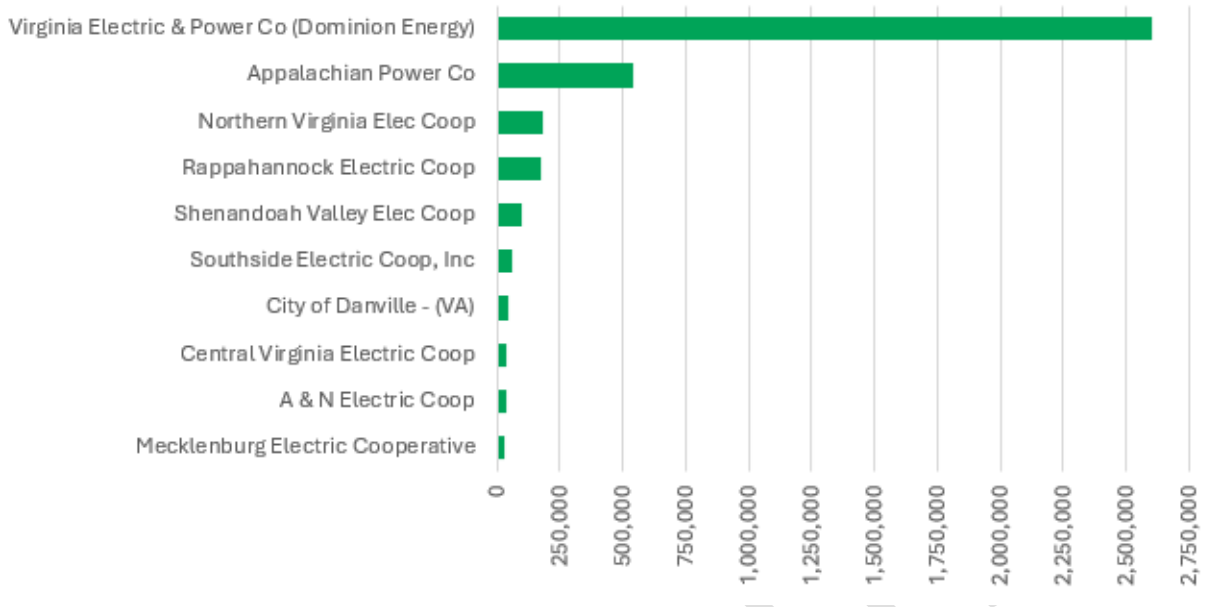
Exhibit 4: Virginia Bundled Electricity Sales by Utility and Sector (MWh), 2022

Utility Name	Ownership	BA Code	Residential	Commercial	Industrial	Transportation	Total	%GT Total
Virginia Electric & Power Co	Investor Owned	PJM	35,896,552.80	60,521,165.40	7,974,825.50	143,889.90	104,536,434	67.88%
Appalachian Power Co	Investor Owned	PJM	7,527,071.00	4,224,837.00	5,440,712.00	0.00	17,192,620	11.16%
Northern Virginia Elec Coop	Cooperative	PJM	2,733,388.00	6,270,549.00	689,160.00		9,693,097	6.29%
Rappahannock Electric Coop	Cooperative	PJM	2,887,994.70	415,919.50	1,264,192.00		4,568,106	2.97%
Shenandoah Valley Elec Coop	Cooperative	PJM	1,459,416.40	597,999.00	731,796.30	0.00	2,789,212	1.81%
Calpine Energy Solutions, LLC	Retail Power Marketer	PJM	0.00	1,168,274.40	214,298.60	0.00	1,382,573	0.90%
Direct Energy Business	Retail Power Marketer	PJM	0.00	1,210,278.20	4,682.90	0.00	1,214,961	0.79%
Southside Electric Coop, Inc	Cooperative	PJM	929,244.00	131,536.00	74,272.00		1,135,052	0.74%
Constellation NewEnergy, Inc	Retail Power Marketer	PJM	0.00	1,073,734.50	0.00	0.00	1,073,735	0.70%
City of Danville - (VA)	Municipal	PJM	560,908.40	324,232.80	165,122.80		1,050,264	0.68%
EDF Energy Services, LLC	Retail Power Marketer	PJM	0.00	705,062.90	305,810.50	0.00	1,010,873	0.66%
Central Virginia Electric Coop	Cooperative	PJM	617,686.00	121,556.00	244,618.00		983,860	0.64%
Mecklenburg Electric Cooperative	Cooperative	PJM	445,693.60	122,761.10	408,248.50		976,703	0.63%
A & N Electric Coop	Cooperative	PJM	456,654.30	199,673.10	176,409.50	0.00	832,737	0.54%
City of Harrisonburg - (VA)	Municipal	PJM	250,538.00	418,631.00	138,498.00		807,667	0.52%
Kentucky Utilities Co	Investor Owned	LGEE	419,208.40	278,857.20	105,769.70		803,835	0.52%
MP2 Energy LLC	Retail Power Marketer	PJM	0.00	349,120.80	294,367.00	0.00	643,488	0.42%
Bristol Virginia Utilities	Municipal	TVA	233,612.00	195,773.00	82,700.00	0.00	512,085	0.33%
City of Manassas - (VA)	Municipal	PJM	203,499.00	211,726.00	40,179.00		455,404	0.30%
Prince George Electric Coop	Cooperative	PJM	211,311.00	91,478.00	107,154.00		409,943	0.27%
City of Salem - (VA)	Municipal	PJM	156,189.90	112,216.40	140,497.20		408,904	0.27%
Virginia Tech Electric Service	State	PJM	67,248.40	275,106.40	10,639.70	0.00	352,995	0.23%
Northern Neck Elec Coop, Inc	Cooperative	PJM	297,538.00	49,151.70			346,690	0.23%
Texas Retail Energy, LLC	Retail Power Marketer	PJM	0.00	327,560.90	0.00	0.00	327,561	0.21%
Town of Bedford - (VA)	Municipal	PJM	100,976.00	43,735.00	53,405.00	0.00	198,116	0.13%
Powell Valley Electric Coop	Cooperative	TVA	106,094.00	39,237.00	15,788.00	0.00	161,119	0.10%
Collegiate Clean Energy, LLC	Retail Power Marketer	PJM	0.00	73,123.00	45,499.00	0.00	118,622	0.08%
American PowerNet	Retail Power Marketer	PJM	0.00	14,811.70	0.00	0.00	14,812	0.01%
Tesla Inc.	Behind the Meter	PJM	397.00	343.00	0.00	0.00	740	0.00%
Sunnova	Behind the Meter	PJM	73.00	0.00	0.00	0.00	73	0.00%
Total			**55,561,293.90**	**79,568,450.00**	**18,728,645.20**	**143,889.90**	**154,002,279**	**100.00%**

Shown in Exhibit 4, Virginia Electric and Power (Dominion Virginia Power) holds a majority (68%) of electricity sales within Virginia. AEP's Virginia subsidiary, Appalachian Power Company, is second with 11% of electricity sales. AEP imports most of the electricity sold in its Virginia service territory from nearby states. The rest of electricity sales and generation capacity ownership are widely dispersed among a number of electricity market participants.[2] The territories of these utilities are shown in Exhibit 6.

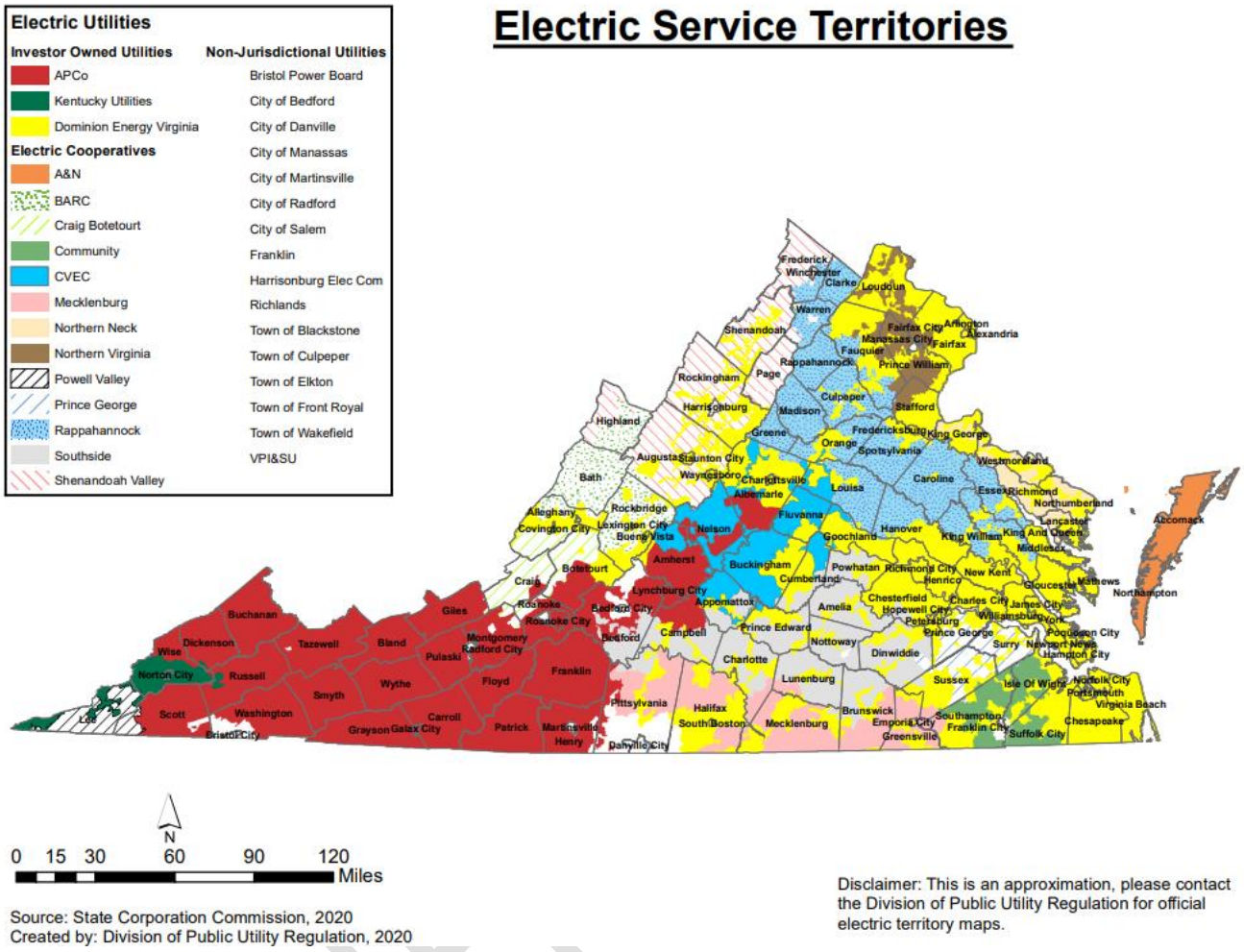
[2] Note: The terms megawatt (MW) and megawatt hours (MWh) may be confusing. Generally, generation is cited in MWh and capacity is cited in MW.

Exhibit 5: Virginia Top 10 Utility Customer Counts, 2022



Source: EIA-861

Exhibit 6: Virginia's Electric Service Territories



ELECTRICITY SUPPLY

The State's electric supply system comprises generation (and its fuel supply), high voltage (100's of kV) transmission over long distances, and local distribution at lower voltage (10's of kV) to transformers, where higher voltage is reduced to lower levels (e.g., 240 volts (V), 120 V) to serve typical end-use customers.

Virginia electricity infrastructure operates as part of a major integrated regional transmission organization (RTO), the PJM Interconnection. The Virginia SCC regulates the generation and transmission components of this system. However, the SCC does not regulate independent power producers (IPPs) or municipal utilities.[3]

Power Generation Supply Sources

Exhibit 7 shows the net generation in Virginia in MWh produced by the fuels used in 2023. Understanding the relative impact of each fuel on net generation helps responders evaluate

[3] Independent power producers, also referred to as exempt wholesale generators, produce and sell electricity on the wholesale market at market-based rates, and do not have franchised service territories.

risk, should a fuel source be curtailed or lost. The table also highlights the potential risks from a loss of natural gas or nuclear generation due to the significant share of state supply.

Exhibit 7: Virginia Generation by Energy Source, 2023

Virgnia Net Electric Generation 2023

Energy Source	Net Generation (MWH)	%GT Net Generation (MWH)
Natural Gas	51,476,059	56.05%
Nuclear	29,662,935	32.30%
Solar	5,355,458	5.83%
Wood and Wood Derived Fuels	2,260,060	2.46%
Hyroelectric (Conventional)	1,520,964	1.66%
Coal	1,415,027	1.54%
Other (Gas)	902,617	0.98%
Other (Biomass/Waste)	496,264	0.54%
Petroleum	165,660	0.18%
Wind (On-shore/Off Shore)	46,969	0.05%
Hydroelectric (Pumped Storage)	-1,454,881	-1.58%
Total	**91,847,132**	**100.00%**

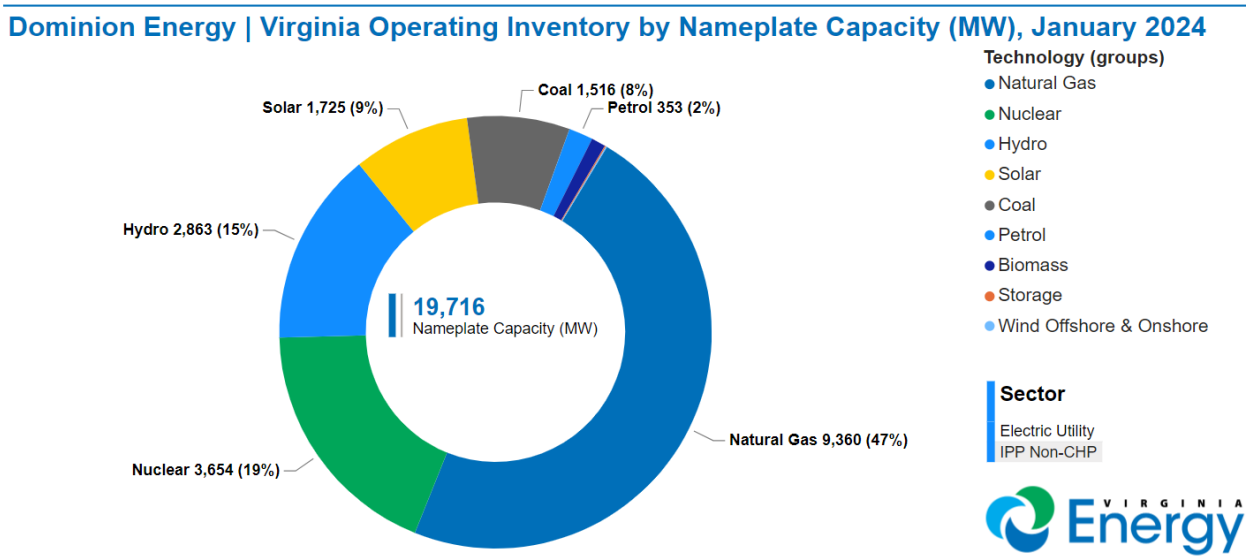
VIRGINIA Energy

Source: https://www.eia.gov/electricity/data.php

Virginia has many power producers that include large investor-owned utilities and IPPs. IPPs include those who build their own generation capabilities such as a residential or business solar or wind farm. In 2020, 20% of Virginia's 126 TWh of energy production came from independent power producers; the remainder was produced by the state's two largest utilities, Dominion Energy and Appalachian Power, and some industrial combined heat and power (CHP) units.

Exhibit 8 breaks down the percentages of Dominion's 19,716 MW of electricity generating capacity as of 2024 by fuel source.

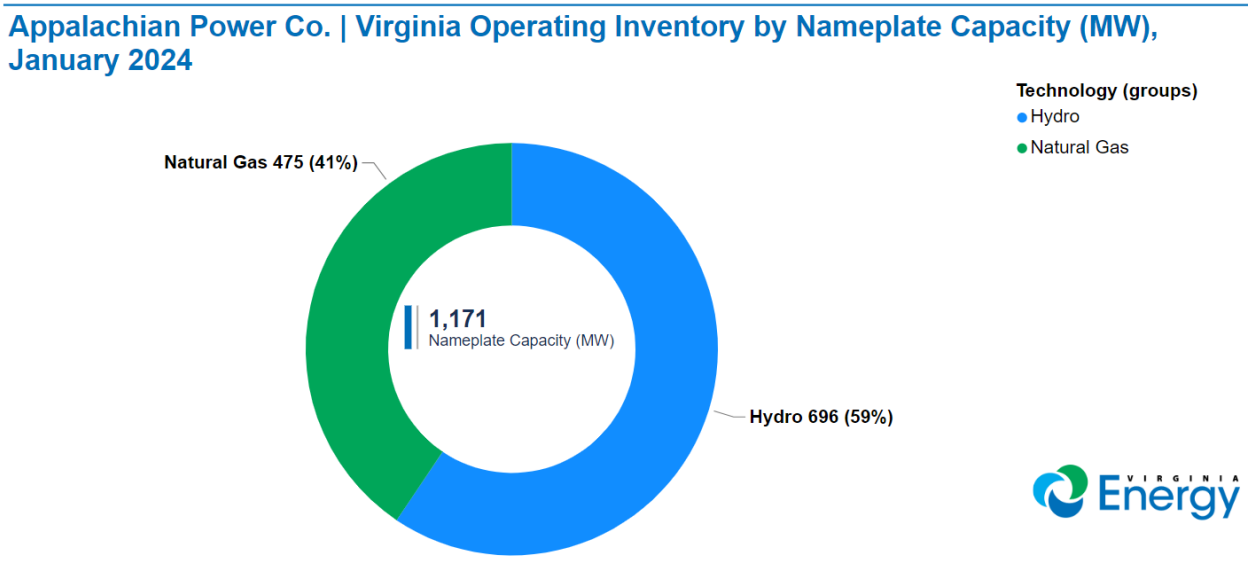
Exhibit 8: Dominion Energy's Generation Mix in Virginia, January 2024



Source: U.S. Energy Information Administration, Form EIA-860, 'Annual Electric Generator Report' and Form EIA-860M, 'Monthly Update to the Annual Electric Generator Report

In January 2024, almost half of Dominion Energy Virginia's operating inventory was made up of natural gas, with the remaining 52% of generation from a diverse portfolio made up of 19% nuclear, 15% hydroelectric and pumped storage, 7.92% solar, 7.77% coal for a total nameplate capacity of 19,516 MW.

Exhibit 9: Appalachian Power's Generation Mix in Virginia, January 2024



Source: U.S. Energy Information Administration, Form EIA-860, 'Annual Electric Generator Report' and Form EIA-860M, 'Monthly Update to the Annual Electric Generator Report

Exhibit 9 shows the percentage of installed capacity by Appalachian Power as of January 2024 by fuel source. Appalachian Power operates in multiple states, and most of their generation resides in West Virginia, which is not included in the exhibit.

In January 2024, Appalachian Power's Virginia operating inventory included a mix of roughly 60% hydro-electric and approximately 40% natural gas for a total nameplate capacity of 1,171 MW. Appalachian Power's Smith Mountain Plant in Pittsylvania County accounts for the hydroelectric pumped storage, while the natural gas steam turbine resides at the Clinch River Plant in Russell County.

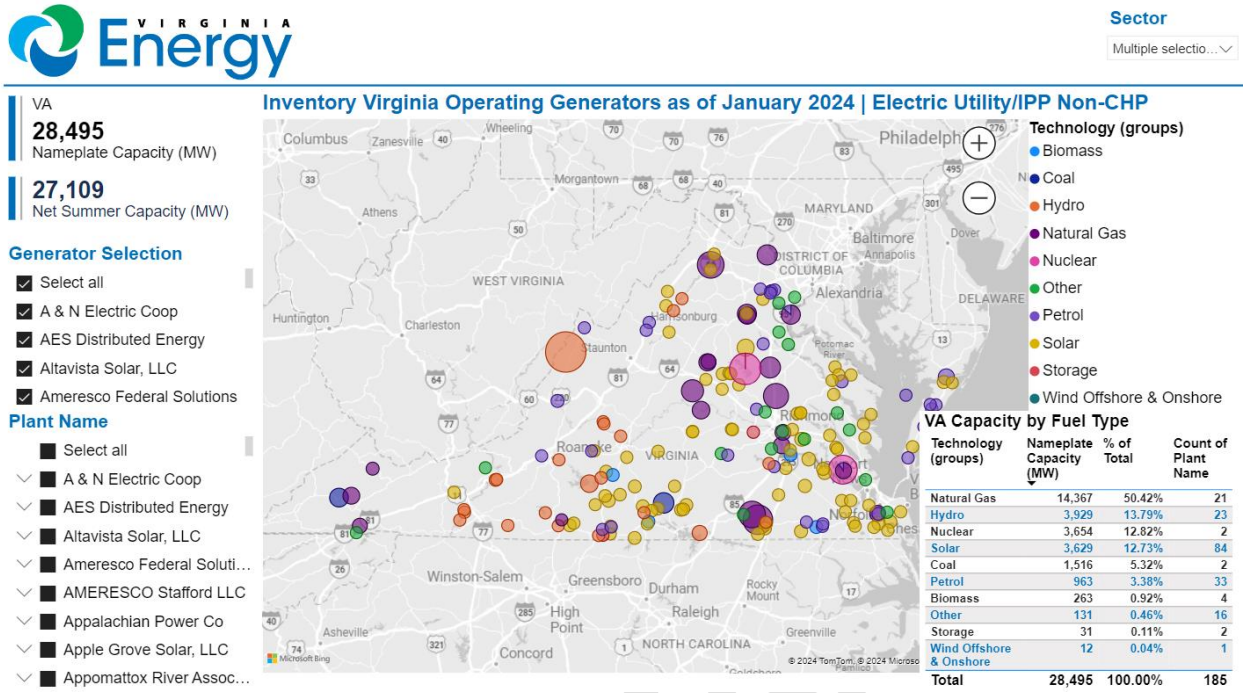
Physical management of Virginia power plants is the responsibility of owners and operators. All Virginia power plant owners and operators, whether regulated, or independent of either IOU or municipal electric systems, are required to provide reliable electrical power.

The reliability requirements for electric service originate with North American Electric Reliability Corporation (NERC), which Federal law empowered to ensure electric system reliability. Virginia falls under the jurisdiction of two NERC regional entities, the Reliability First Corporation (RFC) and the Southeastern Electric Reliability Corporation (SERC). The general guideline for generation reliability is one outage occurrence every 10 years resulting from generation insufficiency. Electric Distribution Companies (EDCs) are required to purchase or maintain sufficient generation to meet this standard. Assuming the proper maintenance and operation of each independently owned and licensed generation company, the most important generation issue for the EDCs is the marketplace where they buy electricity, because that is where availability and price combine to affect supply.

Electric Generation Inventory

In January 2024, Virginia had 185 operating generators in the electric utility and IPP Non-CHP sectors with a total maximum output of 28,195 MW (map shown in Exhibit 10). The assets in the state with the highest nameplate capacity are operated by Dominion Energy and include the natural gas steam turbine in Greensville (1,773 MW), the Surry Nuclear Power Plant (1,695 MW), and Bath County's Hydroelectric Pumped Storage Plant (2,862 MW). Other fuel sources in the Commonwealth include conventional hydroelectric facilities, natural gas, solar, coal, petroleum liquids, and wind. Another map can be found in the Energy Sector Risk Profile Electricity Map showing the location of those plants using petroleum fuels and various alternative or renewable fuels and, thus, provide reference points for emergency responders and ES planners.

Exhibit 10: Power Generators in Virginia, January 2024



Source: U.S. Energy Information Administration, Form EIA-860, 'Annual Electric Generator Report' and Form EIA-860M, 'Monthly Update to the Annual Electric Generator Report

The sample detail provided in Exhibit 11 on plant names, location, nameplate capacity, technology, and owner/operators.

Exhibit 11: Top Virginia Power Plants, 2022

Virginia Power Plants

Sector Name	Plant Name	Nameplate Capacity (MW)	County	State	Technology	Transmission or Distribution System Owner	Utility Name
Electric Utility	Bath County	2862	Bath	VA	Hydroelectric Pumped Storage	Virginia Electric & Power Co	Virginia Electric & Power Co
Electric Utility	North Anna	1959	Louisa	VA	Nuclear	Virginia Electric & Power Co	Virginia Electric & Power Co
Electric Utility	Greensville County Power Station	1773	Greensville	VA	Natural Gas Fired Combined Cycle	Virginia Electric & Power Co	Virginia Electric & Power Co
Electric Utility	Surry	1695	Surry	VA	Nuclear	Virginia Electric & Power Co	Virginia Electric & Power Co
Electric Utility	Brunswick County Power Station	1472	Brunswick	VA	Natural Gas Fired Combined Cycle	Virginia Electric & Power Co	Virginia Electric & Power Co
Electric Utility	Warren County	1472	Warren	VA	Natural Gas Fired Combined Cycle	Virginia Electric & Power Co	Virginia Electric & Power Co
Electric Utility	Chesterfield	1053	Chesterfield	VA	Conventional Steam Coal	Virginia Electric & Power Co	Virginia Electric & Power Co
Electric Utility	Ladysmith	893	Caroline	VA	Natural Gas Fired Combustion Turbine	Virginia Electric & Power Co	Virginia Electric & Power Co
Electric Utility	Yorktown	882	York	VA	Natural Gas Steam Turbine	Virginia Electric & Power Co	Virginia Electric & Power Co
Electric Utility	Clover	848	Halifax	VA	Conventional Steam Coal	Virginia Electric & Power Co	Virginia Electric & Power Co
Electric Utility	Remington	706	Fauquier	VA	Natural Gas Fired Combustion Turbine	Virginia Electric & Power Co	Virginia Electric & Power Co
Electric Utility	Virginia City Hybrid Energy Center	668	Wise	VA	Conventional Steam Coal	Appalachian Power Co	Virginia Electric & Power Co
Electric Utility	Possum Point	613	Prince William	VA	Natural Gas Fired Combined Cycle	Virginia Electric & Power Co	Virginia Electric & Power Co
Electric Utility	Bear Garden	559	Buckingham	VA	Natural Gas Fired Combined Cycle	Virginia Electric & Power Co	Virginia Electric & Power Co
Electric Utility	Marsh Run Generation Facility	513	Fauquier	VA	Natural Gas Fired Combustion Turbine	Virginia Electric & Power Co	Old Dominion Electric Coop
Electric Utility	Louisa Generation Facility	509	Louisa	VA	Natural Gas Fired Combustion Turbine	Virginia Electric & Power Co	Old Dominion Electric Coop
Electric Utility	Clinch River	475	Russell	VA	Natural Gas Steam Turbine	Appalachian Power Co	Appalachian Power Co
Electric Utility	Chesterfield	447	Chesterfield	VA	Natural Gas Fired Combined Cycle	Virginia Electric & Power Co	Virginia Electric & Power Co
Electric Utility	Elizabeth River Power Station	389	Chesapeake City	VA	Natural Gas Fired Combustion Turbine	Virginia Electric & Power Co	Virginia Electric & Power Co
Electric Utility	Darbytown	368	Henrico	VA	Natural Gas Fired Combustion Turbine	Virginia Electric & Power Co	Virginia Electric & Power Co
Electric Utility	Gravel Neck	368	Surry	VA	Natural Gas Fired Combustion Turbine	Virginia Electric & Power Co	Virginia Electric & Power Co
Electric Utility	Gordonsville Energy LP	300	Louisa	VA	Natural Gas Fired Combined Cycle	Virginia Electric & Power Co	Virginia Electric & Power Co
Electric Utility	Smith Mountain	300	Pittsylvania	VA	Conventional Hydroelectric	Appalachian Power Co	Appalachian Power Co
Electric Utility	John H Kerr	297	Mecklenburg	VA	Conventional Hydroelectric	Virginia Electric & Power Co	USCE-Wilmington District
Electric Utility	Smith Mountain	247	Pittsylvania	VA	Hydroelectric Pumped Storage	Appalachian Power Co	Appalachian Power Co
Electric Utility	Fort Powhatan Solar	150	Prince George	VA	Solar Photovoltaic	Virginia Electric & Power Co	Dominion Renewable Energy
Electric Utility	Colonial Trail West	142	Surry	VA	Solar Photovoltaic	Virginia Electric & Power Co	Dominion Energy Inc.
Electric Utility	Maplewood Solar	120	Pittsylvania	VA	Solar Photovoltaic	Virginia Electric & Power Co	Dominion Renewable Energy
Electric Utility	Sadler Solar	100	Greensville	VA	Solar Photovoltaic	Virginia Electric & Power Co	Dominion Energy Inc.
Electric Utility	Spring Grove I	98	Surry	VA	Solar Photovoltaic	Virginia Electric & Power Co	Dominion Energy Inc.
Electric Utility	Possum Point	96	Prince William	VA	Petroleum Liquids	Virginia Electric & Power Co	Virginia Electric & Power Co
Electric Utility	Desper Solar	88	Louisa	VA	Solar Photovoltaic	Virginia Electric & Power Co	Dominion Renewable Energy
Electric Utility	Low Moor	83	Alleghany	VA	Petroleum Liquids	Virginia Electric & Power Co	Virginia Electric & Power Co
Electric Utility	Northern Neck	83	Richmond	VA	Petroleum Liquids	Virginia Electric & Power Co	Virginia Electric & Power Co
Electric Utility	Greensville County Solar Project, LLC	80	Greensville	VA	Solar Photovoltaic	Virginia Electric & Power Co	Dominion Energy Inc.
Electric Utility	Grasshopper Solar	80	Mecklenburg	VA	Solar Photovoltaic	Virginia Electric & Power Co	Dominion Energy Inc.
Electric Utility	Claytor	75	Pulaski	VA	Conventional Hydroelectric	Appalachian Power Co	Appalachian Power Co
Electric Utility	Altavista Power Station	71	Campbell	VA	Wood/Wood Waste Biomass	Virginia Electric & Power Co	Virginia Electric & Power Co
Electric Utility	Hopewell Power Station	71	Hopewell City	VA	Wood/Wood Waste Biomass	Virginia Electric & Power Co	Virginia Electric & Power Co
Electric Utility	Southampton Power Station	71	Southampton	VA	Wood/Wood Waste Biomass	Virginia Electric & Power Co	Virginia Electric & Power Co
Electric Utility	Bedford Solar	70	Chesapeake City	VA	Solar Photovoltaic	Virginia Electric & Power Co	Dominion Renewable Energy
Electric Utility	Chesapeake	51	Chesapeake	VA	Petroleum Liquids	Virginia Electric & Power Co	Virginia Electric & Power Co
Electric Utility	Gravel Neck	40	Surry	VA	Petroleum Liquids	Virginia Electric & Power Co	Virginia Electric & Power Co
Electric Utility	Leesville	40	Pittsylvania	VA	Conventional Hydroelectric	Appalachian Power Co	Appalachian Power Co

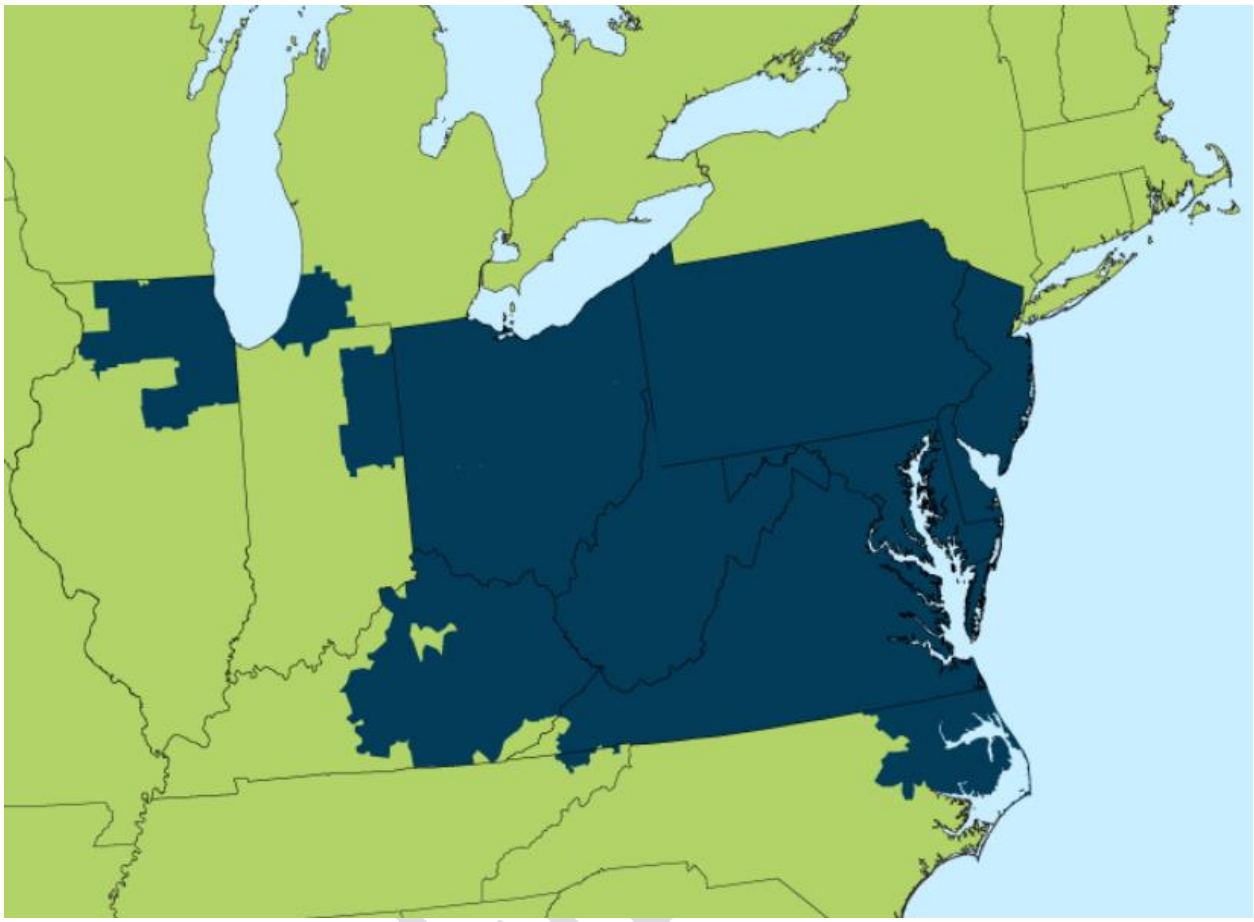
Source: Sample extract from EIA-860 2022 early release data.

Balancing Authority: PJM

PJM is an independent system operator (ISO) and the primary entity that manages electric transmission in Virginia. As an ISO, PJM acts in large measure to lower wholesale electricity prices, and thus retail electricity costs by increasing the efficiency of the transfer of electric power. In practice, to achieve this goal, ISOs do much more. As moving power longer distances became necessary to meet local demand, many transmission line owners imposed fees for use of their transmission facilities. Over time, complex contracting and administration led to increased system costs. Further, a complex system of electrical components reduced flexibility and inhibited the movement of power during high demand, thus stressing the system and decreasing reliability. ISOs were charged with the task, among other things, to reduce barriers, simplify fee structures, and develop common rules, rates, and service requirements. The resulting "Open Access Transmission Tariff" system reduces transmission constraints that evolved both with the growth of the electric power industry and the concomitant regulations designed to prevent monopoly practices. For example, one-on-one power acquisition meant utilities had to increase generation reserves to assure sufficient capacity to meet obligations. Hence, the efficiency gained through a power pool improved energy security by increasing system resiliency and reliability. Now, an Energy Imbalance Service (EIS) market, with a central, independent operator, efficiently and quickly locates and schedules needed power, reduces some of the need for additional expensive generation, lowers market transfer costs, and improves regional system reliability, reducing risk.

The Role of PJM

Exhibit 12: Map of PJM Territory



Source: https://www.pjm.com/about-pjm/who-we-are/territory-served

PJM coordinates the movement of electricity through all or parts of the following 13 states and the District of Columbia: Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia. The PJM footprint includes approximately 1,419 electric power generators and 88,115 miles of transmission lines serving a population of about 65 million and a peak demand of 165,492 MW.[iii] PJM provides eight primary services to its broad territory of states and utilities:

- Energy Market
- Financial Transmission Rights
- Market Settlements
- Compliance
- Reliability Pricing Model
- Demand Response
- Financial Credit
- Transmission Services

The role of PJM is also extremely important for electric supply to Virginia. One of the major roles of any RTO, or ISO, is to dispatch power throughout its system. This role joins with the ISO's role in creating the regional pricing market and managing regional transmission. PJM hosts competitive bidding among its utilities for day ahead and other power needs. Power is dispatched on a cost basis with lower cost power sent first, with increasingly higher-cost power following. This ability to dispatch generated power is also a tool used for mitigating shortage and outage problems. PJM monitors power generation continuously and dispatches power as necessary, or supplies power instantaneously, to maintain load where existing generation has experienced sudden interruption.

The following discussion focuses on those aspects of PJM activity that relate primarily to energy security and reliability.

Market Mechanisms for Reliability

PJM describes its market as "the continuous buying, selling, and delivery of wholesale electricity." Protocols that support reliability and the mitigation of potentially damaging events are a part of this balancing process in an open access market. The primary wholesale markets PJM operates that affect reliability are the Energy Market, the Reliability Pricing Model capacity market, and the Ancillary Services Market.

Energy Market

Market participants wishing to buy and sell energy in PJM have multiple options. Load serving entities (LSEs) decide whether to meet their energy needs through self-supply bilateral purchases from generation owners, or market intermediaries, and through the day-ahead and real time energy markets PJM manages. Generation owners can use generation to meet their own loads, sell into the spot market, or sell bilaterally, and they can sell their output to entities within or outside PJM. Market participants in PJM include power generators, transmission owners, electricity distributors, power marketers, and some large consumers.

The PJM Energy Market operates much like any commodity market, with buyers and sellers establishing a price by matching supply and demand. Generating resources in PJM that do not submit self-schedules or are not assigned to bilateral transactions are required to submit energy bids into the day-ahead energy market. PJM uses the energy price bids to perform a day-ahead, least-cost security constrained economic dispatch (SCED) of the entire PJM system, from which projected loads, net of self-schedules, for the following day are modeled to be served at the lowest possible bid cost of generation, while maintaining adequate transmission system reliability and operating reserves.

Reliability Pricing Model[iv]

Entities serving load in PJM are required to maintain adequate capacity resources to serve their peak demand and reserves as required by the Reliability Assurance Agreements for each reliability region in PJM. These entities may acquire capacity through several means, including bilateral transactions, long-term self-scheduling, and/or participation in the Reliability Pricing Model (RPM) capacity market. PJM developed the RPM to reduce price volatility and secure this region's growing electricity needs with long-term voluntary investments in building capacity, local generation security, and grid improvements. The model is based on an algorithm that optimizes reliability and minimizes the cost of the needed capacity given generation possibilities and the current conditions of the grid. Underlying the RPM is the concept that paying higher prices for capacity in areas with little

excess capacity will help create incentives either to build generation in these areas or to improve transmission.

RPM rules require generating resources in the energy market to be bid into the capacity market, and load is required to purchase capacity from the market (or secure capacity rights through other means, such as bilateral transactions) for three years into the future. The RPM is designed to produce bid prices that reflect the annual fixed carrying costs of new capacity entering the market, less PJM-administered assessments for energy and ancillary services revenues.

Ancillary Services[v]

PJM offers Regulation, Synchronized Reserves, and Day-Ahead Scheduling Reserves through bid-based markets. Regulation is a service that allows PJM to balance supply and demand in real time by working with generators having telecommunications control and response capability to increase or decrease output in response to signals sent by PJM.

Resources that can react to meet larger supply/demand imbalances within a response time of 10 minutes provide Synchronized Reserves. Generators that are synchronized to the grid but are operating at less than full load, or demand resources that can reduce load within the specified time, can also provide this service.

Day-Ahead Scheduling Reserves are supplemental power from 30-minute reserves on the system. According to PJM: “The market is intended to provide a pricing method and price signals that can encourage generation and demand resources to provide day ahead scheduling reserves, and to encourage new resources to be deployed that have the capability to provide such reserves.”

In other words, this pricing tool encourages utilities to avoid last minute load needs by planning correctly in advance of anticipated demand. Advanced planning adds reliability to the entire electricity system by reducing last minute demand when generators might not be available, or fuel that is more expensive must be consumed to produce power.

PJM manages other ancillary and transmission services on a tariff basis. These ancillary services include black start and reactive and voltage control. Firm and non-firm transmission service is managed through the PJM open access transmission tariff and operation of its Open Access Same Time Information System (OASIS).

Demand Response[vi]

Demand response measures are at the heart of energy security and emergency response to market and capacity incidents. PJM has a number of demand response and capacity-related tools available to enhance electricity reliability. These are listed in terms of increasing complexity:

- **End-User Reductions**: End user reductions entail load management by conserving power and scheduling activity to non-peak hours of the day. Customers are encouraged to adopt increasingly efficient procedures and equipment and otherwise initiate load reduction on their own. Their motivation might be to avoid high prices (e.g., locational marginal prices where newer increments of power are increasingly expensive) or perhaps react to an emergency or anticipated severe weather conditions. Essentially, these initiatives are a non-fuel resource that substitutes for more costly fueled generation. This market attracts members of PJM known as curtailment service

providers (CSPs), who reach out to end-users and aggregate (encourage) end-user reductions that "save" capacity.

- **Demand Response Capacity Market**: Demand response resources are eligible to participate in the RPM market described above.
- **Full Emergency Load Response**: A technique used by PJM to secure reserve capacity to meet an unplanned outage. Unused demand capacity is committed for three months before a delivery year begins. The submitting entity is rewarded with offset capacity payments. Both load-serving entities and CSPs can register aggregated demand resources for this purpose. This mechanism is another price advantage tool through which non-fuel capacity is made available to provide reliable service for the market.

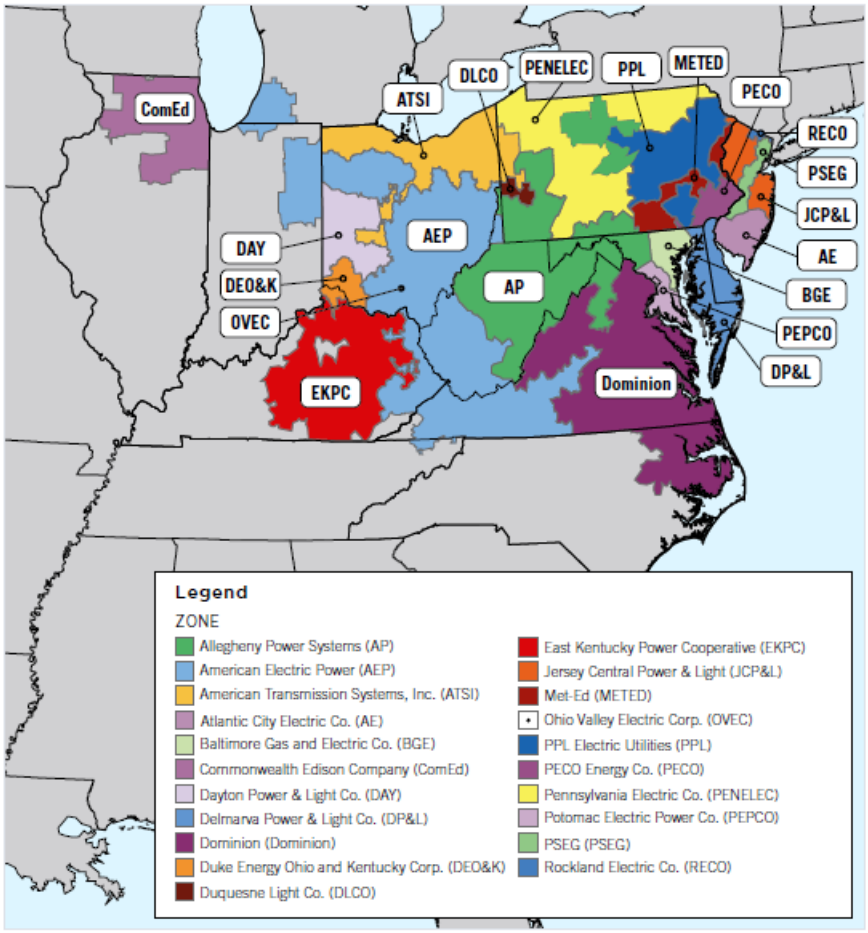
Synchronized Reserve Market[vii]

Demand response resources also are eligible to contribute to the Synchronized Reserve Market. Entities that participate in this synchronized system must be able to deliver power within a ten-minute window. Such entities must have metering that provides for readings at no less than a one minute scan rate to verify that such capacity is indeed available on short notice. Although this type of power acquisition is expensive, it is critical in the event of a sudden power loss. PJM does not utilize this mechanism lightly: "While demand response resources must install infrastructure to allow them to curtail their consumption of electricity within ten minutes, they will be requested to curtail only when system conditions require the ten minute response." Other requirements for this critical resource include operator training.

Transmission

PJM provides two basic transmission service options to its customers, point-to-point transmission service and network transmission service. PJM offers these service options under Open Access Transmission Tariff and OASIS. Exhibit 13 illustrates the various regional electricity transmission zones that affect power supply for Virginia.

Exhibit 13: Map of Regional Transmission Zones in PJM



Source: https://www.pjm.com/library/~/media/about-pjm/pjm-zones.ashx

Point-to-Point Transmission Service

There are three aspects to point-to-point transmission service:

- The service is offered for the transmission of both capacity and actual energy "between a point of receipt and point of delivery."
- The service may be offered as "firm service," meaning that this service receives delivery priority by "reservation."
- The service may be offered as "non-firm service" meaning that this service receives "available" power and capacity and may receive a pro-rated amount or nothing depending on system conditions.

Firm transmission is a concept well understood in the utility market. Satisfying "firm" customers always carries a price premium. Hence, if a utility wishes to assure that customers without any other means of power are protected, the utility will acquire the higher priced, "reserved" power to assure that power flows without interruption.

Network Transmission Service

This type of transmission essentially covers in-network customers of PJM. According to PJM, "Network transmission service enables network customers to use their generation resources to serve their network loads located in PJM." To accomplish this, "PJM works with

transmission owners to plan and coordinate the operation, maintenance and expansion of PJM transmission facilities in order to provide all network and point-to-point customers with transmission service."

This service also allows for economic planning and power delivery. PJM's Transmission Service Request Manual and OASIS cover these complex efforts. Responders do not necessarily need to be able to duplicate these services; understanding that they are available and help provide stability and reliability to the Commonwealth's electricity market is useful.

Compliance

PJM complies with NERC regional reliability standards working closely with the North American Energy Standards Board (NAESB) and the regional entities, Reliability First Corporation (RFC) and Southeastern Electric Reliability Corporation (SERC).

Training[viii]

PJM provides an extensive array of training to support the many reliability functions and standards for such activities as balancing, interchange management, planning and reliability coordination, resource planning, and various transmission services.

Corporate Compliance

The PJM Regulatory Oversight and Compliance Committee, along with associated internal departments attending to compliance training efforts, and other issues, further supports reliability.

Emergency Operation Procedures[ix]

PJM has published a table of its standard emergency procedures. This Section summarizes information found in PJM's Manual 13 : Emergency Operations.

Based on a series of phased notifications, PJM emergency procedures include

- Alerts
- Warnings
- Actions

Each step is intended to alert generators, utilities, and others connected to the electricity system infrastructure about impending incidents. At each level, PJM provides a detailed description that informs participants of PJM actions and details how participants (such as transmission and generation operators, dispatchers and others) should proceed. Hence, PJM works to inform all participants in the PJM electricity network about the nature and management of an issue. Such notifications may be sufficient to mitigate a problem. According to PJM, "However, in certain situations the implementation order of these levels may change. Sometimes PJM must omit a warning or alert and immediately implement an emergency procedure. Certain emergency situations do not have an alert, warning or action level."

Examples of reasons or actions for notification include:

- Weather issues, events
- Curtailment
- Emergency energy request

- Heavy load voltage warning
- Load issues, events
- Voltage issues, events
- Generation issues, events
- Reserve warnings
- Solar magnetic disturbance
- Transmission issues, events

Virginia Electricity Distribution

Exhibit 14 illustrates a typical electric distribution system. Although the distribution system is deceptively simple from the customer's perspective, it nonetheless provides the basic data required to plan for capacity. Behind the wall, switch, and meter are wires carrying several levels of power as substation transformers step down power from high-voltage, long-range transmission to voltage levels for various local distribution lines. Working from the point of generation, complex transformers step up power for long-range transmission as power leaves the generation plant and moves into the transmission system for eventual delivery into a distribution system. The local distribution system is a complex web of infrastructure, from substations and transformers to poles and junction boxes and finally to the wires and meters at the end user's location. Utilities must also operate complex communication networks for routine and emergency operations; control rooms to monitor network activity, maintenance and repair shops, equipment, and trained personnel; and an accounting and billing operation to assure electrons are accounted for when purchased.

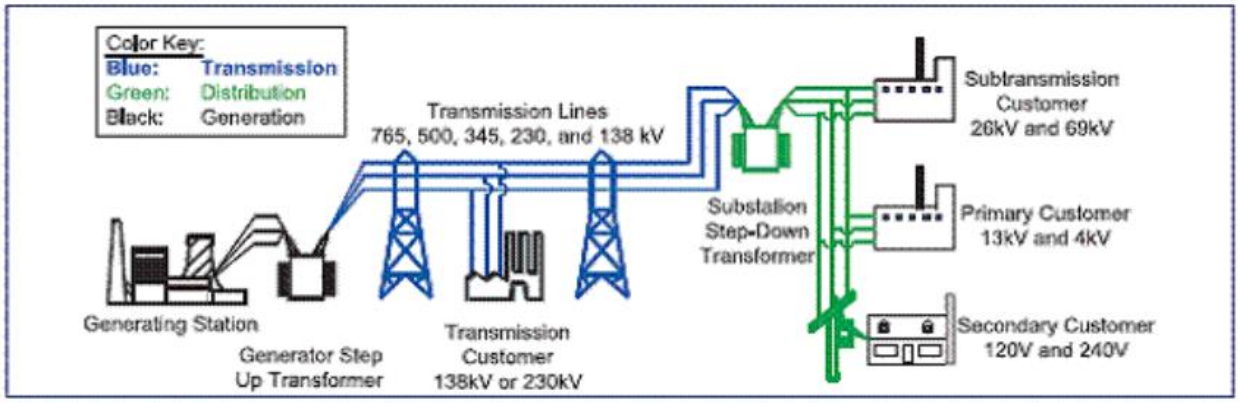
Another feature of Exhibit 14 illustrates an additional level of complexity that helps stakeholders who are unfamiliar with the electricity system to understand potential issues regarding electricity distribution. Some industrial users receive power directly from high-voltage transmission lines and may maintain their own end-use off grid equipment. The diagram also illustrates two additional levels: small industry and commercial/institutional users. These customers may obtain favorable bulk rates depending on size and demand.

At the end of the distribution system are residential customers. Utilities have found that first restoring both larger users, whose distribution infrastructure has the ability to accept higher kV power, and distribution lines that carry the greatest number of users per line segment, is expeditious. This strategy results in customers on a heavily used line generally experiencing a restoration of power before others.

Finally, Exhibit 14 can also be viewed as a summary, illustrating the restoration of power. Companies generally restore power after a loss or interruption based on system created priorities. This strategy relates to energy security as the restoration of the larger (i.e., serving more accounts or customers) circuits occurs first, with smaller sub systems that serve diminishing groups of users following.

EDCs assess outage location and extent after any disruption or incident. Incidents that occur in only a smaller sub system typically result in more rapid restoration than incidents that occur at or near the bulk power level. This more rapid restoration in smaller sub systems occurs because the repair of complex large-scale components that must be restored before local distribution needs can be addressed may require more time.

Exhibit 14: Electric System Diagram



Reliability Requirements

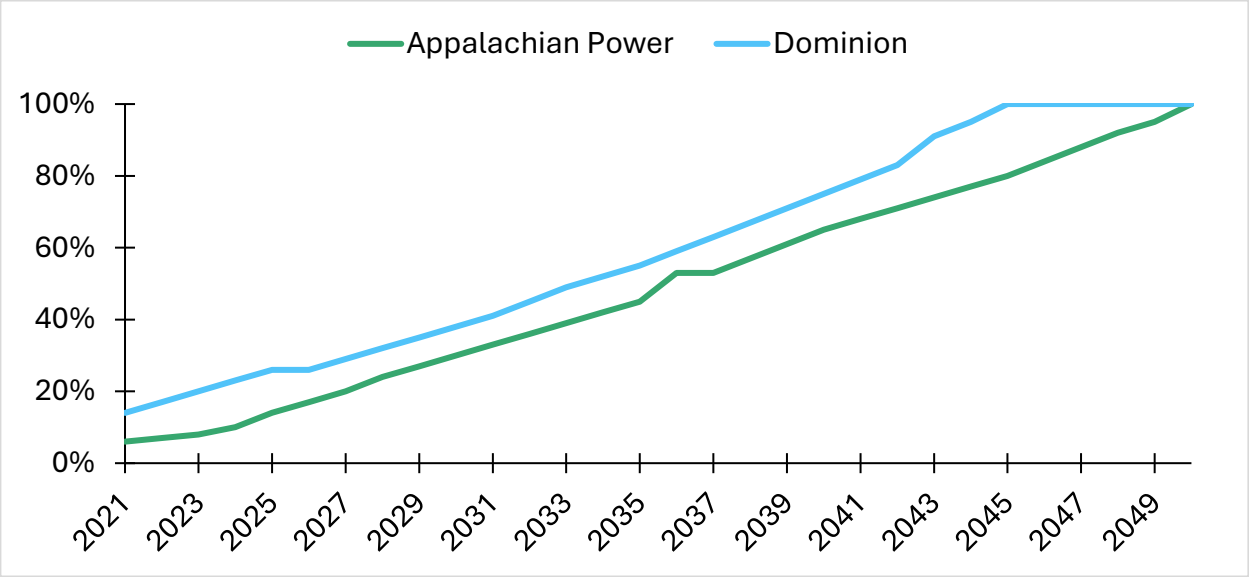
Virginia's utilities must comply with reliability standards in PJM as well as operating within SERC and RFC guidelines. The SCC works with utilities to assure fair and reasonable rates of return because EDCs must make a profit to provide the service that certificates of public convenience and necessity (CPCN) require. At the same time, the SCC must also oversee reliability as a condition of a utility's obligation to serve.

Virginia utilities collect annual data pertaining to electricity reliability. Following major incidents, such as storms, the SCC staff performs both informal and formal analyses to determine if EDCs used adequately prepared and appropriate processes, mutual aid, and resources to mitigate and restore power efficiently and expeditiously. Reports or even formal docket hearings may follow such analyses. The SCC maintains liaison with each utility to assure the flow of information and to handle special requests. The SCC also maintains liaison with PJM, which also does extensive contingency planning.

ELECTRICITY TRENDS

Virginia has a current renewable portfolio standard (RPS) that was established by the Virginia Clean Economy Act (VECA) in 2020. This act requires 100% renewable energy generation for Dominion Energy by 2045 and Appalachian Power Company by 2050 and various percentages of clean electricity by utility by year, shown in Exhibit 15. Renewable Energy Credits (RECs) can be used to meet this standard; however, starting in 2025, 75% of RECs for Dominion must be sourced from renewable generators in the state of Virginia.[x] Eligible resources include solar, wind, and existing hydroelectric, waste-to-energy landfill gas, and biomass. In addition, VECA requires the retirement of all carbon-emitting baseload generation in favor of renewable generation by 2045.

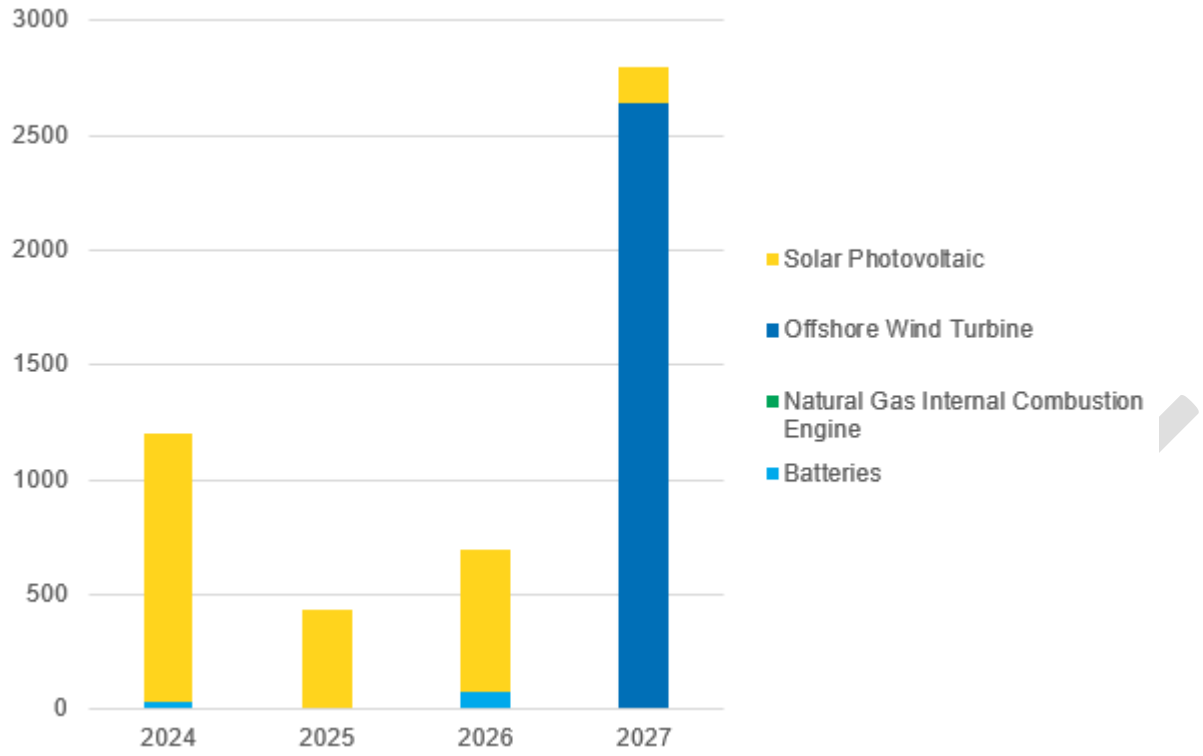
Exhibit 15: Virginia Clean Economy Act RPS Percentages of Clean Electricity



Source: PJM's Environmental Information Services: Virginia Overview

Currently, most utilities are targeting solar projects to increase renewable generation. However, Dominion Energy has a large offshore wind energy project set to be completed and operational for 2027. Offshore wind tends to be more reliable than other renewables and is strongest at night which offsets the decrease in generation from solar panels. Batteries are expected to only make up a small percentage of planned projects over the next five years; however, battery installments will become more common as baseload generation is retired.

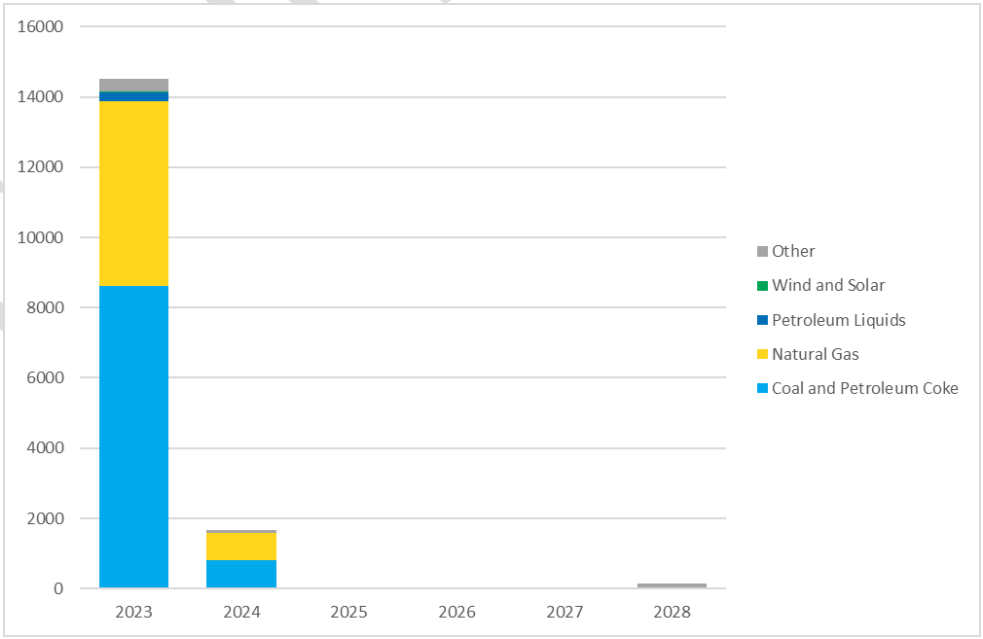
Exhibit 16: Planned Utility-Scale Generation Installments in Virginia, 2024-2027



Source: EIA-860M, March 2024

Overall, both PJM and Virginia are looking to transition to renewable energy which will reduce fossil fuel emissions, decrease dispatchable generation capacity, and increase reliance on utility scale battery systems.

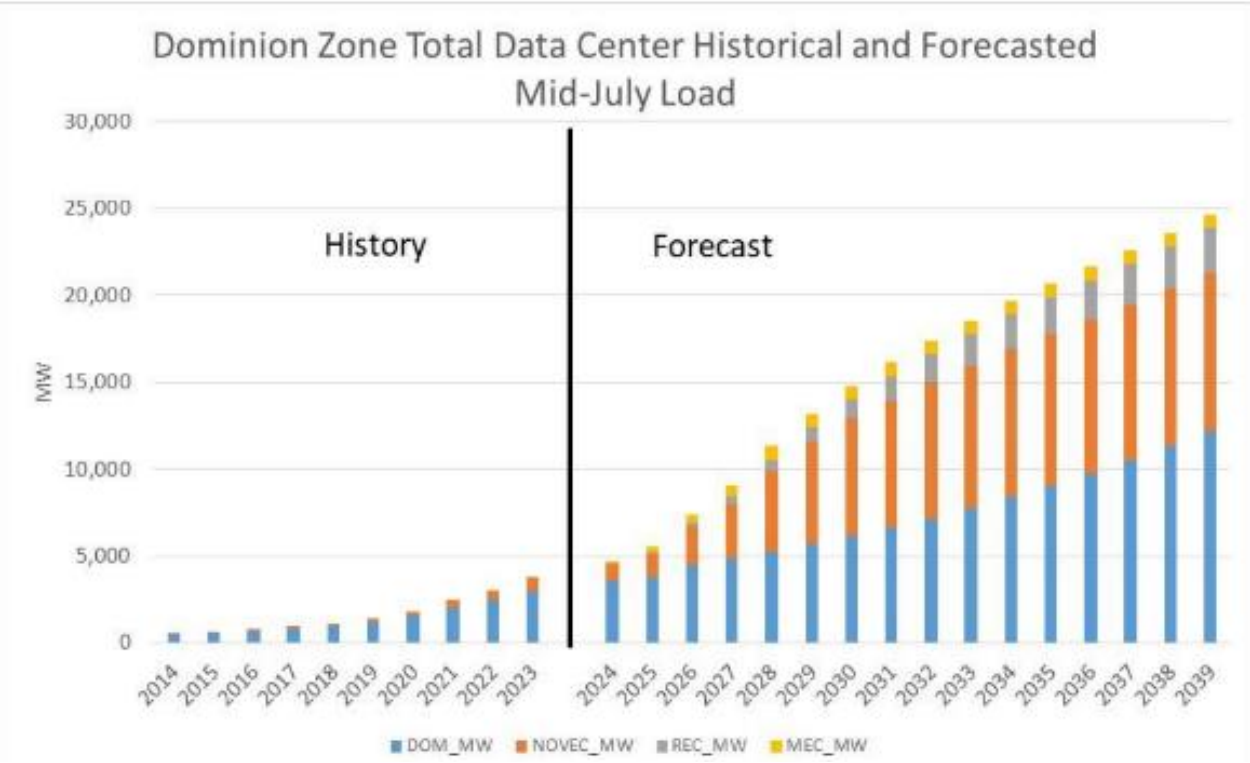
Exhibit 17: Recent and Planned Utility Scale Generation Retirements, 2023-2028



Source: EIA-860M, March 2024

Virginia hosts the largest data center market in the world. PJM projects that the Northern Virginia data center hub will consume 25GW by 2035.[xi] To meet the ever-growing demands of new data center siting, Virginia's utilities have continued to have to upgrade transmission, distribution, and generation infrastructure to meet the growing electricity demand at data centers. Although data center demand will be the primary driver, gradual adoption of electric vehicles will also increase electricity demand in the state over time. Although Virginia originally had a ban of non-electric vehicles set to start in 2035, the State exited the electric vehicle mandate in 2024.[xii]

Exhibit 18: Dominion Zone Data Center Load Growth



Source: PJM Load Forecast

Coal

Virginia has 40 operating coal mines, which contributes less than 2% of the nation's total coal production. However, the state plays a crucial role in the coal export market. Virginia boasts the nation's largest coal port complex, making it a key player in coal exports. In 2022, approximately 38% of the U.S. total coal exports passed through the Norfolk Customs District, which encompasses Norfolk and Newport News; most of this coal actually originates from other states and travels via rail to Norfolk.[xiii]

Virginia also consumes a small amount of coal: nearly 2.9 million tons in 2022. About half was mined in Virginia, and the other half is delivered in from nearby states. Nearly 60% of the coal consumption in Virginia is used for electric power generation with another 30% consumed in coke plants. Nearly all the remaining coal goes to industrial processes.

Petroleum

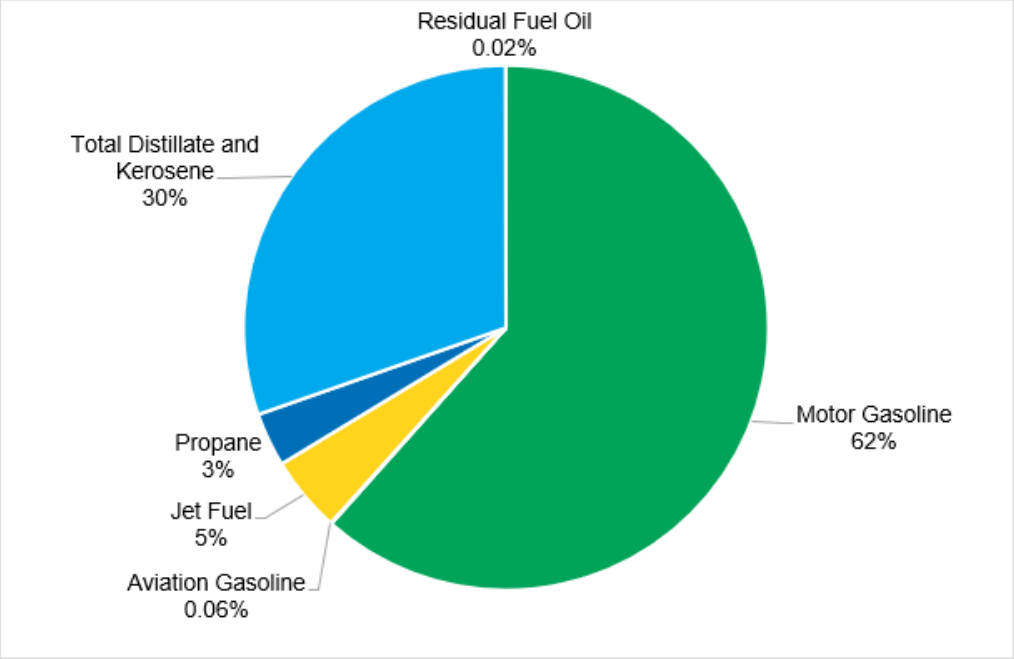
The second energy sector addressed in this section is petroleum, with a specific focus on three fuel types since they are the most widely used in Virginia: motor gasoline, distillate, and propane (one form of LPG).

Unlike electricity and natural gas, the liquid fuels market does not consist of regulated utilities. Instead, the market consists of entities ranging from large-scale integrated major companies that may do business in global markets, regional independents and wholesalers, to independent businesses operating on a local basis with perhaps only a single location.

PETROLEUM PRODUCTS CONSUMPTION

Most of the Commonwealth's petroleum consumption is for ground transportation in the form of motor gasoline. However, kerosene and heating oil account for 30%, and aviation fuels account for another 5%.

Exhibit 19: Petroleum Product Consumption, 2021

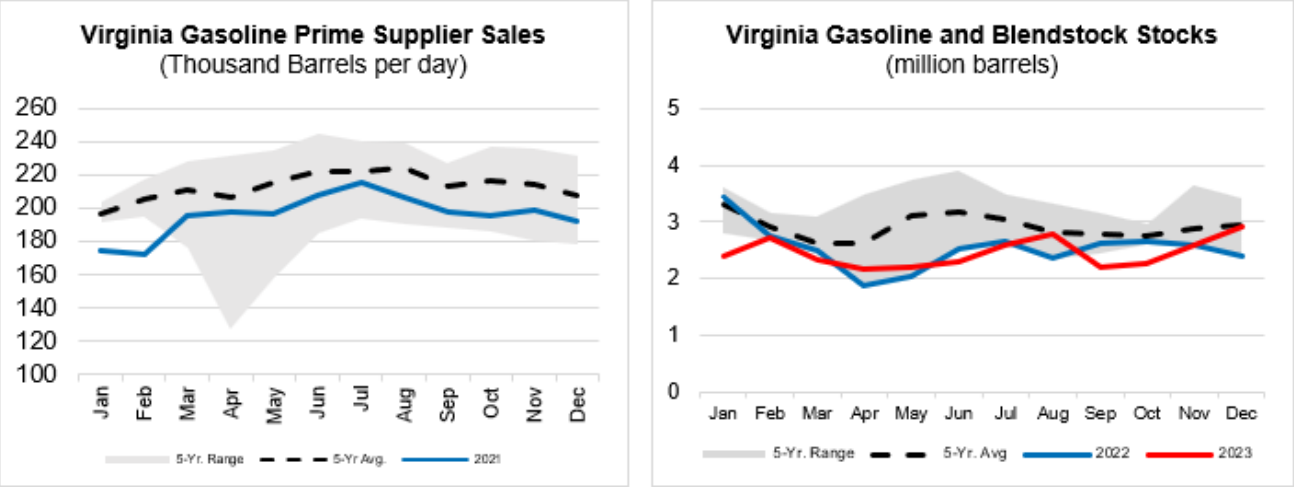


Source: EIA Prime Supplier Sales Volumes

Gasoline

Virginia's gasoline consumption is driven primarily by the transportation sector, which consumes roughly 87% of the state's petroleum products, with more than three-fifths of that as motor gasoline.[xiv] Most of Virginia consumes conventional gasoline, while counties and cities in northern, central and eastern Virginia are federally required by EPA's Clean Air Act – to consume solely reformulated gasoline blended with ethanol to reduce harmful emissions.[xv] In 2021, Virginia consumed roughly 196,000 b/d of gasoline on average.[xvi] Gasoline consumption is fairly consistent throughout the year, with small peaks occurring during the summer season, matching consumption trends for the United States, as the summer months are considered peak driving season.

Exhibit 20: Gasoline Sales and Stocks in Virginia

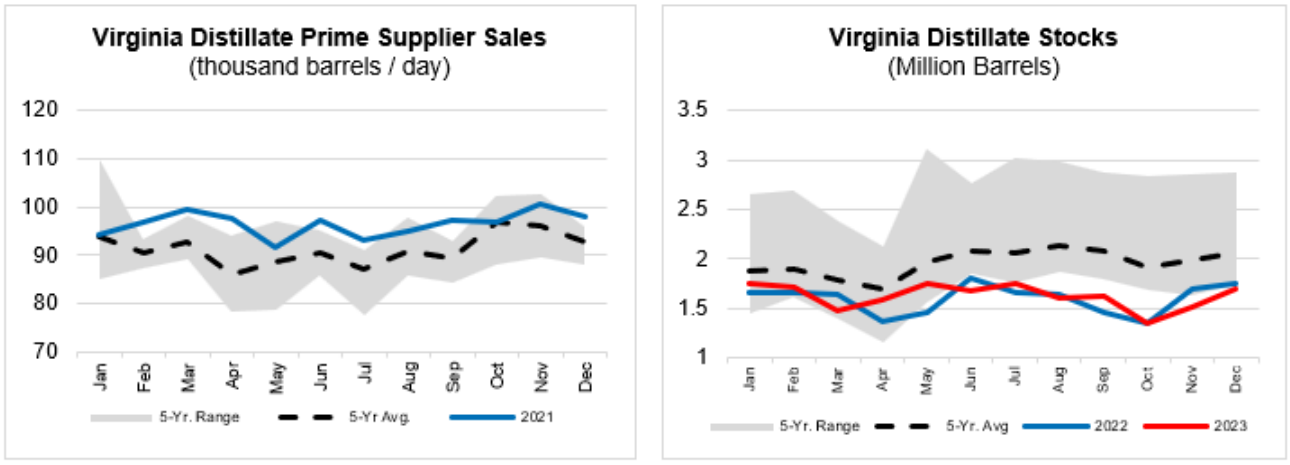


Sources: EIA Inventories at Refineries, Bulk Terminals, and Natural Gas Plant Stocks. EIA Prime Supplier Sales

Distillate

Distillate fuel is comprised of diesel fuel and fuel oil which are used for trucks, automobiles, off-highway engines, machinery, space heating, and electric power generation. In 2021, demand for distillate fuel in Virginia averaged 96,500 b/d as shown in the prime supplier sales graph in Exhibit 21. Historically, on-road diesel is the highest end-use of distillate in the state, followed by railroad, residential, and industrial end uses. While distillate consumption rises and falls month over month, due to high on-road consumption, use of the product typically peaks in the winter driving months, during home heating season and as backup power generation needs in the commercial and industrial sectors increase.

Exhibit 21: Distillate Sales and Stocks in Virginia



Sources: EIA Inventories at Refineries, Bulk Terminals, and Natural Gas Plant Stocks. EIA Prime Supplier Sales

Jet Fuel

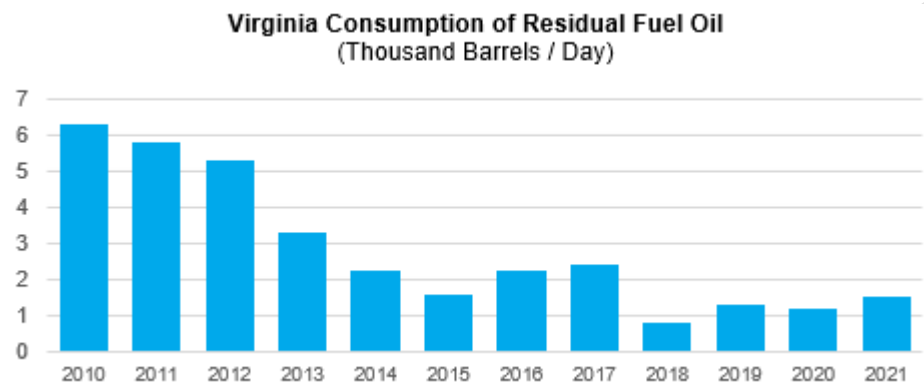
Jet fuel consumption is driven solely by international and domestic flights into and out of the 66 public use airports in the state. In 2022, Viginia consumed 21.6 million barrels of jet fuel, roughly 59,000 b/d, making it the seventh largest consumer of the product in the U.S.[xvii]

Virginia consumption of jet fuel is primarily driven by commuters into the Washington D.C metropolitan area where Virginia houses Reagan National Airport (DCA) and Dulles International Airport.[xviii]

Residual Fuel Oil

In 2022, Virginia consumed 601,000 barrels of residual fuel oil, roughly 1,650 b/d, driven primarily by consumption in the transportation sector. Residual fuel oil in Virginia is primarily consumed as bunker fuel in the maritime shipping sector. Given the high volume of maritime movements into and out of ports in Virginia, residual fuel oil is critical in supporting stable traffic of vessels and barges in the state.

Exhibit 22: Residual Fuel Oil Consumption and Stocks in Virginia

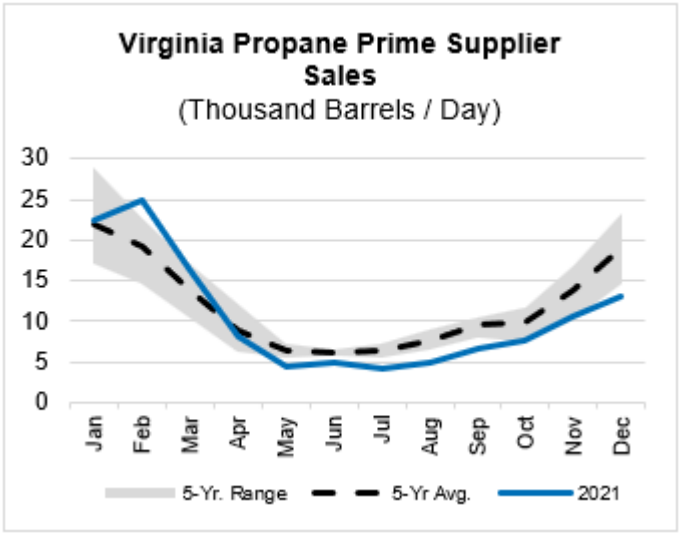


Sources: EIA Inventories at Refineries, Bulk Terminals, and Natural Gas Plant Stocks. EIA State Energy Data System

Propane

Propane consumption in Virginia is relatively low when compared to some of the colder areas in the United States. Roughly 4% of homes in Virginia are heated by propane,[xix] however the residential sector in Virginia primarily uses propane to heat water for in house uses.[xx] In 2021, Virginia consumed roughly 10,700 b/d of propane, making it the 20th largest consumer of the product during that time period.

Exhibit 23: Propane Sales in Virginia



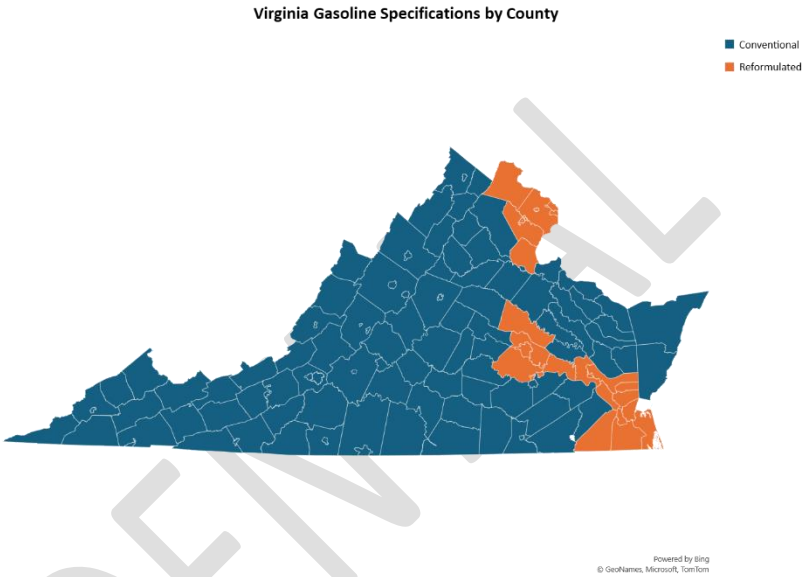
Source: Prime Supplier Sales

Propane enters the market as either a product of petroleum refining or a liquid by-product of natural gas. The propane distribution system is similar to that for other liquid petroleum products, and it is generally regarded as part of the petroleum sector.

State Fuel Specifications

The Clean Air Act mandates the use of reformulated gasoline (RFG) in some Virginia jurisdictions to reduce emissions of volatile organic compounds, carbon monoxide, and nitrogen oxides. The 28 jurisdictions, in Northern Virginia, Richmond, and Hampton Roads areas, which must use RFG in Virginia are shown in Exhibit 24. All other jurisdictions in the state use conventional gasoline.

Exhibit 24: Virginia Gasoline Specifications by County

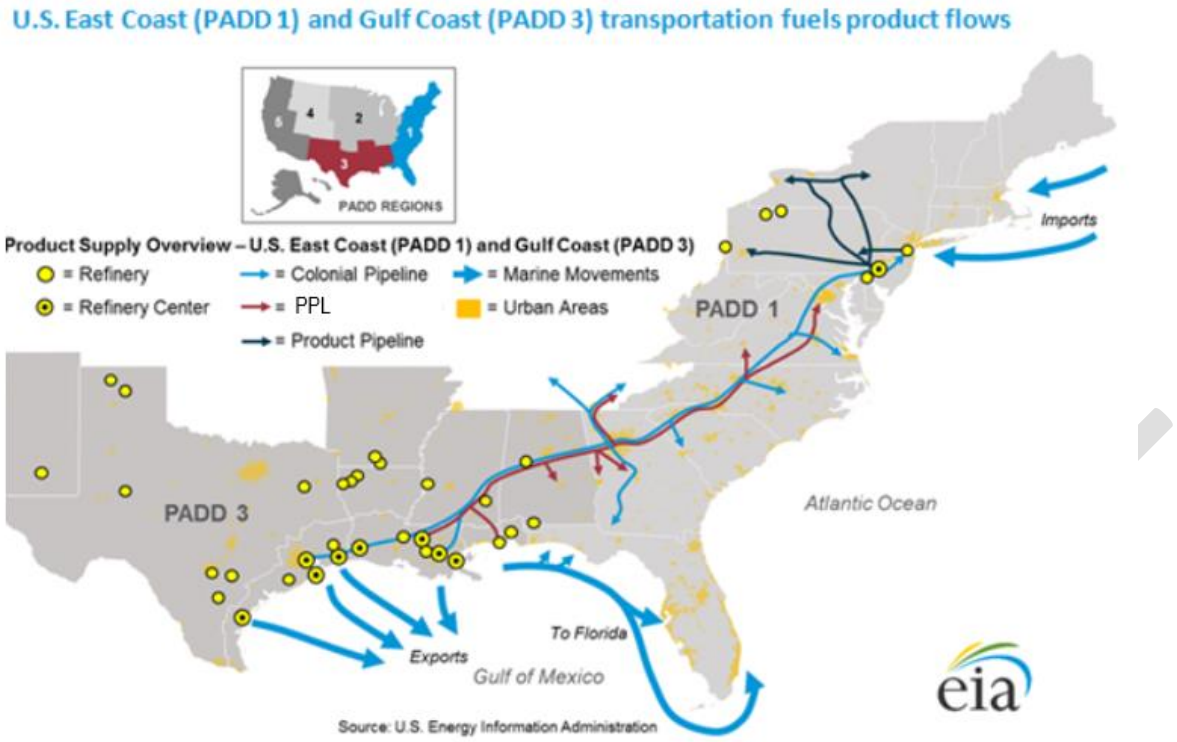


PETROLEUM PRODUCTS SUPPLY

The distribution of petroleum products in Virginia begins with major oil company suppliers. Depending on price and availability of supply, major petroleum companies may deliver oil and propane products to Virginia. Major national product trading firms that buy from many suppliers also sell petroleum in Virginia. The major companies, or independent petroleum marketers, also known as jobbers, also directly supply motor gasoline. Most of the distillate and propane passes though jobbers as well. Virginia consumers purchase distillate and propane mostly through independent retailers.

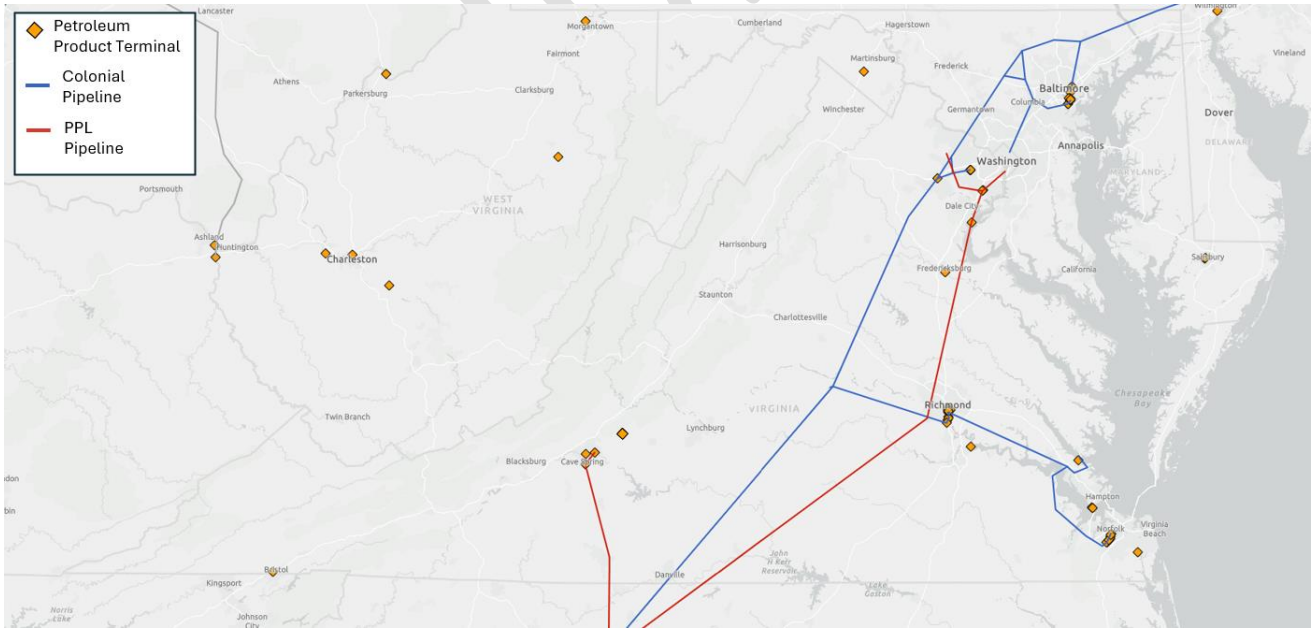
The Commonwealth is dependent on the continuity of the interstate pipeline network for supply. Both the Colonial and Kinder Morgan's Products SE Pipe Line (formerly the Plantation Pipeline and still abbreviated PPL) pipelines serve Virginia; these two are also the major petroleum liquids pipelines serving the East Coast from the Gulf and Texas coasts through Mississippi, Alabama, Georgia, South and North Carolina, and into Virginia (Exhibit 25). The State also receives some petroleum products via the Port of Norfolk.

Exhibit 25: Map of East Coast and Gulf Coast Transportation Fuel Product Flows



Source EIA: https://www.eia.gov/analysis/transportationfuels/padd1n3/ with Virginia Energy updates

Exhibit 26: Map of Transportation Fuel Infrastructure in Virginia



Source: EIA Petroleum Product Pipelines and Petroleum Product Terminals Layers

Pipelines

Two major petroleum product pipelines—Colonial Pipeline and PPL Pipeline—deliver refined petroleum products to locations across the state. The Colonial Pipeline originates at refineries along the Gulf Coast and has several delivery locations in Virginia before reaching its endpoint

in the New York Harbor region. Colonial Pipeline operates two parallel lines in Maryland, Lines 3 and 4, with respective capacities of 885,000 barrels per day and approximately 504,000 barrels per day of mixed products including gasoline, distillate, and jet fuel.

Line 27 is a spur line that branches off Colonial's Lines 3 and 4 at the Mitchell Junction Tank Farm to serve fuel demand in Richmond, VA and the Hampton Roads. From Mitchell Junction Tank Farm, Line 25 brought refined petroleum products to the Roanoke area before it closed in 2018 due to uneconomic repairs. Additionally, Line 28A delivers products to the Fairfax terminal cluster, and Line 30 transports jet fuel to Dulles International Airport in Northern Virginia.

The PPL Pipeline brings petroleum products north from Louisiana and Mississippi to its terminus in northern Virginia near Washington, DC. It has a spur line from Greensboro, NC that delivers to terminals in Roanoke as the area's sole source of supply.

Ports

Virginia's liquid fuel demand is supplied partially by imports and domestic movements brought into the State's maritime ports in Norfolk and Richmond. In 2022, the Port of Norfolk received nearly 15,000 b/d of petroleum products.[xxi] Petroleum products are typically delivered into ports via vessels and barges and unloaded into terminals with marine access. In 2022, liquid fuel imports to the state originated in Canada and the Netherlands, with roughly 2,100 b/d of foreign imports being received in Norfolk. Petroleum products are also brought into the ports via domestic movements from other parts of the United States, primarily the Gulf Coast region from Texas and Louisiana.

Terminals Serving Virginia

Petroleum product terminals are a key component of the state supply infrastructure. Terminals delineate between supply entering the Commonwealth and distribution of products to consumers inside the State.

Major terminal companies often serve liquid petroleum product markets throughout the United States. For example, both Kinder Morgan and Magellan are terminal companies acting as national product intermediaries, and each operate multiple terminals in Virginia. Petroleum terminals are shown in Exhibit 27 Such companies buy petroleum products at all levels, including acquisition of non-contract product from refineries, in essence creating and maintaining the spot market for excess petroleum products. They balance the cost of their market involvement with efficiencies in purchasing, so their market presence is transparent to the end-user. They could also be called national jobbers.

The petroleum market in Virginia has changed over the past two decades. Consolidation has taken place at the national, regional, and local level. Although the basic distribution structure remains the same, fewer companies supply the same volume of liquid petroleum products. Regional offices of supply companies have consolidated as well, reducing the number of competitive contacts that State responders could reach in the event of a shortage. However, the impact on supply is transparent.

Another link in the fuel acquisition chain is storage. Local storage diminished significantly in Virginia as major suppliers moved to just-in-time delivery. The cost of implementing environmental management requirements and the soaring cost of tank insurance have also reduced storage. Currently, there are approximately 100 bulk facilities remaining in Virginia.

Exhibit 27: Petroleum Terminals in Virginia

COMPANY	SITE	CITY
Petroleum Fuel & Terminal Co	Chesapeake	Chesapeake
BKEP Materials LLC	Newport News Va	Newport News
BKEP Materials LLC	Dumfries	Dumfries
Associated Asphalt Bristol LLC	Bristol	Bristol
Associated Asphalt Roanoke LLC	Roanoke	Roanoke
Associated Asphalt Hopewell LLC	Hopewell	Hopewell
Buckeye Terminals LLC	Fairfax	Fairfax
Buckeye Terminals LLC	Richmond	Richmond
Buckeye Terminals LLC	Chesapeake	Chesapeake
Buckeye SE Terminals LP	Richmond	Richmond
Buckeye SE Terminals LP	Roanoke	Roanoke
Colonial Terminals Operating Co LLC	Fredericksburg	Fredericksburg
Sunoco Logistics	Manassas	Manassas
Sunoco LLC	Virginia Beach	Virginia Beach
Sunoco Midstream LLC	Norfolk	Norfolk
Intl Matex Tank Terminals	Chesapeake	Chesapeake
Intl Matex Tank Terminals	Richmond	Richmond
Kinder Morgan Transmix LLC	Deepwater	Richmond
Kinder Morgan Southeast Terminals	Chesapeake	Chesapeake
Kinder Morgan Southeast Terminal	Newington	Newington
Kinder Morgan Southeast Terminal	Richmond 1	Richmond
Kinder Morgan Southeast Terminal	Richmond 2	Richmond
Kinder Morgan Southeast Terminal	Roanoke 1	Roanoke
Kinder Morgan Southeast Terminal	Roanoke 2	Roanoke
Kinder Morgan Southeast Terminal	Newington 2	Lorton
Kinder Morgan Va Liq Terminals Llc	South Hill	Chesapeake
NGL Energy Partners LP	Chesapeake LPG	Chesapeake
First Energy Corp	Richmond	Richmond
Citgo Petro Corp	Chesapeake	Chesapeake
Citgo Petro Corp	Fairfax	Fairfax
Citgo Petro Corp	Richmond	Richmond
Plains Marketing LP - Yorktown Terminal	Yorktown	Yorktown
Motiva Enterprises LLC	Fairfax	Fairfax
Motiva Enterprises LLC	Richmond	Richmond
TransMontaigne Operating Company	Norfolk	Norfolk
TransMontaigne Operating Company	Montvale Piedmont	Montvale
TransMontaigne Operating Company	Montvale	Montvale
TransMontaigne Operating Company	Richmond	Richmond
TransMontaigne Operating Company	Fairfax	Fairfax
TransMontaigne Operating Company	Richmond-Atl	Richmond
World Fuel Services	Newport News	Newport News

Source: ArcGIS, EIA

Natural Gas Liquids

Most propane comes to Virginia through the Dixie Pipeline to the Apex Terminal located in Apex, North Carolina. Some is railed into the state, and some comes via barge into the Port of Norfolk to a terminal in Chesapeake, Virginia. Propane is then trucked from the North

Carolina and Chesapeake terminals to wholesale and retail bulk plants in Virginia. Smaller retail delivery (bobtail) trucks deliver the propane from these plants to end-users.

Processing plants obtain propane, or LPG, by stripping it from natural gas or as a by-product during the refining of crude oil. Most of the LPG sold in Virginia is purchased on contract and delivered to consumer tanks owned by a delivery company. Dealers generally contract with a propane gas transport company to deliver contracted product to their local bulk plant.

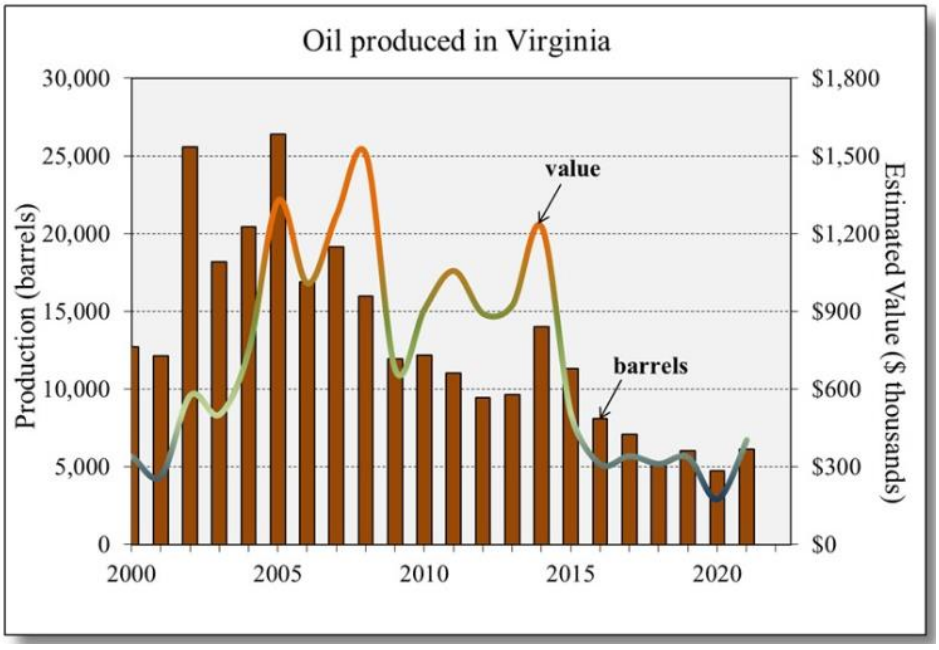
Exhibit 28: Propane Terminals in Virginia

NAME	CITY	INBOUND AND OUTBOUND MODES
Greenwood RRST	Greenwood	Rail in/Truck out
Watts Petroleum	Lynchburg	Rail in/Truck out
Quarles Milford	Milford	Rail in/Truck out
NGL Supply Co Milford	Milford	Rail in/Truck out
Woodgate Petroleum/Enterprise	Stephens City	Rail in/Truck out
NGL Supply Wholesale	West Point	Rail in/Truck out

CRUDE OIL

Virginia has no appreciable crude oil reserves and only a very small amount of crude oil production, all of which is from wells in two counties in the far southwestern corner of the state. Virginia's gas and oil industry reported the production of 6,116 barrels of crude oil in 2021, up about 29 percent from the production reported in 2020. The estimated value is $403 thousand (Exhibit 29).

Exhibit 29: Crude Oil Production in Virginia, 2000-2021



Source: https://www.energy.virginia.gov/geology/Oil.shtml

BIOFUELS

There are no fuel ethanol production facilities in Virginia, but the state accounted for about 3% of the nation's fuel ethanol consumption in 2021. Ethanol is primarily railed into the state from Midwestern ethanol production facilities.

Virginia's one biodiesel plant, Virginia Biodiesel Refinery in West Point, VA, has a production capacity of about 325 barrels per day. However, Virginia consumers used more than 900 barrels per day of biodiesel in 2021.[xxii] Additional biodiesel is railed into the state from out-of-state production.

LIQUID FUEL TRENDS

In 2020, the General Assembly passed the Virginia Clean Economy Act (VCEA), which mandated a goal of 100% zero-carbon energy generation by 2050 and prescribed increasingly strict Renewable Portfolio Standards (RPS) for Virginia's investor-owned electric utilities. Similar to RPS requirements, the California Air Resources Board regulations, which are statutorily mandated in Virginia, eliminate consumer choice and ban the sale of non-electric vehicles by 2035, which will start to decline the usage of transportation fuels in the state.[xxiii]

LIQUID FUEL MARKET BACKGROUND

To explain how petroleum and propane market components affect ES, the discussion identifies the principal petroleum liquid market delivery systems. In order to address the management of disruptive energy events, this text also describes industry issues and supply disruption, mitigation, and response, as well as energy shortage identification.

International Commodity

Petroleum is a global commodity. While there are domestic laws pertaining to the integrity and safety of petroleum shipping and pipelines, as well as certain trade practices prohibited in the United States, crude oil and its refined petroleum products are bought and sold in an unregulated international marketplace. The economic principles of supply and demand generally govern petroleum markets. However, essential elements of this marketplace can be obscure. In other words, both sides of the supply and demand equation can be, and often are, adjusted to affect market pricing.

Some of the factors that affect pricing, and thus create uncertainty, are the ability of producers to increase or decrease extraction, of refiners to expand or contract refinery output and product production ratios, and of end-users to reduce consumption. For example, speculation in oil futures from participants who do not take actual (wet) barrels affects price. This speculation in turn may send market signals that result in an inaccurate representation of the physical market. Components of this market may be more or less vulnerable, depending on the apparent need for petroleum products at any given moment and the ability of the market to clear. In other words, supply is expected to satisfy demand at a price that facilitates (even if reluctantly proffered) this exchange. If supply does not satisfy demand at the given price, there may be risk of shortage.

Essential Market Systems

There are several essential systems affecting petroleum: exploration/production of crude oil, pipeline and shipping transportation, refining, reserves, and the State petroleum market.

Each system has its own supply and demand structure. These system structures further complicate the availability and price of petroleum products sold for consumption.

Exploration/Production

At the international and national levels, a complex system of factors affects oil exploration and production: demand for crude oil (and natural gas because production wells often produce both); the cost of exploration, including location and discovery of the resource; infrastructure; supplies; insurance; time; personnel; national and local laws and regulations; and, to be frank, luck.

Transportation

Many factors affect the transportation of crude oil. Some of these include shipping rates, vessel availability and location, alternative transport such as secure pipelines, insurance, personnel, weather, and international and national shipping and transportation rules and practices. In the U.S., and for product from neighboring countries, crude oil can move from production to refinery via international and interstate pipelines, thus reducing risk and cost to the U.S. domestic market. However, with about 37% percent of U.S. oil imports coming from outside North America in 2023, ocean shipping is also an important component of the supply equation.[xxiv]

Perhaps the two most important points concerning shipping are that 1) the U.S. petroleum market would collapse without shipping, and 2) shipping is an essential pathway linking the United States to world prices with all the implications for domestic price and supply risk. Although Virginia receives the bulk of its petroleum products via pipeline from the Gulf Coast region, those products may have begun their journey in any of several states where much of the oil is produced, offshore in the Gulf of Mexico or be imported from South America, the Middle East or Africa or even Europe. Consequently, the Commonwealth's consumers pay market prices that world shipping makes possible.

National Storage and Reserves

Petroleum supply stakeholders make the claim that price is the best way to manage (or clear) a shortage. When product is short, jobbers will seek supply from outside of their usual area to re-supply. The higher prices they charge cover the costs of bringing in the product. Market fundamentals demonstrate that upward pressure on prices also attracts newer volumes of product that should help satisfy and moderate retail demand, thus reducing the impact of supply shortage. Over time, supply and demand tend to balance. This theory works well enough but is subject to variance attributable to permanent changes in the market. For example, a significant factor in the U.S. market is the creation of a relatively new reduced storage supply chain. While this new supply chain increases the efficiency of the market from the seller's viewpoint, it also reduces market flexibility from the perspective of the buyer. This just-in-time delivery mechanism has caused permanent change, reflecting a newer (higher-priced) balancing point.

Although just-in-time product delivery strategy tends to reduce product storage speculation on the New York Mercantile Exchange it may increase volatility, as speculators trade petroleum commodities based on real-time risk attributable to refinery status, national oil politics, and political turmoil in some oil-producing counties.

At one time, locally stored petroleum products helped to moderate price volatility. As costs to retain such storage increased (e.g., Environmental Protection Agency (EPA) pollution rules, insurance and capital to replace aging infrastructure), reduced local storage raised

the economic risk for consumers in tight supply markets. Aside from rhetoric, the federal government has one tool to manage price volatility during supply shortage, the SPR. A 2021 Presidential decision to release a limited amount of crude oil for purchase by refineries illustrated a moderate reduction of price volatility. However, this release for economic (versus significant shortage) reasons created considerable political debate.[xxv]

The SPR is located in Louisiana and Texas near the Gulf Coast. The SPR's total capacity is 714 million barrels (MMbbl) of crude oil; no petroleum products are stored in the U.S. SPR. It was intended that the SPR should contain as much oil as the nation imports in 90 days. The President can order the SPR to solicit bids from U.S. refineries for its crude oil to mitigate a severe shortage. As of June 2024, the SPR contained 371 MMbbl, which at a rate of consumption of 16 MMbbl per day by U.S. refineries would last about 23 days.[xxvi]

Liquid Petroleum Fuel Acquisition – Prices/Contracts

The most important factor in jobber product acquisition is price. Jobbers will seek the lowest cost per gallon of fuel their customers require and send trucks to terminals (within a reasonable distance their own calculations determined)[4] to supply their retail outlets. For example, the Kinder Morgan terminal in Richmond may post a different price on any given day than the Kinder Morgan terminal in Roanoke.

Consumer contracts are another important element of fuel acquisition. Contract secured accounts generally receive service; non-contract (so-called unbranded) customers follow. Many of the State's unbranded dealers are affiliated with convenience, or "C" stores supplied by spot market product. Over 90 percent of the C-stores in Virginia sell fuel obtained in the spot market.

Ordering Product

Retail dealers signal their jobbers in two ways. Either they send a regular (daily) posting to their jobber (supplier) indicating how much product they anticipate selling, or the jobber obtains this information automatically via electronic sensors in the retailer's underground tanks. In the latter case, an automatic tank gauge (ATG) sends a morning reading and the jobber's tanker is dispatched. Under this system, a retailer may never know if there is a shortage if sales proceed at a normal pace. However, if a shortage worsens or if the public perceives a shortage, the jobber is likely to inform the retailer because there is a chance that supply could run short before the end of the day. This type of automation is still under development for other end-users.

Motor Gasoline, Distillate and Propane Fuel Curtailment

Commercial, institutional (including governments), and industrial end-users may purchase fuel with long-term supply contracts. However, the sale of most motor fuel (diesel and motor gasoline) occurs through contracts with general retail outlets that in turn sell to end-users. Alterations to contractual arrangements may occur during a significant supply shortage.

If crude oil supply is less than refiners anticipate, prices increase as refiners compete to obtain the lower number of barrels available for sale. This price increase causes the refiners' profit margins to decrease, unless they raise the cost of the petroleum products they sell. This chain of events describes the impact of the OPEC embargo in the 1970s. A

[4] Weather affects price spread variations. In general, most jobbers will not drive farther than 100-135 miles out of their area for fuel. As a rule of thumb, they will not make such an out-of-area pick-up unless there is a 10-cent or greater price spread.

similar pattern occurred when Venezuela crude shipments diminished from 2002 to 2003 during a workers' strike in that country.

When petroleum consumption is flat or shrinking because of weak market conditions, refiners avoid "competing with themselves" by reducing production. This reduction prevents supply from exceeding demand and helps maintain refinery margins (i.e., prices). Another way to explain this strategy is that a common response of the petroleum product industry to a decrease in consumption is to reduce production to balance supply and demand. This method may not prevent lower prices but does soften the impact on profits.

If refinery production decreases enough, product marketers may receive notice (which may not be formal; sometimes jobbers must recognize a decrease in volume on their own) of a reduction in (or curtailment of) the previously calculated volume for contract fulfillment. Because Federal trade practice laws prevent discrimination in choosing or favoring buyers, jobbers reduce the amount of contract specified available to all their retail dealers. In such cases, the retail dealer is "put on allocation." Retail dealers may experience a curtailment up to "100 percent-of-contract." Curtailment reduces jobbers' flexibility in serving non-contract customers.

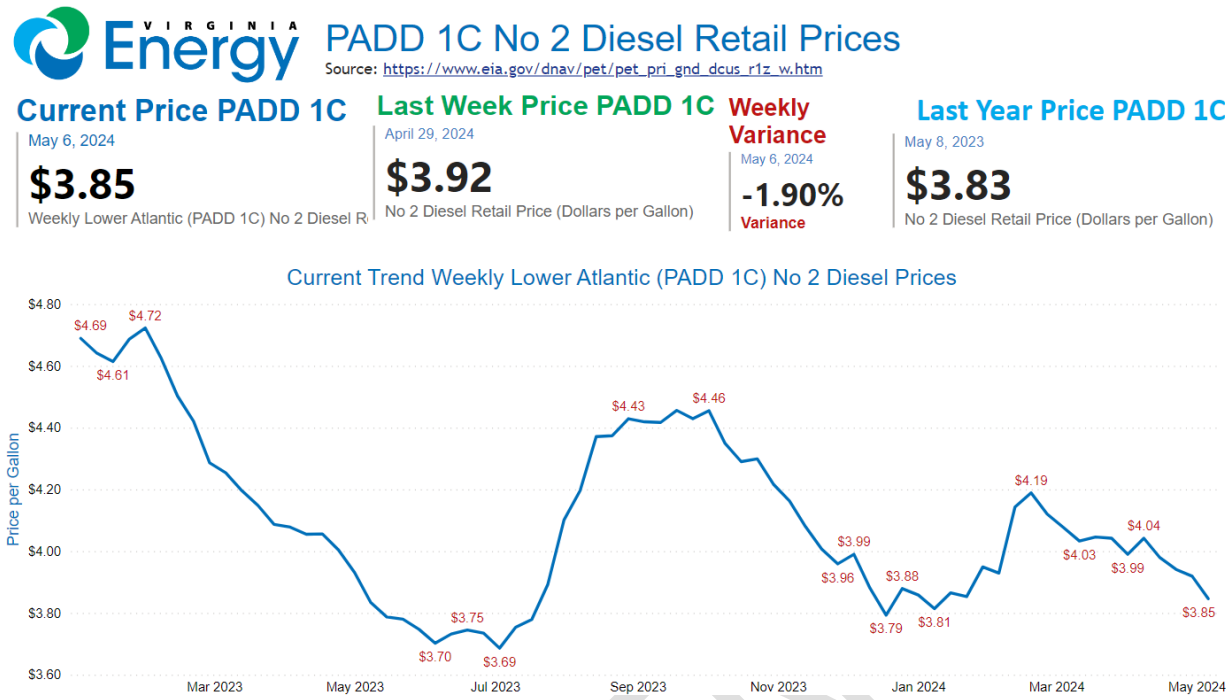
Local propane systems can manage a temporary supply reduction because the contracted customer base is filled in cycles; hence, most customers will have enough fuel on hand until normal supply is restored. If supply remains low or diminishes further, customers become increasingly vulnerable to fuel shortage risk. To counter this risk, ESF-12 directs the SCC to work with railroad companies in a propane or energy shortage to prioritize movement of fuel and empty propane cars.

Experienced dealers know they must be aware of market conditions and check their tank volume gauges frequently. If supply is short, they may adjust their hours of operation. However, they may not reduce purchased volume at the point of sale without authorization from a public authority. For this reason, waivers or some of the petroleum emergency mitigation measures in Exhibit 82 may help to soften the impact of severe shortage. The least obtrusive of the suggested mandatory measures provide substitutes for rationing (e.g., tank topping prevention or odd even day purchases). The most stringent measure, the Petroleum Set-aside, transfers the assignment of a percentage of products from private suppliers to the state government (the actual sale remains with the private sector seller, but the set-aside customers are assigned to them by the state. No money passes to the state through such transactions).

Implications of Price and Shortage

Geopolitical tension with Russia, contributed to higher crude oil prices in the first half of 2022.[xxvii] Diesel prices rose significantly in the latter half of 2022 as result of a more competitive overseas market combined with reduced refinery capacity contributing to domestic supply constraints (see Exhibit 30).[xxviii]

Exhibit 30: Southeast (PADD 1C) Diesel Retail Price January 2023- May 2024



The economic burden of price as the mediator of energy shortage is that the consumer must reduce travel or pay more. Businesses with insufficient cash flow, weak market position, or other disadvantages are vulnerable. Institutions without alternative sources are also vulnerable. Homeowners may conserve up to a point beyond which their jobs, health, or other needs demand fuel-or-food decisions. Vehicle travel and fuel economy are relatively unaffected by short-term retail price changes.[xxix]

Other Propane Issues

An understanding of seasonal supply and customer consumption behavior is important for retail LPG dealers, because liquid propane is ordered each spring for winter storage and shipment. If an order is inaccurate, customers may be vulnerable to insufficient supply and volatile prices. Local retailers work to maintain sufficient bulk plant storage to meet short-term demand. This risk combined with economic efficiency considerations is why most propane retailers insist on contracted, automated fuel delivery for space conditioning customers. With a known customer base and a record of usage rates, a knowledgeable LPG dealer can determine how much storage remains in customers' tanks versus demand requirements.

Generally, State propane dealers will learn about an impending shortage from the terminal operators. If major suppliers invoke allocations reducing available fuel for sale, word spreads quickly. Servicing customers, plus excess time spent waiting at terminal racks, can cause delivery and tanker driver hours to exceed Federal standards. Virginia propane and petroleum industry officials consider relief from Federal HOS regulations for supply and distribution drivers a vital tool for mitigating shortage while it is still manageable.

The SCC also regulates certain propane distribution systems across the state that meet regulatory definitions. In the event of a disruption or interruption we would also work with the operators of these systems. In the event that the LPG terminals supplying State propane retailers cannot deliver sufficient fuel, local retail dealers are prepared to drive to distant

terminals. This additional transport increases the cost of the fuel; a rule of thumb used by dealers is to try, if possible, to avoid adding more than 30 to 35 cents per gallon in long-range transport and personnel time costs. Such long-haul efforts almost inevitably entail requests for exemption from Federal HOS regulations. A reduction in supply or shut down of either of the two principal sources from which Virginia obtains LPG during the winter season would create major supply issues. The contract nature of LPG sales provides some margin of safety, because at any time about two thirds of the State's propane customers will have sufficient supply in their tanks to sustain them until normal supply can resume. Customers who do not contract for supply are the most vulnerable to shortage.

Natural Gas

Natural gas is a critically important component of Virginia's energy mix. Access to reliable supply of natural gas is key in Virginia reaching its economic goals, and many industrial applications are contingent on natural gas availability.

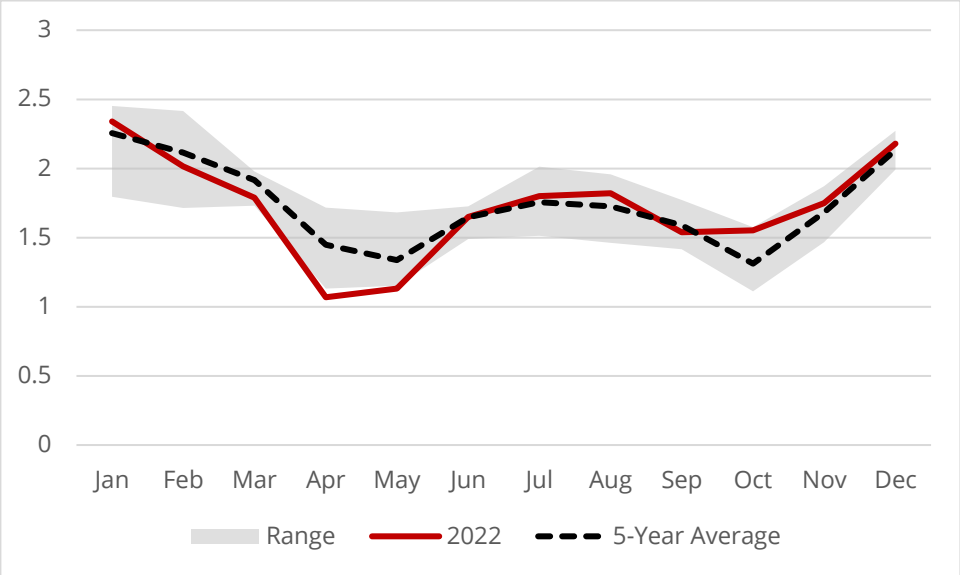
Natural gas is a mixture of hydrocarbon compounds, mainly methane (CH4), ethane (C2H6), and propane (C3H8), usually containing small amounts of impurities such as carbon dioxide (CO2), nitrogen (N2), and water vapor. It is relatively abundant worldwide and reaches end-use destinations via interstate and international pipelines.

While a mix of regulations ranging from federal transportation to State production, supply, and distribution management govern the Commonwealth's natural gas industry, the industry is also subject to unregulated market dynamics. Natural gas production in Virginia comes from underground resources. Both the federal and state governments regulate aspects of distribution to ensure safety and to prevent unfair pricing and restraint of trade. Under Virginia law, customers may purchase natural gas from any natural gas supplier.

NATURAL GAS CONSUMPTION

According to the EIA, Virginia ranks 15th in total natural gas consumption out of 50 states, utilizing 627 billion cubic feet during 2022.[xxx,xxxi] In fact, natural gas is second only to gasoline in terms of BTU consumption in the Commonwealth. Natural gas is a fossil fuel energy resource that serves residential and commercial needs for space heating, water heating, and cooking. It also fuels natural gas-powered vehicles and electric power generating plants and is used as a chemical feedstock in industrial processes.

Exhibit 31: Virginia Natural Gas Consumption (Bcf/d)



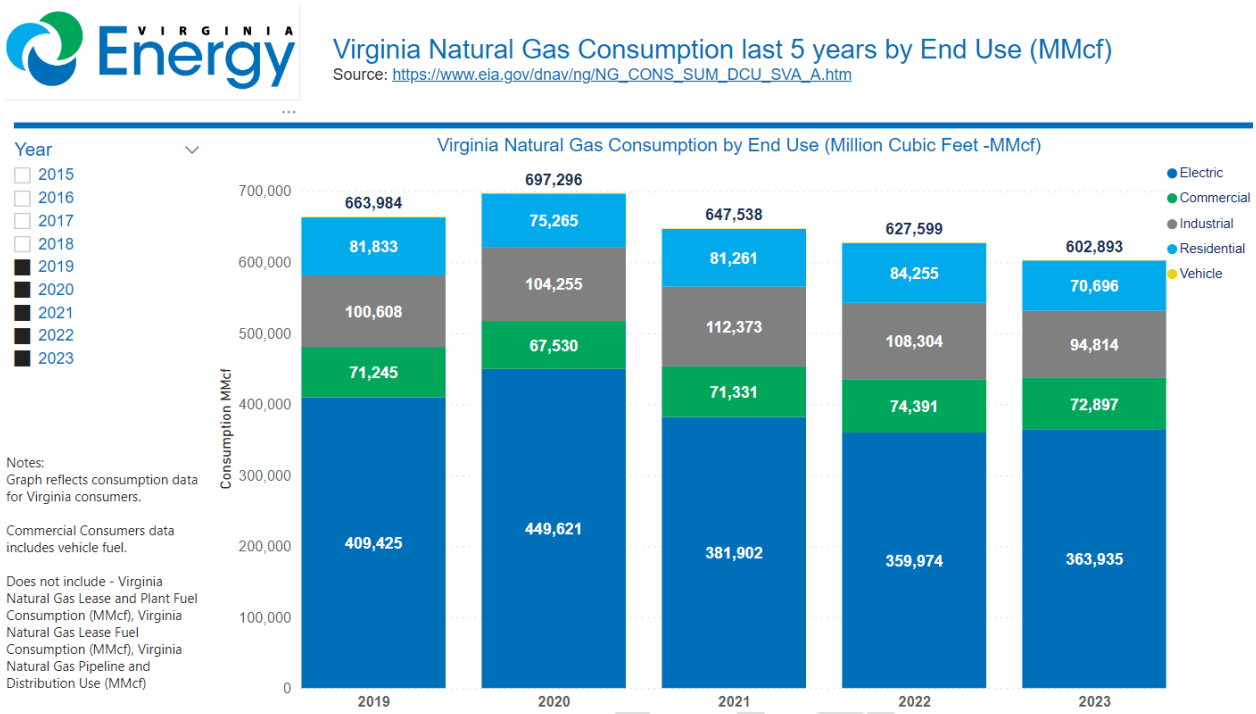
Source: Virginia Natural Gas Consumption by End Use (eia.gov)

Error! Reference source not found. reflects a breakdown of natural gas consumption by s ector in Virginia in 2023.

Virginia's electric power sector accounted for about 60% of the state's natural gas consumption. The industrial sector, which includes agriculture, manufacturing, biofuels production, and oil and natural gas production, accounted for 16% of the state's natural gas consumption in 2023. The residential sector accounted for about 12% of the state's natural gas use, and almost a third of Virginia households rely on natural gas as their primary energy source for home heating.[xxxii] The commercial sector, which includes government buildings, businesses, hospitals, and schools, is the fourth-largest natural gas consumer, making up approximately 12% of the state's gas use. Natural gas consumed by vehicles represents only about a tenth of a percent in 2023. Gas consumption in the state is highly seasonal with consumption volumes peaking as high as 2.3 Bcf/d during the winter heating season, nearly double typical spring demands.

Exhibit 32 shows the five-year growth in consumption, seeing only a slight decline in 2021.

Exhibit 32: Virginia Natural Gas Consumption by End Use, 2019-2023 (MMcf/d)



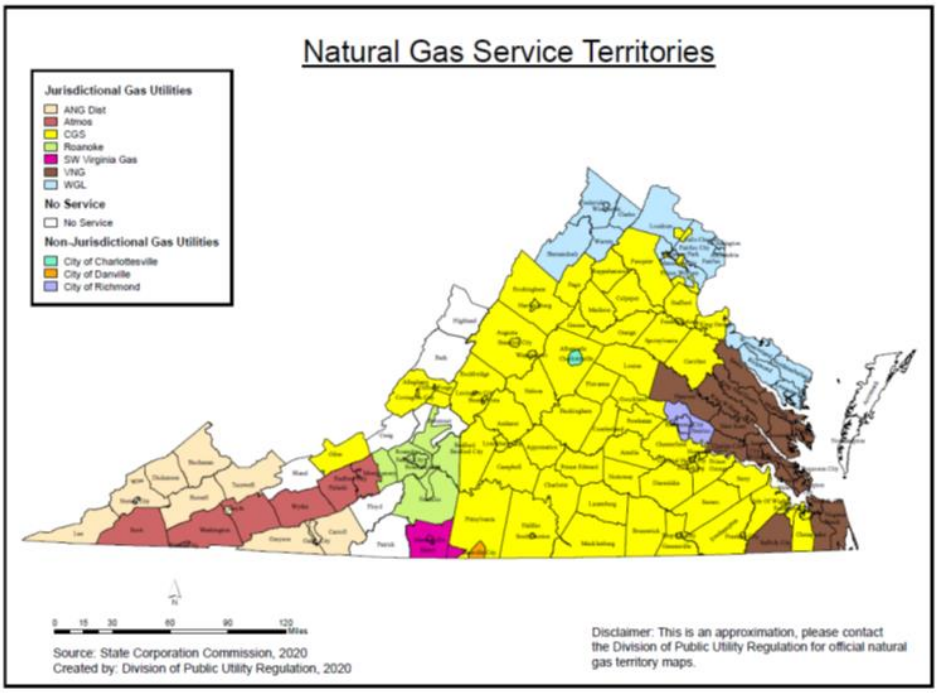
Source: EIA https://www.eia.gov/dnav/ng/NG_CONS_SUM_DCU_SVA_A.htm Virginia Natural Gas Consumption by sector 5 Year snapshot

These numbers give energy assurance responders perspective on the relative vulnerability to shortage among end-use sectors. A severe loss of natural gas would have the greatest impact on the residential sector in terms of number of customers and consumption volume.

Local Distribution Companies

Natural gas distribution is managed in large part through seven privately owned or publicly traded local distribution companies (LDCs) and three municipally owned gas pipeline distribution operators (see Exhibit 33). The SCC has rate making jurisdiction of "Utilities" as defined by applicable regulations. The SCC's Division of Public Utility Regulation (PUR) is responsible for evaluating the utilities rates and capital structures, also setting the utilities' rates of returns. Additionally, the SCC's Division of Utility and Railroad Safety (URS or Pipeline Safety) has safety regulatory oversight over all intrastate pipelines including the ten local distribution operators and approximately 70 other gaseous pipeline operators of various sizes in Virginia.

Exhibit 33: Map of Natural Gas Service Territories



Source: SCC

Exhibit 34: Top Natural Gas Delivery Companies in Virginia

TOP GAS DELIVERY COMPANIES	2022 RESIDENTIAL AND COMMERCIAL DELIVERY VOLUME (MMCF/D)
Washington Gas Light (WGL)	186
Columbia Gas (CGS)	89
Virginia Natural Gas (VNG)	84
City of Richmond	33
Roanoke Gas Company	19
Atmos Energy	9
City of Charlottesville	8

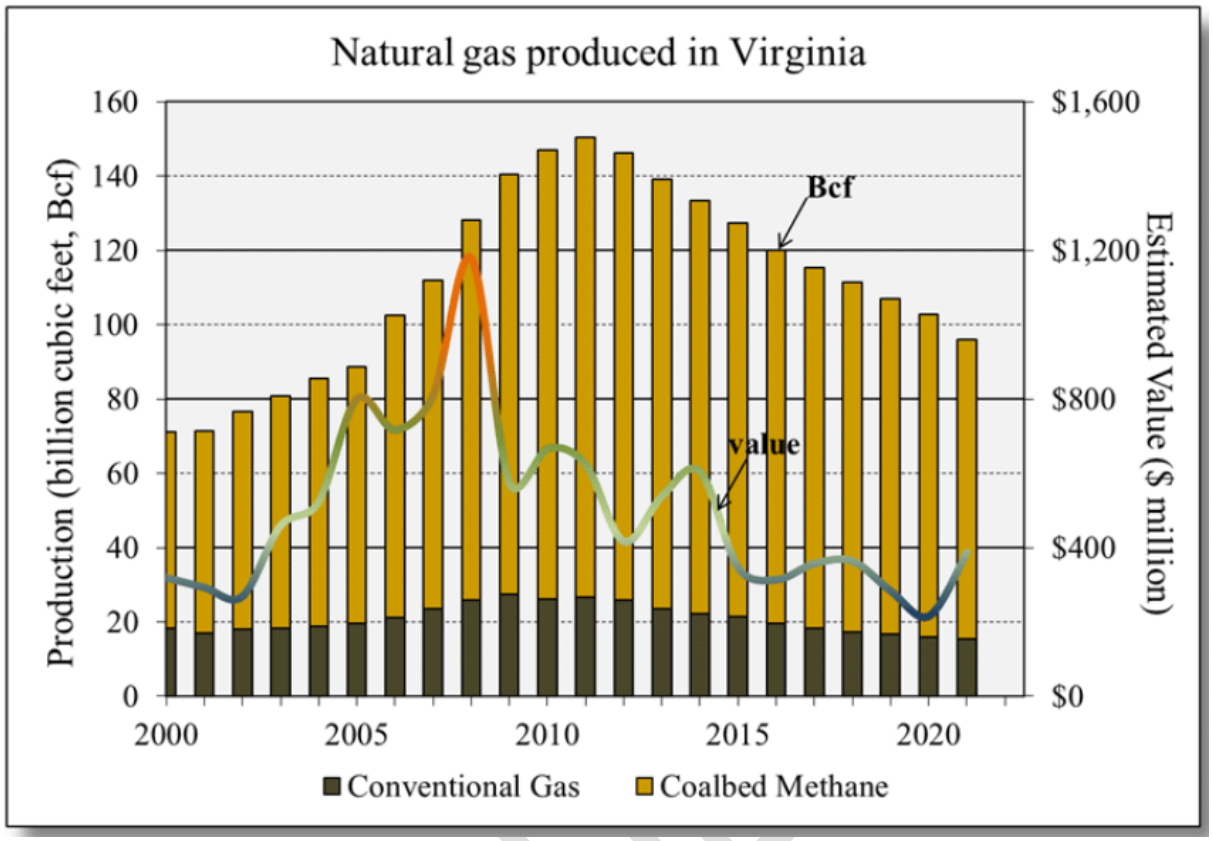
Source: EIA Natural Gas Annual Respondent Query System (EIA-176 Natural Gas Deliveries)

NATURAL GAS SUPPLY

Natural Gas Production

Virginia's gas and oil industry reported the production (Exhibit 35) of 96.1 billion cubic feet (Bcf) of natural gas in 2021 down about 7 percent from the production reported in 2020.[xxxiii] Coalbed methane accounted for about 84 percent of the total. The estimated value of natural gas produced in 2021 is $387 million.

Exhibit 35: Natural Gas Production and Value in Virginia, 2000-2021

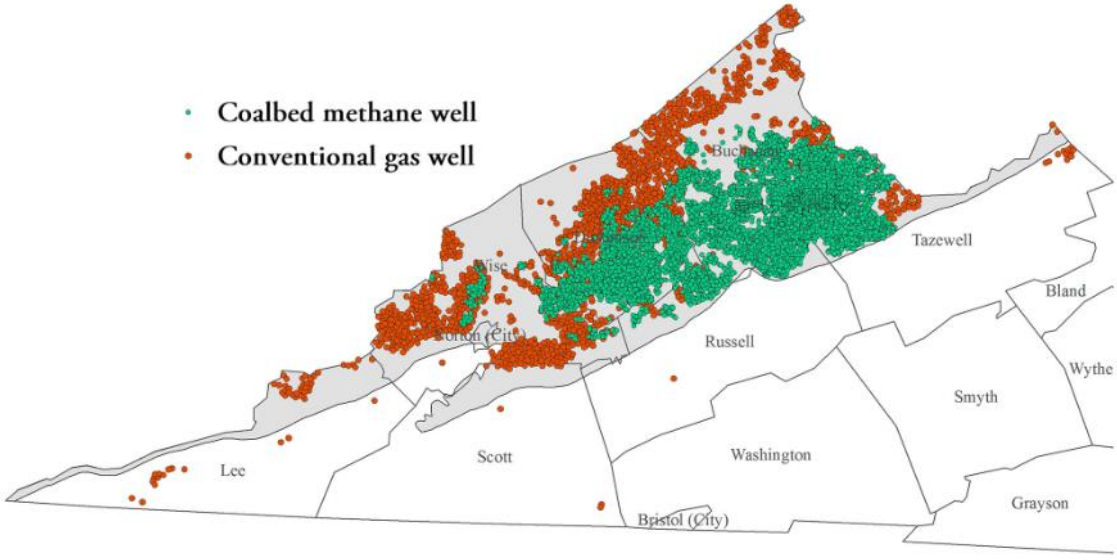


Source: Virginia Energy

Despite significant gains in production due to implementation of new drilling technologies over the last 20 years, that availability has been limited due to permitting and legal challenges.

In Virginia, natural gas is commercially produced from two types of geologic reservoirs. Gas that originally forms in deeply buried organic source rocks and subsequently migrates and is trapped in porous or fractured rock reservoirs is known as conventional gas. Conventional gas reservoirs occur in Devonian-age (354 to 417 million years old) shales and Mississippian-age (323 to 354 million years old) limestones and sandstones in the Appalachian Plateaus Province. The other type of reservoir is known as unconventional or "continuous", and includes gas that forms in coal beds, i.e. coal bed methane. Significant coal bed methane resources occur in the Pennsylvanian-age (290 to 323 million years old) Norton, Lee (New River), and Pocahontas Formations, also in the Appalachian Plateaus Province. Exhibit 36 illustrates where natural gas production wells are concentrated in Virginia.

Exhibit 36: Natural Gas Production Locations in Virginia



Source: Virginia Energy: Natural Gas

Natural Gas Pipelines

The supply of natural gas in Virginia became more robust during the past decade with the development of Appalachian shale gas. In particular, natural gas from the Marcellus Shale formation may provide supplies for many decades.

Most of the natural gas delivered to consumers in Virginia comes from the Appalachian region by interstate natural gas pipelines including Transcontinental Gas Pipeline Company (Transco), East Tennessee Natural Gas Company, Columbia Gas Transmission Corporation, and Berkshire Hathaway Eastern Gas Transmission & Storage. The Gulf Coast region can also supply many of these lines. Exhibit 38 outlines these gas transmission companies with a map in Exhibit 37.

Exhibit 37: Map of Major Natural Gas Pipelines in Virginia

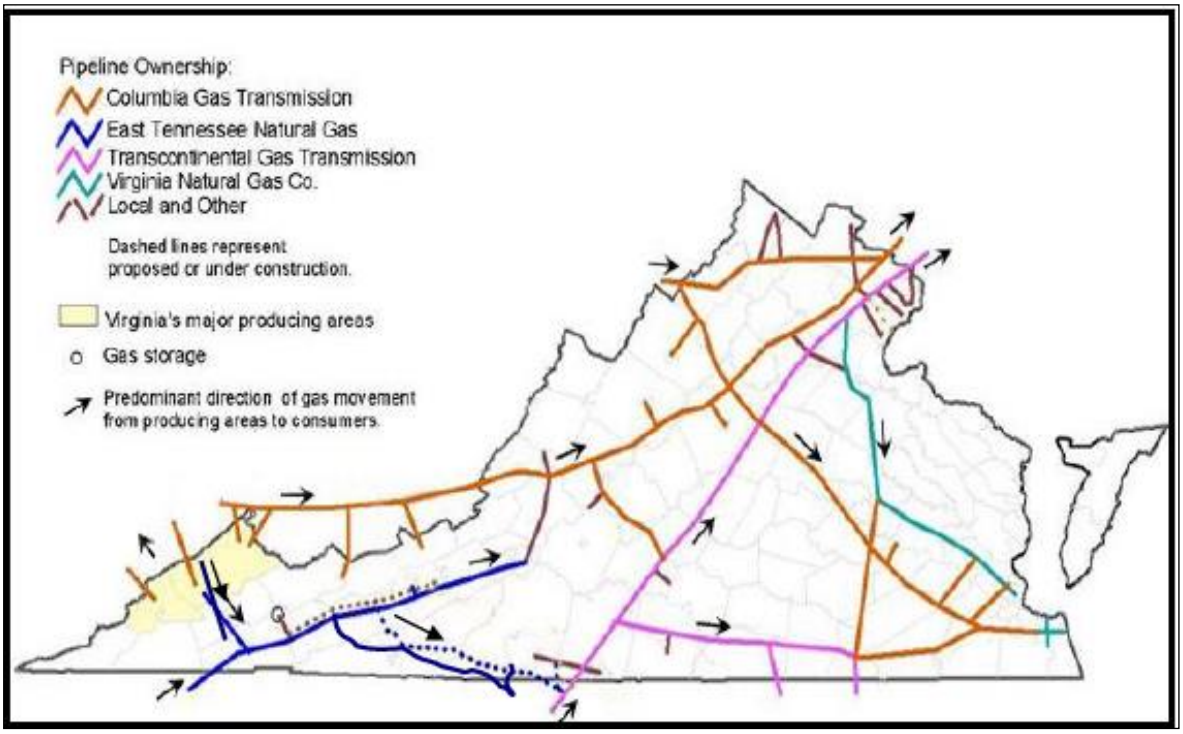


Exhibit 38: Virginia Natural Gas Pipelines

PIPELINE COMPANY	PRINCIPAL SUPPLY	SYSTEM CONFIGURATION (PRIMARY/ SECONDARY)	ENTERS VIRGINIA	EXITS OR TERMINATES	2022 DELIVERIES TO VIRGINIA CUSTOMERS (MMCF/D)
Columbia Gas Transmission Co. (operated by TC Energy)	Southwest & Appalachia	Grid with spurs southwest to northeast and north central to southeast and adjacent to northern border	West Virginia	District of Columbia & Maryland	620
BHEG GT&S Virginia Natural Gas (includes gas from Cove Point)	Southwest & Appalachia	Grid & Trunk	North to southeastern part of the State	Chesapeake	466
East Tennessee Natural Gas Co.	Interstate system	Trunk & Grid	Tennessee border	Roanoke & spur to Martinsville	48
Transcontinental Gas Pipeline Co. (TRANSCO)	Southwest	Trunk	Mid-south near Danville	North to District of Columbia and Maryland and spur southeast	555

Source: EIA About U.S. Natural Gas Pipelines – Transporting Natural Gas – Natural Gas Pipelines in the Northeast Region. https://www.eia.gov/naturalgas/archive/analysis_publications/ngpipeline/northeast.html

High-pressure pipelines deliver natural gas to the City Gate[5], where a reduction in pressure occurs as the gas enters the LDC or municipal gas company system. [xxxiv] Following this delivery, gas is sold in several consumption sectors.

The Mountain Valley Pipeline, a 303-mile natural gas pipeline connecting the Equitrans Midstream transmission system in the northeast to the Transco Pipeline through West Virginia and Virginia, is expected to go online mid-2024 and will transport Marcellus and Utica shale gas to Mid and South-Atlantic markets.

Natural Gas Storage

Spectra, the parent company of the East Tennessee Natural Gas, owns two large underground storage facilities located in Saltville field, Washington County, and Early Grove field, Scott County (see Exhibit). Nearby storage is in Maryland, Ohio, Pennsylvania, and West Virginia. Virginia natural gas companies also operate compressed and LNG tanks for local needs.

Exhibit 39: Major Natural Gas Storage, 2022

COMPANY	FIELD	COUNTY	TOTAL CAPACITY (BCF)[6]	WORKING GAS CAPACITY (BCF)	MAXIMUM DAILY DELIVERABILITY (MMCF)
VIRGINIA					
Saltville Gas Storage Company	Saltville	Smyth, Washington	5.7	3.5	325
Saltville Gas Storage Company	Early Grove	Scott	3.3	1.4	20
NEIGHBORING STATES					
Extensive natural gas storage is contained in Maryland, Ohio, Pennsylvania, and West Virginia; hence, this storage is listed by company total capacity (with some exceptions) instead of individual facilities.					
MARYLAND					
Texas Eastern Transmission	Accident	Garrett	64	18.3	400
OHIO					
Columbia Gas Transmission	Various	Various	397	175	2,095
Dominion Energy Ohio	Various	Various	170	64	2,788
NGO	Various	Various	7	3	37

[5] City Gate is defined as a point or measuring station at which a distributing gas utility receives gas from a natural gas pipeline company or transmission system.

[6] Total capacity refers to the physical measurement of how much gas a storage facility could hold. Working capacity is what is typically stored, which the owner/operator typically determines. In reality, acquiring and storing natural gas that seasonal storage history reveals to be unnecessary is generally too expensive.

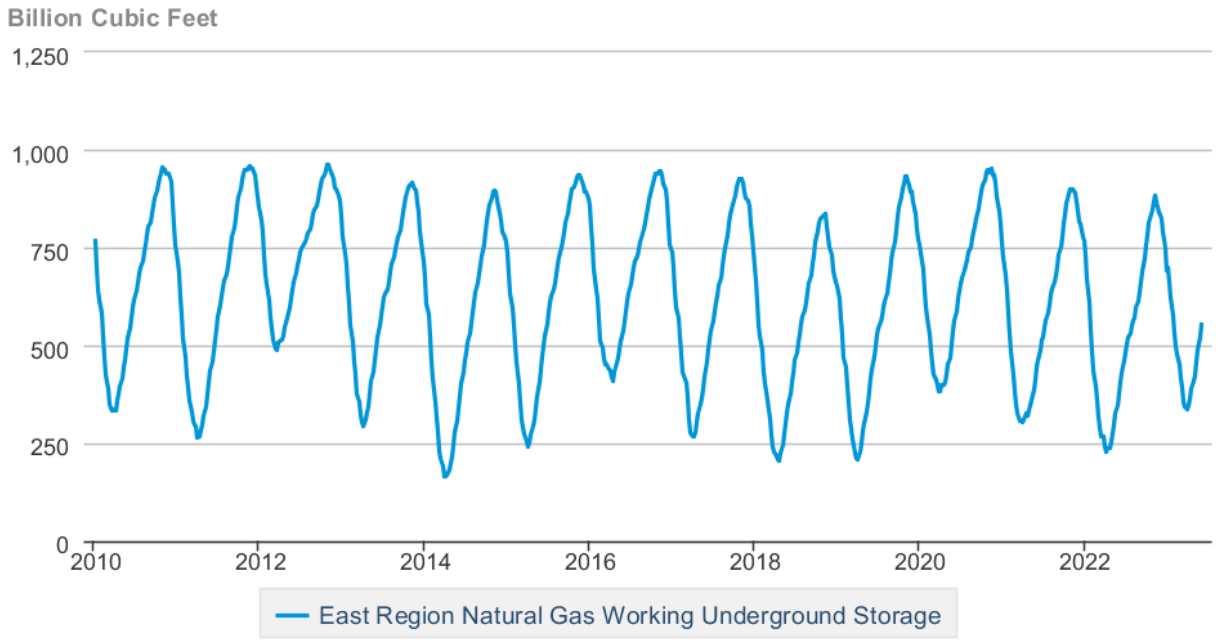
COMPANY	FIELD	COUNTY	TOTAL CAPACITY (BCF)[6]	WORKING GAS CAPACITY (BCF)	MAXIMUM DAILY DELIVERABILITY (MMCF)
PENNSYLVANIA					
Columbia Gas Transmission	Various	Various	38	24	522
BHE GT & S	Various	Various	529	297	6,509
Equitrans, LP	Various	Various	47	25	657
National Fuel Gas Supply Corp	Various	Various	92	44	881
Tennessee Gas Pipeline Co.	Hebron	Potter	29	17	485
Steckman	Steckman Ridge	Bedford	18	12	300
Peoples Gas Co	Murrysville	Allegheny	3	2	32
UGI Storage Co	Meeker	Tioga	5	4	60
WEST VIRGINIA					
Columbia Gas Transmission (Operated by TC Energy)	Various	Various	264	131	1,798
BHE GT & S	Various	Various	184	98	1,352
Equitrans, LP	Various	Various	35	19	414
Diversified Oil and Gas	Various	Various	5	3	63
Hampshire Gas Co	Various	Various	15	5	137
Hardy Storage Company	Hardy	-	31	12	171

Source: EIA Field Level Storage Data, 2022

Exhibit 40 shows natural gas storage inventory for the storage region that includes Virginia.[7] The exhibit also shows that the natural gas drawdown from storage in the region is seasonally driven.

[7] The U.S. is divided into three gas storage areas: the Producing Area (essentially the Gulf Coast) the Consuming West and Consuming East. The Eastern region is comprised of states from Florida to Maine as well as the upper Midwest and Nebraska, Iowa and Missouri.

Exhibit 40: East Region Natural Gas Working Underground Storage Inventory, 2010-2022



Source: https://www.eia.gov/dnav/ng/hist/nw2_epg0_swo_r31_bcfw.htm

There are 3 peak shaving facilities in Virginia that can supplement LDC volumes when needed: some LNG or propane air.

NATURAL GAS TRENDS

While natural gas consumption had been increasing in Virginia for a number of years as the state shifted from coal to low-emission natural gas-fired power generators, the future trend will likely be to see declining demand as the VCEA requires the Commonwealth to retire its natural gas power plants by 2045 (Dominion) and 2050 (Appalachian Power).[xxxv]

NATURAL GAS MARKET BACKGROUND

Design Day

Natural gas companies generally gauge supply needs sufficient to meet demand for a specified peak, or design day, lessening the risks associated with natural gas consumption.[8] This practice includes supply to customers who arrange for their own supply with transport through the distribution system, as well as reserves for demand contingencies and anomalies in the volume of demand (e.g., weather events that extend beyond a moving average or "normal" pattern). Virginia LDCs use different design days based on specific criteria for the area they serve. In addition, seasonal, "swing" gas contracts are in place to supplement gas supply for winter use. The use of, and settings for, a design day are at the discretion of the gas utilities in Virginia. Notably, Virginia does not require LDCs to file an integrated resource plan.

[8] Design day is the difference between the average ambient temperature and a base point of 65 degrees Fahrenheit.

Inter-fuel Awareness

The use of natural gas to fuel electricity generation is an example of inter-fuel awareness in Virginia. LDCs generally purchase natural gas from third parties and deliver to electricity generators. Transportation of the gas is sold as a "firm commitment" (an industry term for a supply contract). The gas supply is contracted between the generating plant and the third-party supplier. According to EIA, natural gas used for generating electricity increased from 171,258 MMcf in 2013 to 359,975 MMcf in 2023, with 2020 being the record high year at 449,622 MMcf.[xxxvi]

An additional inter-fuel element of interest to Virginia emergency responders is the role of electric power for natural gas pipeline compressors. A loss of electricity for any length of time may jeopardize the flow of natural gas. Loss of pressure on any one of the major lines in Virginia would only reduce delivery capability by a few percentage points, minimizing pumping loss. As Exhibit 37 illustrates, the State enjoys a robust multi-directional pipeline system with the potential for diversity in routes in the event of pipeline failure. The risk of interruption to more than one line is minimal, but if such an event occurred, the extensive grid lines supplementing major trunk lines would tend to minimize the impact in most cases.

Interruptible Service

Delivery of gas sold to firm customers, typically residential and commercial users, is an extremely high priority for LDCs. Industrial customers who possess, or have access to, an alternate fuel source can obtain more favorable rates than residential and commercial customers can by subscribing to an interruptible gas delivery tariff. As a result, they may experience an interruption in service when necessary.[9] This "interruptible service" may occur when demand exceeds (or the company expects demand to exceed) capacity – primarily because of weather. Though there is no precise temperature or standard at which a service interruption may occur, LDCs are most likely to invoke interruptible service in subfreezing (Fahrenheit) weather. An interruption applies to all interruptible customer uses, including process, manufacturing, or space conditioning.

[9] The tariff is not available if no back-up system is in place. LDCs survey such customers annually to see that back-up is maintained; but LDCs do not "act as policemen." The company enjoying the tariff bears the risk. In some shortages, service may be retained for a very high-rate cost. In other situations, there may be no choice but shut down if back-up was not arranged.

Risk Profile

Threats and Vulnerabilities

Virginia is susceptible to various vulnerabilities arising from natural and man-made hazards, as well as technological failures. The SESP has leveraged the 2023 Commonwealth of Virginia Hazard Mitigation Plan (VHMP) to identify and address the most relevant threats to the energy sector.[xxxvii]

NATURAL HAZARDS

Flooding

Flooding is one of the most common natural hazards that occurs in Virginia. Virginia is subject to a variety of flood types; the three major types defined by the VHMP are:

1) **Coastal Flooding and Storm Surge:** Storm surge occurs when strong onshore winds push water from an ocean, bay, or inlet onto the land. Storm surge arrives ahead of a storm or hurricane's actual landfall and will arrive sooner the more powerful the storm event is offshore. In Virginia, all coastal areas are susceptible to storm surge, especially the areas with flat topography and low land elevations.
2) **Non-tidal Riverine Flooding:** Riverine flooding occurs when rain events or rapid snowmelt add more water into a waterway than it can hold. This causes the water to rise, overtopping the riverbank, and flooding agricultural fields, roads, or populated areas. There are 52,232 miles of free-flowing streams and rivers within the Commonwealth.
3) **Urban Flooding:** Urban flooding occurs when man-made development obstructs the natural flow of water or when impervious surfaces significantly decrease the ability of natural groundcover to absorb and retain surface water runoff. Flooding increases as solid surfaces replace permeable surfaces or natural green spaces, because storm water is unable to filter into the landscape. An extreme example in Virginia was when the remnants of Hurricane Gaston stalled out over the Richmond area in 2004. The swift onset of torrential downpours inundated drainage systems in the city, stranding people and causing significant flood damage to structures.[xxxviii]

Flooding can occur along all waterways in the state. Localized riverine flooding can occur even in areas not directly adjacent to a major body of water. Within Virginia's coastal watersheds, there are sections of the region that are low in elevation and subject to tidal flooding during hurricanes and severe nor'easters.

Severe floods can significantly disrupt an impacted area's economy due to delayed return of displaced homeowners and renters to work, blocked or debris-laden transportation routes, and the closure of schools and businesses. Power outages are frequent during these events, impacting thousands of residents and businesses for days or even weeks.

Sea Level Rise

Sea level rise poses significant and potentially catastrophic risks to coastal communities, causing inundation in previously dry areas and exacerbating other flood hazards. As sea levels rise, so do the impacts of coastal flooding and storm surge. Local sea level rise rates vary due to factors like Gulf Stream water movement and land subsidence.

The Hampton Roads region experiences the highest sea level rise rates on the Atlantic Coast, with land subsidence accounting for more than half of the relative sea level rise. Land

subsidence is the downward movement of the earth's crust. Several factors influence the rate of sea level rise in Hampton Roads, including an increased ocean water volume from melting ice and thermal expansion of a warming ocean. Scientists believe that thermal expansion also contributes to the increasing ocean volume. The rate of sea level rise is relative to the adjacent land.

Hampton Roads experiences both regional and local subsidence, which, along with sea level rise, exacerbates storm impacts. Subsidence alone can harm wetlands, coastal marsh ecosystems, and infrastructure, but combined with sea level rise, the effects are even more devastating. Sea level rise, primarily driven by thermal expansion of the oceans and loss of land-based ice, is a growing threat linked to climate change.

Future Outlook

National Oceanic and Atmospheric Administration's (NOAA's) 2022 Sea Level Rise Technical Report predicts that the relative sea level (RSL) along the contiguous U.S. coastline will rise as much over the next 30 years (2020-2050) as it has over the past 100 years.[xxxix] The Virginia Academy of Science, Engineering, and Medicine's June 2021 report highlights the immediate consequences of climate change for Virginians, particularly sea level rise.[xl] Flood-related consequences include recurrent flooding, extreme rainfall, and septic system inundation. Climate change increases the likelihood of certain weather events. Recent trends in heavy rains align with rising temperatures, with more frequent and intense rain events expected over time. Warmer air holds more moisture than cooler air, leading to increased rainfall during heavy rain events.

Over the past 50 years, the heaviest one percent of rain events have seen a 67 percent increase in the Northeast. If temperatures continue to rise, heavy rainfall events are expected to increase by 20 to 40 percent by the end of the century, resulting in more frequent and severe flooding in vulnerable areas. [xxxvii]

Hurricanes/Tropical Storms

According to NOAA, a tropical cyclone is a rotating low-pressure weather system that has organized thunderstorms but no fronts. Tropical cyclones with maximum sustained surface winds of less than 39 miles per hour (mph) are called tropical depressions. Those with maximum sustained winds of 39 mph or higher are called tropical storms. When a storm's maximum sustained winds reach 74 mph, it is called a hurricane. Most hurricanes form in the Atlantic Ocean, Caribbean Sea, and Gulf of Mexico between June and November.

During hurricanes, Virginia's coastal areas are particularly vulnerable to storm surge, wind-driven waves, and tidal flooding. Many parts of the Coastal Virginia Tidewater region are flat, causing intense, prolonged rainfall to accumulate without sufficient drainage. The Chowan River Basin, with its minimal elevation, is particularly vulnerable. This was exhibited during Hurricanes Denis and Floyd, which caused catastrophic flooding in the City of Franklin and other communities along the Blackwater River.

Extreme rainfall in higher elevation areas can trigger secondary hazards like landslides and debris flows. Flash flooding and debris flows were experienced in Buchanan County in southwestern Virginia as the remnants of Hurricane Ida passed through in 2021.[xli] High winds from hurricanes also lead to widespread debris from damaged trees and buildings which lead to widespread power outages.

Hurricanes can be felt throughout the entire Commonwealth, primarily through flooding (both coastal and riverine) and high winds. When hurricanes make landfall south of Virginia, winds in Hampton Roads initially come from the northeast and then shift as the storm travels north. Hurricanes can also approach from the South Atlantic and brush coastal Virginia, or they can move inland from the Gulf and traverse various terrains, including mountainous areas. Although high winds may weaken over land, they still can pose a threat to structures outside of hurricane-prone, coastal regions which may not be built to withstand such events.

Winter Weather

The National Weather Service (NWS) defines a winter weather event as a "winter weather phenomenon (such as snow, sleet, ice, or wind chill) that impacts public safety, transportation, and/or commerce," typically occurring between October 15 and April 15. During such events, communications and power can be disrupted for days, and even small amounts of ice can create extreme hazards for motorists and pedestrians.

Winter weather events in Virginia are typically regional, affecting large areas and sometimes the entire state. The winter season generally features cold temperatures, snow or ice accumulations, and the potential for strong winds. These conditions can negatively impact roadways, utilities, and normal business activities. They can also pose health risks (such as frostbite and hypothermia), and in severe cases, lead to loss of life. Virginia has a long history of hazardous winter weather. These weather events can occur in various forms – whether snow, freezing rain, ice, or wind – either independently or in combination.

Virginia's most significant winter weather threat comes from a storm pattern known as a Nor'easter. The NWS defines a Nor'easter as "a storm along the East Coast of North America, named for the northeast winds that typically affect the coastal area." These storms can occur any time of year but are most frequent and intense between September and April. According to the NWS, Nor'easters typically develop between Georgia and New Jersey, within 100 miles of the East Coast, and move northeastward, bringing heavy rain or snow, gale-force winds, rough seas, and sometimes coastal flooding and erosion. The combination of heavy frozen precipitation and strong winds can be destructive, often damaging trees and utility lines. While Nor'easters can occur from September through April, they are usually most severe in Virginia during January, February, and March.

Extreme Cold

Excessively cold temperatures can pose significant threats to Virginia, regardless of precipitation. A freeze is characterized by low temperatures, though what constitutes extreme cold can vary widely across the state. While wind chill advisories are issued almost every year, life-threatening cold is rare. Its impact depends on how prepared households and heating fuel/energy providers are. The use of supplemental heating devices (like wood or kerosene heaters) and fuel-burning lanterns or candles for emergency lighting can increase the risk of house fires and carbon monoxide poisoning.

Definitions of extreme cold vary significantly across the state and country. Southeastern areas of the state, which do not experience winter weather frequently, might consider temperatures below 32 degrees Fahrenheit as extreme, while regions in the Blue Ridge or Piedmont may have a different threshold. In Virginia, the average low temperatures during the winter are generally consistent statewide. There has not been a record-low temperature occurrence since 1989, over 30 years ago. [xxxvii]

Since detailed temperature and records began being compiled, several significant low-temperature events have impacted the state. The two most notable extreme cold events occurred in 1940 and 1977. In January 1940, a blizzard caused temperatures to drop below -10 degrees Fahrenheit in central Virginia, affecting 57 municipalities. The harsh winter of 1977 brought lows of around 10 degrees Fahrenheit even along the coast, leading to parts of the Chesapeake Bay freezing over. This event, often referred to as the Deep Freeze of 1977, impacted approximately 64 municipalities.[xxxvii]

Wind

Examples of non-tornadic winds include severe thunderstorms, windstorms, and derechos. These weather events may be accompanied by other hazards like extreme rainfall, thunder, and lightning. Derechos are often the most damaging of these incidents. A derecho is a large-scale, straight-line windstorm associated with a band of severe thunderstorms. Primarily a warm weather occurrence, derechos are most common in June and July in the Northern Hemisphere. Derechos also form as a thunderstorm complex, generating a band of winds at least 240 miles in length with wind speeds of at least 58 MPH along most of its length. The damage caused by derechos can be similar to that of tornados.

A recent example of a significant derecho event occurred in 2012. A derecho of historic proportions swept through Virginia, causing widespread and significant damage. Numerous power outages occurred, leaving some customers without power during a prolonged period of excessive heat. The derecho originated near Chicago, Illinois, around 1:00 PM EST and reached Virginia by 9:00 PM EST. By midnight, it had gone through the entire state and reached the Atlantic Coast. Thunderstorm winds toppled a vast number of trees and caused the most damage to Franklin County. One mobile home was split in half by a falling tree. Several other homes in the northern part of the county sustained minor to moderate damage.

Non-tornadic winds can occur throughout the state, however historical records show that severe winds (excluding those from tropical storms) have predominantly affected Northern Virginia and far Southwest Virginia. Significant events have been reported across the Commonwealth, with over 200 incidents in Fauquier, Prince William, Fairfax, Loudoun, and Arlington counties, as well as the cities of Manassas, Manassas Park, Alexandria, Fairfax, and Falls Church.

Drought

Virginia's 2023 Hazard Mitigation Plan defines drought as "a natural climatic condition caused by an extended period of limited rainfall beyond that which occurs naturally in a broad geographic area." Drought conditions can be worsened by high temperatures, high winds, and low humidity. These conditions also make areas more susceptible to wildfire. Drought-related impacts can also be accelerated from man-made causes.

Droughts are classified as one of the following four types:

1. **Meteorological droughts:** typically defined by the level of "dryness" when compared to an average or normal amount of precipitation over a given period.

2. **Agricultural droughts:** relate common characteristics of drought to their specific agricultural-related impacts. Emphasis tends to be placed on factors such as soil water deficits, water needs based on differing stages of crop development, and water reservoir levels.

3. **Hydrological droughts:** directly related to the effect of precipitation shortfalls on surface and groundwater supplies. Human factors, particularly changes in land use, can alter the hydrologic characteristics of a basin.

4. **Socio-economic droughts:** the result of water shortages that limit the ability to supply water-dependent products in the marketplace.

Droughts are generally measured using indices that take into account rainfall, temperature, stream flow, groundwater, and other factors. One widely used metric is the Palmer Drought Severity Index (PDSI), which uses temperature and precipitation data to quantify dryness. A PDSI value of zero represents normal conditions, with increasingly negative values indicating more severe drought conditions.

In Virginia, PDSI values of -3 or lower (indicating severe drought) occurred 5 to 9.99 percent of the time between 1895 and 1995.[xlii] While droughts typically do not cause significant damage to built environments, they often impact agricultural areas, especially in the initial stages. As water shortages become acute and restrictions are implemented, urban consumers face greater impacts, including use restrictions, effects on drinking water supply, and saltwater intrusion.

Beyond the primary impacts of drought, there are secondary effects that can heighten the risk of other hazards. Prolonged drought can elevate the likelihood of wildfires, which in turn can leave behind burned woody debris, increasing the potential for landslides or mudflows. Additionally, drought conditions can weaken trees, making them more susceptible to damage from high wind events.

PHYSICAL AND CYBER THREATS

Cyber Threats

Cyber within Energy

Energy systems (electric, liquid fuel, and natural gas) within Virginia 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 1990s. 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.

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);
- Electricity generation distributed control systems (DCS);
- Pipeline pump/compressor stations and electrical substations; and

- 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 Exhibit 41.

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.

Exhibit 41: Impacts of IT and OT Attacks

	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

Cybersecurity Threat Assessment and Adversaries

The capabilities of malicious actors have 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.

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 U.S. or compromise supply chains. It is known that adversaries – whether politically, socially, or financially motivated – are targeting U.S. and global energy infrastructure and the digital supply chain. Exhibit 42 describes categories of different kinds of threat actors.

Exhibit 42: Cyber Threat Actors

The energy sector is uniquely critical because all 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.

Exhibit 44 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. The National Infrastructure Protection Plan (NIPP) recognizes that public-private partnerships are vital to keeping critical infrastructure safe and secure, including from cyber-attacks.

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 Exhibit 43.

Exhibit 43: Cyber Attack Types

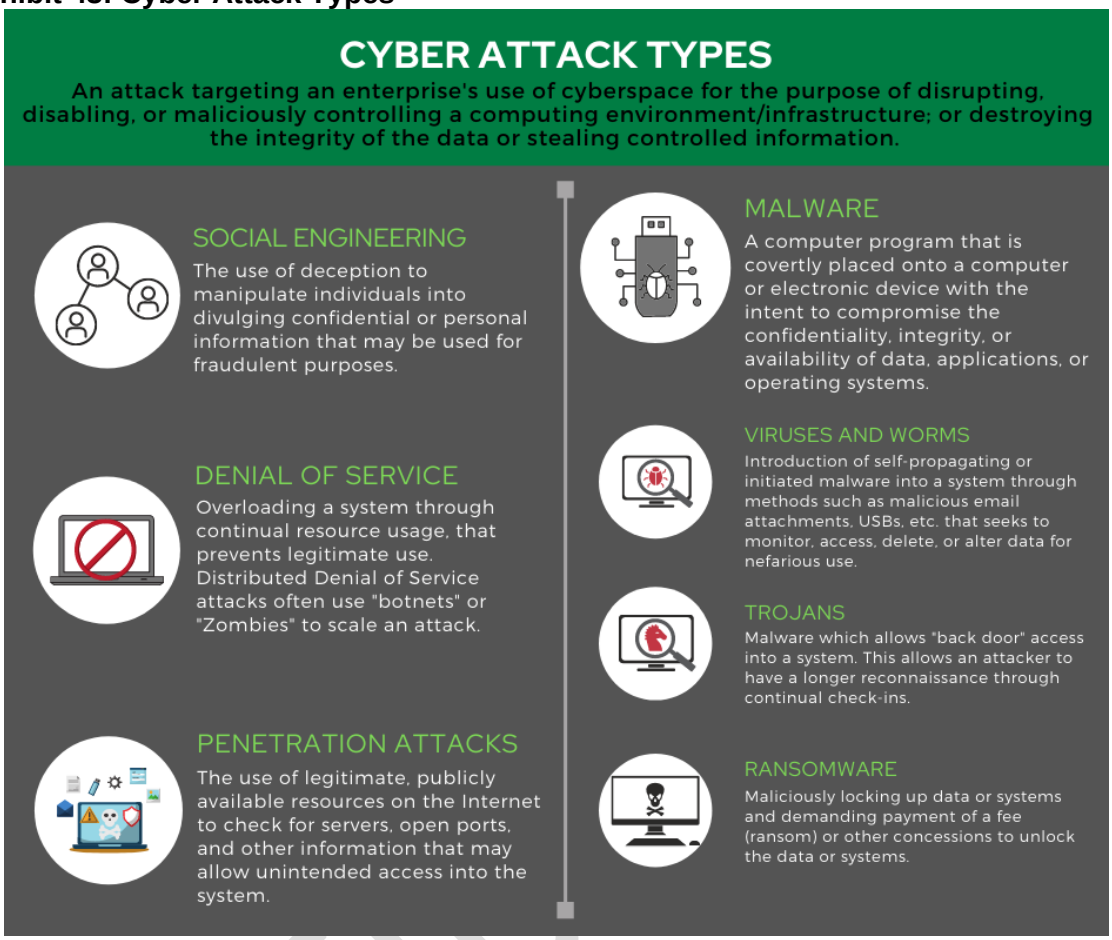


Exhibit 44 includes several notable examples of cyber-attacks perpetrated by various threat actors.

Exhibit 44: 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 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.

ATTACK NAME	PHYSICAL TARGET	METHOD	IMPACT / IMPLICATION
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 several 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 automatically kill known processes run by ICS.	First known ransomware that targeted ICS/OT. Manufacturing operations disrupted on 3 continents after victims decided to suspend ICS/OT operations.
Colonial Pipeline Ransomware Attack	U.S. petroleum pipeline	Darkside Ransomware The cyberattack targeted Colonial Pipeline's IT network, prompting the company to proactively shut down pipeline operations as a precaution.	Fuel stopped flowing, affecting Southeast and Mid-Atlantic states who are heavily reliant on the Colonial Pipeline (with limited alternatives). Consumer panic buying and tanker truck driver shortage further exacerbated the issue

Federal and State Cyber Information Sharing

Cybersecurity information sharing is vital and ideally is bi-directional. This includes sharing cybersecurity best practices, guidance, and trends; information on emerging cyber threats and vulnerabilities affecting energy sector stakeholders; and real-time information sharing during the response and recovery stages following a cyber event.

Robust, timely, actionable information is crucial to all partners, because each has a unique role to play in protecting critical infrastructure against cybersecurity threats as well as participating in a coordinated response should a cyber incident occur.

Virginia agencies engage in information sharing by:

- Working with public utilities to ensure executive level commitment to effective cybersecurity (and physical security) including assurance that each utility has conducted a risk assessment, developed cybersecurity (and physical security) plans and procedures, and routinely tests and updates its incident response and continuity of operations plans;
- Maintaining and testing interagency communications;
- Regularly conducting outreach with infrastructure stakeholders sharing the importance cybersecurity;
- Facilitating and attending threat briefings (unclassified or classified) such as those at the Virginia Fusion Center; and
- Actively monitoring reports, alerts, advisories, and informational bulletins such as those from the Cybersecurity Infrastructure Security Agency (CISA), Department of Energy Office of Cybersecurity, Energy Security, and Emergency Response (CESER), or other Information Sharing and Analysis Centers, or “ISACs” such as those listed in Exhibit 45.

Exhibit 45: Cyber Information Sharing Entities

RESOURCE	MEMBERS	DESCRIPTION
Multi-State Information Sharing and Analysis Center (MS-ISAC)	Virginia Fusion Center	The MS-ISAC is dedicated to improving the overall cybersecurity posture of state, local, territory and tribal (SLTT) governments, and is a resource for information on cyber threats to critical infrastructure. Virginia members of the MS-ISAC can share threat information to the energy sector when appropriate.
Electricity Information Sharing and Analysis Center (E-ISAC)	Electricity owners and operators in North America Approved individuals at states with energy emergency response roles	The E-ISAC provides information and resources to help the North American electricity industry prepare for and defend against both cyber and physical security threats.
Oil and Natural Gas Information Sharing	Public and private ONG companies, select collaborators and	The ONG-ISAC serves as a central point of coordination and communication to aid in the protection of exploration and production, transportation, refining, and delivery systems of the

RESOURCE	MEMBERS	DESCRIPTION
and Analysis Center (ONG-ISAC)	partners, subject to membership requirements	oil and natural gas (ONG) industry, through the analysis and sharing of trusted and timely cyber threat information, including vulnerability and threat activity specific to ICS and SCADA systems.
Downstream Natural Gas Information Sharing and Analysis Center (DNG-ISAC)	Natural gas utility companies	The DNG ISAC serves natural gas utility (distribution) companies by facilitating communications between participants, the federal government, and other critical infrastructures.
Virginia Fusion Center (VFC)	State and federal public safety partners	The VFC (Richmond) is the primary fusion center for Virginia and is operated jointly by Virginia State Police and VDEM, supported by other agencies.
Northern Virginia Regional Intelligence Center (NVRIC)	Local, state, and federal public safety partners	The NVRIC (Fairfax) is a recognized major urban area fusion center supporting the Virginia jurisdictions within the National Capitol Region.

Assessing Cybersecurity Maturity

Critical infrastructure entities are encouraged to regularly assess and improve their cybersecurity maturity. No one tool is required, however several tools are encouraged and include:

- The Department of Energy's (DOE) Cybersecurity Capability Maturity Model (C2M2) enables organizations to voluntarily measure the maturity of their cybersecurity capabilities in a consistent manner through a publicly available tool.
- The American Public Power Association (APPA) developed the Public Power Cybersecurity Scorecard, an online self-assessment tool for municipal utilities to evaluate their cybersecurity programs and overall posture. This tool is based on C2M2 and builds upon the assessment with additional resources.
- The National Rural Electric Cooperative Association (NRECA) developed the RC3 Cybersecurity Self-Assessment. The assessment, available either hardcopy or online, is designed to help cooperatives understand their cybersecurity posture and is part of the larger Rural Cooperative Cybersecurity Capabilities (RC3) Program. The RC3 program develops and provides tools and resources focused on improving the cybersecurity capabilities of cooperatives. The program also provides opportunities for collaboration, education, and training.
- The National Association of Regulatory Utility Commissioners (NARUC) has developed a suite of cybersecurity resources for public utility commissions (PUCs), including Understanding Cybersecurity Preparedness: Questions for Utilities.

Physical Attacks

Intentional attacks on energy infrastructure are an increasing concern, especially after the December 2022 attacks on electricity substations in Washington state and North Carolina.

Energy infrastructure is a target for domestic and foreign terrorists, activists, disgruntled employees, vandals, and thieves (e.g., stealing copper wire). Energy operators and law enforcement are not always able to connect a motive to infrastructure damage, such as attributing whether gunshot damage to equipment is intentional or incidental.

Pandemics

Pandemics can cause significant disruption to energy sector workforce availability. Additionally, a global pandemic can disrupt international supply chains for energy equipment, such as transformers. As of 2023, the energy industry still reports issues sourcing transformers and lengthy delays in acquiring new transformers from foreign manufacturers.

Maintenance Issues/Faulty Equipment

Poorly maintained or older infrastructure is more prone to line arcing, power surges, corrosion, shifting, leaks, or other failures. For example, pipeline integrity issues have caused problems on Colonial Pipeline, both in Virginia (Centreville, 2014) and in the southeast a major leak in Hendersonville, NC and explosions and leaks in Alabama (2016). Control systems can also potentially disrupt energy supply, even without underlying infrastructure damage.

Human Error

Accidents due to human error that impact energy infrastructure are relatively common and can occur at any level of the supply chain.

ENERGY SECTOR VULNERABILITIES

Virginia faces unique threats to its energy infrastructure. As a result, stakeholders must be aware of the potential challenges these hazards pose for energy security. In Exhibit 46, energy sector vulnerabilities are described for each of the top hazards in the state.

Exhibit 46: Vulnerabilities by Energy Sector

HAZARD	ELECTRIC	LIQUID FUELS	NATURAL GAS
Cyber Incident	• Informational technology and operational technology systems can be impacted; this can include company data, payment and scheduling systems, sensors, and control systems.		
Drought	• Reduced hydroelectric generation due to low water levels. • Reduced efficiency at thermoelectric generation facilities if there are constraints on steam or cooling.	• Low water levels can prevent barge traffic on inland waterways. • May limit drilling and biofuel operations if alternative water supply is not available.	• May limit drilling activity if alternative water supply is not available.
Dam Failure	• Damage to downstream infrastructure due to flooding and debris.		
	• Hydroelectric power generation may be disrupted, which may also reduce black start capabilities.	• Unearthing and rupturing of pipelines.	• May limit drilling activity if alternative water supply is not available.
Earthquake	• Damage to power generation facilities, transmission poles, etc.	• Damage to pipeline rupture, biofuel production, well sites, pumping stations, etc.	• Damage to pipeline rupture, biofuel production, well sites, pumping stations
Equipment Malfunction	• Line arcing, faults, corrosion, or moisture on equipment can cause equipment to malfunction or go offline.	• Corrosion, material failure, excess pressure buildup, or controls malfunction can cause supply disruptions.	
Extreme Heat	• Increased demand for cooling. Depending on the available capacity, this can cause ISOs to operate below reserve margins. Increased risks of wildfires from power lines.	• A heat wave could result in reduced cooling tower capacity which can hinder operations at processing units in biofuel facilities.	
Flood	• Damage to equipment exposed to water and debris.		
	• Examples: power generation equipment, control center buildings, transmission lines.	• Examples: pump stations, tanks, underground pipelines.	• Examples: processing plant units, compressor stations, underground pipelines.
Landslide	• Damage to nearby infrastructure due to debris or foundation impacts.		
Man-made Damage	• Deliberate physical attacks on or takeovers of infrastructure. Human error can cause facilities to run outside of designed parameters.		
	• Transmission lines may be impacted by individuals hitting power poles, cutting	• Third-party strikes of pipelines can rupture lines.	

HAZARD	ELECTRIC	LIQUID FUELS	NATURAL GAS
	trees down, or striking underground wires.		
Pandemic	• Shifts in demand and reduced worker availability.		
Tropical Cyclone	• Damage to infrastructure from high winds, debris, and flooding. Production facilities may shut down ahead of storm for personnel safety.		
	• Examples: power generation facilities, transmission poles, etc.	• Examples: pipeline pumps, tanks. • Shoaling in ports can prevent ship and barge traffic to terminals.	• Examples: compressor stations
Thunderstorm and Lightning	• Blown transformers and downed trees may impact power lines. • Lightning strikes to transmission lines may result in line outages.	• Power outages may impact terminal or pumping operations.	• Power outages may impact select electric compressor operations.
Tornado	• High winds can cause damage to power lines and power generation facilities.	• High winds can cause damage to terminals or other above-ground facilities.	• High winds can cause damage to compressor stations, metering and regulating stations, and other above-ground facilities.
Wildfire	• Damage to power lines and power generation facilities. • Utilities may shut off power to prevent wildfires (e.g., high temperatures and high winds).	• Combustible material if exposed, primarily impacting above-ground infrastructure.	
Winter Storm and Extreme Cold	• Rail freezing impacting feedstock to power generation (e.g., coal). • Increased demand for heating can add strain to available capacity, causing RTOs/ISOs to operate below reserve margins.	• Freezing for non-weatherized equipment, including frozen product within piping systems, malfunctioning flow control equipment, flaring, and production shut ins. • Increased back-up generator demand.	• Freezing may impact non-weatherized equipment, which can cause production shut-ins. • Increased demand for heating can strain capacity.

Risk Assessment

Virginia Energy solicited information from key stakeholders about energy infrastructure risk, including information on threats and hazards, energy infrastructure vulnerabilities, and the consequences of energy infrastructure outages to inform the risk assessment. Individual stakeholder interviews were conducted with each of the stakeholders to offer the opportunity to gather information specific to their experience and allow for an in-depth discussion. Additionally, Virginia Energy leveraged the 2023 Hazard Mitigation Plan to focus the risk assessment on the following key threats impacting energy supply in the state: high winds, hurricane winds, storm surge, flooding, ice storms, climate change, cyberattacks, physical attacks, aging infrastructure, increased energy demand, and generation retirements.

Stakeholders

- Virginia Department of Emergency Management (VDEM)
- Virginia State Corporation Commission (SCC)
- American Petroleum Institute (API)
- Virginia Petroleum & Convenience Marketers Association (VPCMA)
- Virginia, Maryland & Delaware Association of Electric Cooperatives (VMDAEC)
- Dominion Energy
- Appalachian Power

The risk assessment evaluated the prioritized threats and hazards against the following key energy infrastructure:

Electricity Infrastructure	Petroleum Infrastructure	Natural Gas Infrastructure
Electric Power Transmission Lines	Petroleum Product Pipelines	Natural Gas Interstate and Intrastate Pipelines
Power Plants	Petroleum Terminals	Natural Gas Underground Storage
Substations		

Due to their sensitive nature, the risk assessment results have been retained as confidential within Virginia Energy and only shared with associated state and federal agencies.

Risk Assessment Methodology

The risk assessment is built on the following three components, leveraging assessment methodology from the DOE CESER's Risk Assessment Essentials for State Energy Security Plans[xliii]:

- **Exposure**: The exposure element represents the magnitude and likelihood of a threat or hazard occurring in the same location as an energy asset.
- **Vulnerability:** This factor represents the susceptibility of the energy asset or system to be disrupted by the given hazard and the most likely duration of an outage.
- **Consequence**: This factor represents the importance of the asset to energy supply and customers in the State and therefore the consequence to the State if the asset were to be offline due to a hazard.

Conceptually, the risk formula is:

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

Although this risk analysis does not quantitatively assess scores for the three factors, each was taken into account for this qualitative, stakeholder-based analysis. As any one of the risk factors increases, the resulting risk will similarly increase.

Consequence in the context of energy infrastructure systems or assets refers to the impact resulting from their loss or degradation. These consequences can be categorized as direct and indirect:

- **Direct Consequences:** These involve the immediate effects of an energy infrastructure system or asset outage, the loss of energy supply or services provided by the asset. These losses can be quantified in terms of energy units (e.g., megawatt-hours of electricity, barrels of petroleum products, cubic feet of natural gas) or the number of affected customers.
- **Indirect Consequences:** These are more complex and challenging to quantify. They encompass broader societal impacts resulting from the energy supply loss. Examples include economic losses, threats to human health, disruptions in dependent infrastructure functionality, and compromised customer services. The severity of indirect consequences varies based on factors like regional and seasonal energy consumption patterns and use case, redundancies in supply or transportation systems, and the availability of energy storage or alternative resources to offset the loss. It should consider impacts to critical energy users like critical infrastructure and specific vulnerable communities that are impacted.

The energy sector is intricately connected to other critical infrastructure sectors. Understanding these interdependencies is crucial for assessing risks, vulnerabilities, and planning energy security and resilience.

- Electricity: Because electricity is essential for the operation of most lifeline sectors (healthcare, emergency services, water, home heating, etc.), electricity outages typically have the largest overall secondary consequences. Widespread electricity outages also typically have cascading impacts on the petroleum and natural gas sectors since pipeline infrastructure (including pumping stations), distribution terminals, and retail filling stations all rely on electric power for operations. Natural gas furnaces also cannot provide heating without blower motors that require electric power.
- Petroleum: Petroleum outages primarily impact the transportation sector, though they may also impact home heating and/or electricity.
- Natural Gas: Natural gas outages impact home heating, electricity generation, and industrial heating processes.

Energy Security Authorities and References

Virginia Authorities – Emergency Management

CODE OF VIRGINIA CHAPTER 3.2

Ch. 3.2 of the *Code of Virginia* establishes the state's Department of Emergency Management and provides the legal authority for the development and maintenance of the Commonwealth's emergency management program. Additionally, it defines the emergency powers, authorities, and responsibilities of the Governor and State Coordinator and requires that state and local governments be prepared for a variety of

natural and human-caused hazards by developing, maintaining, and ensuring their ability to implement an emergency operations plan (EOP).

CODE OF VIRGINIA TITLE 44

Title 44 provides general and specific statutory authority for the development, maintenance, and implementation of the COVEOP (Code of Virginia Emergency Operations Plan) including, but not limited to:

- Ch. 3.2. Commonwealth of Virginia Emergency Services and Disaster Law of 2000 defines the powers and duties of the Governor and political subdivisions; establishes the Department of Emergency Management; defines emergency declarations; establishes the duties of emergency management agencies and joins the Commonwealth in the Emergency Management Assistance Compact (EMAC).
- **§ 44-146.17 Powers and Duties of Governor** — The Governor shall be Director of Emergency Management. He shall take such action from time to time as necessary for the adequate promotion and coordination of State and local emergency services relating to the safety and welfare of the Commonwealth in time of disasters.
    - **Application of Power to Energy (Fuels)**
      § 44-146.17(1) To proclaim and publish such rules and regulations and to issue such orders as may, in his judgment, be necessary to accomplish the purposes of this chapter including, but not limited to, such measures as are in his judgment required to control, restrict, allocate or regulate the use, sale, production and distribution of food, fuel, clothing and other commodities, materials, goods, services, and resources under any State or Federal emergency services programs.
    - **Powers Related to Energy Emergencies – Political Subdivisions**
      In addition to the Governor's direct powers, if the Governor declares an emergency, then according to § 44-146.19(C), Powers and Duties of Political Subdivisions include the following: Each political subdivision within the disaster area may, under the supervision and direction of the Governor or his designated representative, control, restrict, allocate or regulate the use, sale, production and distribution of food, fuel, clothing and other commodities, materials, goods, services and resource systems that fall only within the boundaries of that jurisdiction and that do not impact systems affecting adjoining or other political subdivisions, enter into contracts and incur obligations necessary to combat such threatened or actual disaster, protect the health and safety of persons and property, and provide emergency assistance to the victims of such disaster.

VIRGINIANS WITH DISABILITIES ACT

Title 51 of the *Code of Virginia* encourages and enables persons with disabilities to participate fully and equally in the social and economic life of the Commonwealth and to engage in remunerative employment. Additionally, it requires all agencies to provide, in a

comprehensive and coordinated manner that makes the best use of available resources, those services necessary to assure equal opportunity to persons with disabilities in the Commonwealth.

ECONOMIC CRISIS STRIKE FORCE

Section 2.2-205.1 of the *Code of Virginia* establishes the Economic Crisis Strike Force for the purpose of serving as a working group to respond as needed to economic disasters in Virginia.

FLOOD PLANNING

Section 10.1-602 of the *Code of Virginia* requires the Department of Conservation and Recreation to develop a flood protection plan for the Commonwealth and serve as the coordinator of all flood protection programs and activities, including the FEMA National Flood Insurance Program (NFIP) and the federal flood protection programs of the United States Army Corps of Engineers (USACE) and the United States Geological Survey (USGS).

EXECUTIVE ORDERS

Executive orders will be issued as necessary by the Governor when the Commonwealth is threatened or impacted by an emergency or disaster. The orders are required to activate the COVEOP and supporting plans and to authorize specific emergency actions. Executive orders by the Governor supplement the laws and establish specific planning initiatives and requirements.

LOCAL EMERGENCY MANAGEMENT ORGANIZATIONS

Local jurisdictions are required to have an emergency management organization as defined in § 44-146.19 of the *Code of Virginia*. Every political subdivision within the Commonwealth is responsible for local disaster mitigation, preparedness, response and recovery and is required to have a director of emergency management and coordinator of emergency management or coordinator of emergency services in towns with a population over 5,000. It also requires all local or inter-jurisdictional emergency operations plans contain provisions to ensure that the plan is applied equitably and that the needs of minority and vulnerable communities are met during emergencies.

FEDERAL NON-DISCRIMINATION STATUTES AND EXECUTIVE ORDERS

The following statutes and presidential executive orders require all state and local governments that receive federal funds or other federal financial assistance to ensure that emergency programs and services are equally accessible to individuals with disabilities and those with limited English proficiency.

- Americans with Disabilities Act of 1990, as amended 2008 and 2010
- Rehabilitation Act of 1973, as amended, § 504 & 508
- Code of Federal Regulations (CFR); 20 C.F.R. § 44.1.16
- Civil Rights Act of 1964

- Presidential Executive Order 13166 - Improving Access to Services for Persons with Limited English Proficiency (Federal Register Vol. 69, No. 159 (August 16, 2000))
- Executive Order 13347 (July 2004): Individuals with Disabilities in Emergency Preparedness (Federal Register Vol. 69, No. 142 (July 26, 2004))

EMERGENCY MANAGEMENT EQUITY WORKING GROUP

Senate Bill 1296 (2021) amended § 44-146.18 of the Code of Virginia to include the establishment and maintenance of an Emergency Management Equity Working Group to ensure that emergency management programs and plans provide support to at-risk individuals and populations disproportionately impacted by disasters.

Virginia Authorities – Energy

REGULATED ENERGY SOURCES

Virginia Code Chapter 10, Heat, Light, Power, Water and Other Utility Companies

Chapter 10, Title 56 of the Virginia Code lists other requirements pertaining to all related utilities, including telephone and water. For the purpose of this Section of the ESP, only those related to electricity and natural gas are highlighted in Exhibit 47.

Exhibit 47: Summary of Chapter 10 Sections - Energy and Natural Gas

SECTION NUMBER	SUMMARIZED DESCRIPTION
§ 56-234	Duty to furnish adequate service at reasonable and uniform rates
§ 56-236	Public utilities required to file rate schedules, charges, rules and regulations
§ 56-237	How changes in rates effected; notice required; changes to be indicated on schedules
§ 56-249	Reports by utilities
§ 56-249.1	Commission may require transfer of gas, water or electricity from one utility to another
§ 56-250	Commission may authorize action by public utility in time of emergency or shortage
§ 56-257	Manner of installing underground utility lines
§ 56-257.2	Gas pipeline safety
§ 56-265	Certain sections not to limit Commission's powers
Other Sections that Could Apply to Energy Security Planning	

SECTION NUMBER	SUMMARIZED DESCRIPTION
§ 56-245.1:1	Customers to be notified about nuclear emergency evacuation plans
§ 56-555.2	Commission authority to conduct safety activities regarding interstate gas pipeline facilities

Section 56-249.1 is of special interest because the ESF-12 uses the authority conferred by this section for both natural gas and electricity shortages.

> § 56-249.1. Commission may require transfer of gas, water or electricity by one utility to another; compensation. The Commission may require a public utility to transfer to another public utility of like business, gas, water or electricity, whenever the public health, welfare or safety shall be found to so require; provided, however, that the transferring public utility shall be compensated, at a rate fixed by the Commission, for all such deliveries by the receiving public utility.

Section 56-265 provides broad generalized authorization for emergency actions:

> § 56-265. Certain sections are not to limit Commission's powers. "Nothing in § 56-261 or §§ 56-262 through 56-264 shall be construed so as to limit or curtail the existing powers of the Commission to require of all public service corporations in all cases the rendition of adequate service to the public at reasonable rates nor the existing right of municipalities or individuals to apply to the Commission for the enforcement of such duties, the purpose of such sections being to extend and not to limit the powers of the Commission."

State Regulation of Pipelines

The State Corporation Commission has been designated as the appropriate state agency for the Commonwealth of Virginia to prescribe and enforce compliance with standards for jurisdictional pipeline facilities used for intrastate transportation. In Case No. PUE-1989-00052*, the Commission adopted Parts 191, 192, 193, and 199 of Title 49 of the Code of Federal Regulations to serve as minimum gas pipeline safety standards in Virginia. The Commission is authorized to enforce the standards for natural gas facilities under § 56-257.2 B of the Code of Virginia, which allows the Commission to impose the fines and penalties authorized therein.

In Case No. PUE-1994-00070, the Commission adopted Parts 195 and 199 of Title 49 of the Code of Federal Regulations to serve as minimum intrastate hazardous liquids pipeline safety standards. The Commission is authorized to enforce the standards for liquid pipeline facilities under § 56-555 of the Code, which allows the Commission to impose the fines and penalties authorized therein. The Commission's Division of Utility and Railroad Safety is charged with the investigation of each jurisdictional operator's compliance with the safety standards.

Currently in Virginia, this includes gas gathering, gas distribution (including certain master metered and liquefied petroleum gas systems). In addition, the Division inspects liquefied natural gas, hazardous liquid pipelines, certain renewable natural gas pipelines, and gas transmission pipelines. The Division acts as an Interstate Agent for the U.S.

Department of Transportation for certain interstate gas transmission projects and all interstate hazardous liquid pipelines. All other interstate gas pipelines and underground gas storage are subject to Pipeline and Hazardous Materials Safety Administration (PHMSA) jurisdiction. Among the provisions of Chapter 10.1, Utilities Facilities Act is § 56-265.1 requires that SCC approval is necessary for the construction of "gas pipelines and related facilities."

In addition, Chapter 10.1, § 56-265.2, Certificate of Convenience and Necessity Required for Acquisition of New Facilities, requires all utilities to obtain SCC permission after public hearings and due notice. Further, the transfer authority noted under § 56-249.1 applies to ESF-12. Other provisions in the basic emergency sections also apply. The role of the SCC is clearly delineated in Chapters 10 and 10.1 of Virginia Code.

ANCILLARY LAWS PERTAINING TO ENERGY EMERGENCIES; NON-REGULATED ENERGY

State Regulation of Electricity: Chapter 23, Electric Service Provider

Chapter 23 of the Code contains specific sections pertaining to emergencies. § 56-586, Emergency Service Provider, states that "if any supplier fails to fulfill an obligation, resulting in the failure of retail electric energy to be delivered into the control area serving the supplier's retail customer," the local energy supplier (or the regional transmission entity or other entity the SCC designates) may charge the "defaulting" supplier the full cost of replacement energy. If circumstances justify, SCC may revoke a supplier's license in Virginia according to § 56-287.

The Code also defines an Electric Energy Emergency under § 56-586-1 (Exhibit 48).

Exhibit 48: Summary of Provisions – Electric Energy Emergency

SECTION	PROVISIONS
§ 56-586-1 (A)	An electric supply emergency is defined as an: unplanned interruption in the generation or transmission of electricity resulting from a hurricane, ice storm, windstorm, earthquake or similar natural phenomena, or from a criminal act affecting such generation or transmission, act of war or act of terrorism, which interruption is (i) of such severity that minimum levels of reliable service cannot be maintained using resources practicably obtainable from the market and (ii) so imminently and substantially threatening to the health, safety, or welfare of residents of this Commonwealth that immediate action of State government is necessary to prevent loss of life, protect the public health or safety, and prevent unnecessary or avoidable damage to property.
(B)	Upon finding that an electric emergency exists, the Governor can declare an electric energy emergency by filing a written declaration with the Secretary of the Commonwealth. The declaration must state the counties and cities or utility service areas of the Commonwealth in which the declaration is applicable, or its statewide application. The declaration is limited to 30 days unless extended in another declaration by the Governor or rescinded by joint resolution of the General Assembly (sub§ F).
(C)	The Governor may: require any generator or any municipal electric utility that is capable of generating but

SECTION	PROVISIONS
	(i) is not generating or (ii) is not generating at its full potential during such declared electric emergency, to generate, dispatch or sell electricity from a facility that it operates within the Commonwealth, to the Commonwealth for distribution within the areas of the Commonwealth designated in the declaration.
(D)	The Governor may use the "services, equipment, supplies, and facilities" of all State agencies "to the maximum extent practicable and necessary to meet the electric energy emergency."
(E)	The Governor is authorized to request the Secretary of the U.S. Department of Energy to invoke section 202(C) of the Federal Power Act, 16 U.S.C. §824(a). (This is essentially an order for temporary connections of facilities, during times of war or other emergency, for the generation or transmission of electric energy and such generation, delivery, interchange, or transmission of electric energy as is requested.)
(F)	See (B) above.
(G)	VDEM is charged with coordinating and establishing guidelines pertaining to the protection of public health, safety, avoidance of property damage to minimize any economic disruption to the electricity supply industry.
(G1)	VDEM defines levels of electric emergency and specifies appropriate mitigation measures to protect public health, safety and property damage.
(G2)	VDEM prescribes appropriate response (immediate actions required) measures.
(G3)	VDEM assures the distribution of benefits for such measures equitably among affected users.
(H)	The Attorney General may seek prompt compliance. Courts may issue ex parte temporary orders without notice.
(I)	No intentional violations are permitted during a declared emergency

Petroleum Dealer Supplier Relationship

The petroleum and coal industries are not regulated *per se* in Virginia. However, State laws govern trade practices. Foremost among these State laws is Chapter 2.2, Virginia Petroleum Products Franchise Act, under Title 59.1, Trade and Commerce. The impact of this chapter on managing petroleum shortage issues is indirect. While this chapter contains no specific provisions regulating the petroleum industry's response to shortage or disruption, the law's provisions protecting retail dealers within the State petroleum market do affect the local distribution system's reliability. These provisions aid local dealers to operate profitably. The economic viability of the dealers helps maintain the ready supply of retail petroleum products. These supplier-retail dealer provisions may also impact pricing, although pricing, *per se*, is not generally considered a direct emergency supply issue. Exhibit 49 summarizes the legislation that affects the petroleum sector.

Exhibit 49: Virginia Trade and Commerce: Virginia Petroleum Product Franchise

VIRGINIA CODE TITLE 59.1	SUMMARY OF PROVISIONS

Chapter 2.2,§ 59.1-21.11	Required provisions pertaining to agreements between refiners and dealers: • Protects dealers from potential supply requirements for excessive (over 16) operating hours per day • Protects dealers from other trade practices that are seen as harmful to their operation, e.g., waiver of legal rights, premium participation, assignment of franchise, term of agreement • Certain fees dealers may be required to pay defined and managed • Passing franchise to heirs • Fees on transfer of franchise • Allowable percent of profit fees charged by supplier • No waiver of dealer legal rights
Chapter 2.2,§ 59.1-21.13	Obligation of refiner to repurchase upon termination, etc., of agreement includes a good faith effort on part of refiner must be made to repurchase merchantable products “upon termination” of franchise
Chapter 2.2,§ 59.1-21.14	Producer or refiner not to terminate agreement without notice and reasonable cause: • Notice of termination required • Reasons for termination by refiner defined

Federal Authorities and Responsibilities

Multiple agencies within the federal government are involved in energy security. These agencies fulfill a variety of roles, including setting standards and regulations related to energy sector safety and security, providing baseline energy information and situational awareness during emergencies, and assisting energy system operators and state, local, tribal, and territorial (SLTT) officials in emergency preparedness and response activities.

Prior to emergency events, the federal government publishes energy data and market information, analyzes and shares information on threats to the energy sector, conducts research and develops new technologies, assists SLTT partners with hazard assessment and mitigation, provides support for SLTT planning and preparedness activities, funds energy resilience projects, and convenes government and non-government stakeholders for energy emergency exercises.

During emergency events, the federal government provides assistance to industry and SLTT governments, convenes stakeholders for information sharing and situational awareness, distributes energy resources (generators, fuel, etc.) as needed, and grants relief from energy-related federal regulations to facilitate response and recovery.

The following tables provide an overview of the many federal departments and agencies that play a role in energy security. Many of these agencies have roles and responsibilities that extend beyond the energy sector. Each agency’s energy-related activities have been categorized as applying to electricity, liquid fuels, or natural gas. Agencies that safeguard cybersecurity and physical security of energy infrastructure are also indicated.

Agencies’ energy security activities may involve:

- **Energy emergency preparedness and response**, including hosting and participating in preparedness planning and exercises and deploying responders or resources during an emergency event.
- **Information sharing and situational awareness,** including publishing data and threat information and issuing situation reports during emergency events.
- **Development and enforcement of standards and regulations** for energy industry safety and security. During emergency events some of these standards and regulations may be waived to facilitate faster response and restoration.

Exhibit 50 and Exhibit 51 from DOE CESER provide an overview of the federal agencies with responsibilities for energy security, including energy sector(s) of interest and the type of mission, including response and preparedness, situational awareness, and standards and regulations.

Exhibit 50: Federal Agency Matrix of Responsibilities

Department or Agency		Sector	Preparedness & Response	Situational Awareness	Standards & Regulations
White House		Electricity, Liquid Fuel, Natural Gas, Cyber and physical security	✓	✓	
DHS	FEMA	Electricity, Liquid Fuel, Natural Gas	✓	✓	
	CISA	Cyber and physical security	✓	✓	
	Coast Guard	Liquid Fuel, Natural Gas	✓		✓
	TSA	Liquid Fuel, Natural Gas, Cyber and physical security	✓		✓
	CBP	Electricity, Liquid Fuel, Natural Gas			✓
DOE	CESER	Electricity, Liquid Fuel, Natural Gas, Cyber and physical security	✓	✓	
	OE	Electricity		✓	✓
	EIA	Electricity, Liquid Fuel, Natural Gas		✓	
	FERC	Electricity, Liquid Fuel, Natural Gas			✓
DOT	FMCSA	Electricity, Liquid Fuel			✓
	PHMSA	Liquid Fuel, Natural Gas	✓		✓
EPA		Electricity, Liquid Fuel, Natural Gas			✓
IRS		Liquid Fuel			✓
DOD	USACE	Electricity, Liquid Fuel, Natural Gas	✓		✓
NRC		Electricity	✓	✓	✓
DOJ	FBI	Cyber and physical security	✓		
DOI	DOI BSEE	Liquid Fuel, Natural Gas		✓	✓

Electricity | Liquid Fuel | Natural Gas | Cyber and physical security

Exhibit 51: Table of Federal Agency Roles in Energy Security and Emergency Response

DEPARTMENT / AGENCY		ENERGY SECURITY / EMERGENCY RESPONSE ROLE
White House		The White House—particularly the National Security Council—participates in public briefings and interagency situational awareness activities. The President also has the authority to declare a national state of emergency.
Department of Homeland Security (DHS)	Federal Emergency Management Agency (FEMA)	FEMA coordinates federal incident response and recovery activities. FEMA's duties during an event include assisting the President in carrying out the Stafford Act, operating the National Response Coordination Center (NRCC), supporting all Emergency Support Functions (ESFs) and Recovery Support Functions (RSFs). FEMA mission assigns the Defense Logistics Agency (DLA) to provide fuel support to federal responders and, if requested, SLTT responders and critical infrastructure. FEMA funds Public Assistance (PA) disaster funds, hazard mitigation projects through the Building Resilient Infrastructure and Communities (BRIC) Program, Hazard Mitigation Grant Program (HMGP), and others.
	Cybersecurity and Infrastructure Agency (CISA)	CISA leads the national effort to understand, manage, and reduce risk to cyber and physical infrastructure. CISA manages the Protected Critical Infrastructure Information, leveraging expertise from government and private partners to identify and address cybersecurity risks to critical infrastructure. CISA publishes best practices for cybersecurity protection. During a cyber incident, CISA assists impacted infrastructure, helps investigate the responsible actors, and coordinates the national response to significant cyber events.
	U.S. Coast Guard	The U.S. Coast Guard is the principal federal agency responsible for maritime safety, security, and environmental stewardship in U.S. ports and inland waterways used for the movement of energy products, including petroleum, natural gas, and coal. The Coast Guard reviews and approves security assessments and security plans developed by vessel owners and terminal operators, and inspects terminals for compliance with security requirements. The Coast Guard's role is particularly important during hurricanes and other severe weather that can disrupt energy supplies (primarily liquid fuels) into and out of U.S. ports.
	Transportation Security Administration (TSA)	TSA oversees the physical security and cybersecurity of all U.S. pipelines. TSA issues directives for owners and operators of pipelines to better secure pipelines against cyberattacks. TSA also oversees security at marine ports, where oil and gas marine terminals, petroleum refineries, and other energy infrastructure may be located. TSA conducts background checks and issues federal identification cards (called TWIC® cards) to workers accessing secure areas within port boundaries, including fuel truck drivers, refinery workers, and other energy industry workers. TSA may waive TWIC requirements during energy emergencies to facilitate energy restoration and response activities.
	U.S. Customs & Border Protection (CBP)	CBP is the primary federal agency tasked with ensuring the security of the nation's borders. CBP is responsible for enforcing and administering laws and regulations to control and oversee vessel movements in to, out of, and between U.S. ports. CBP enforces the Merchant Marine Act of 1920, also called the Jones Act, which generally prohibits the transportation of merchandise between two U.S. ports in any vessel not built in, documented under the laws of, and owned by citizens of the United States. Applications may be made to CBP for the Secretary of Homeland Security to grant a Jones Act waiver, which can help facilitate the delivery of fuel and equipment during energy shortages.

DEPARTMENT / AGENCY		ENERGY SECURITY / EMERGENCY RESPONSE ROLE
Department of Energy	Office of Cybersecurity, Energy Security, and Emergency Response (CESER)	CESER's mission is to enhance the security of U.S. critical energy infrastructure to all hazards, mitigate the impacts of disruptive events and risk to the sector overall through preparedness and innovation, and respond to and facilitate recovery from energy disruptions in collaboration with other federal agencies, the private sector, and State, local, tribal, and territory governments. CESER's preparedness and response activities include SLTT capacity building, energy security and resilience planning, hosting energy emergency exercises and deploying ESF-12 responders to impacted regions during emergencies. CESER facilitates interagency coordination, shares situational awareness products, and provides emergency response support to SLTT governments. CESER also advances research, development, and deployment of technologies, tools, and techniques to reduce risks to the Nation's critical energy infrastructure posed by cyber and other emerging threats. CESER administers programs that can be used to mitigate impacts to energy infrastructure and energy supply, and to provide resources during energy emergencies: • The Federal Power Act Section 202(c) grants DOE the power to temporarily order connections of facilities, and generation, delivery, interchange, or transmission of electricity during grid emergencies. • The Strategic Petroleum Reserve is a federally owned emergency supply of crude oil. Volumes can be released to mitigate the impact of crude supply disruptions. The Northeast Home Heating Oil Reserve provides emergency supplies of heating oil in the Northeast region.
	Office of Electricity (OE)	OE provides national leadership to ensure that the Nation's energy delivery system is secure, resilient and reliable. Through research and development, OE develops new technologies to improve electric infrastructure. OE also oversees the Federal and state electricity policies and programs that shape electricity system planning and market operations.
	Office of the Under Secretary for Infrastructure	The Office of the Under Secretary for Infrastructure oversees four federal Power Marketing Administrations (PMAs) - Bonneville Power Administration (BPA), Southeastern Power Administration (SEPA), Southwestern Power Administration (SWPA) and Western Area Power Administration (WAPA) – that operate electric systems and sell the electrical output of federally owned and operated hydroelectric dams in 34 states.
	U.S. Energy Information Administration (EIA)	EIA collects, analyzes, and disseminates independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding of energy and its interaction with the economy and the environment. EIA's data can be used in energy security planning and energy emergency response activities. EIA publishes state energy profiles, data products related to energy supply, demand, infrastructure, and prices, as well as GIS maps.
Federal Energy Regulatory Commission (FERC)		FERC is an independent agency that regulates the interstate transmission of electricity, natural gas, and oil. FERC's role includes oversight of the transmission and wholesale sale of electricity in interstate commerce, transportation of oil by pipeline in interstate commerce, and proposals to build liquefied natural gas (LNG) terminals and interstate natural gas pipelines as well as licensing hydropower projects. During energy emergencies, FERC also has emergency authority under the Interstate Commerce Act to direct companies to provide preference or priority in transportation, embargoes, or movement of traffic. This authority can be used to direct interstate pipeline operators to prioritize shipments of specific fuels to address shortages.

DEPARTMENT / AGENCY		ENERGY SECURITY / EMERGENCY RESPONSE ROLE
		FERC Order 636 radically changed the national natural gas market in April 1992. Interstate natural gas pipelines became common carriers transporting natural gas; they no longer bought and sold the gas. In the process of enforcing this Order, FERC governs several areas of the national natural gas market and, thus, directly affects distribution and sales in Virginia. Examples of FERC oversight include1: ▪ Determining rate-setting methods for interstate gas pipelines ▪ Developing rules for pipeline company business practices ▪ Approving or disapproving the siting, construction, and operations of interstate gas pipelines ▪ Coordinating gas pipeline projects with applicable federal agencies ▪ Effecting environmental, endangered species, and historic preservation reviews ▪ Cooperating with OPS ▪ Examining pipeline mergers and acquisitions in coordination with other federal agencies and state authorities Even when FERC grants certification of an interstate pipeline, storage, or LNG facility over which the Commission has jurisdiction, the applicant must still obtain certain approvals from the affected state(s) pursuant to the Clean Water Act, Coastal Zone Management Act, and Clean Air Act. If a state finds a proposed project is inconsistent with its Federally approved coastal management program and rejects the project, the applicant may appeal the state's decision to the U.S. Secretary of Commerce. Through this process, the state maintains a role in the building of new natural gas infrastructure. When FERC approves a pipeline project pursuant to the Natural Gas Act, the Act grants the right of eminent domain to the applicant. Therefore, if the applicant is unable to obtain necessary property and rights-of-way through agreement with affected property owners, the Natural Gas Act provides a mechanism for reaching a solution. The Restructuring Rule FERC Order 636 did more than make the pipelines common carriers, it also mandated the unbundling of sales services from transportation services, providing natural gas customers with a choice of providers, and opening gas markets to competition. FERC intended the unbundling requirement to ensure that the gas of other suppliers would receive the same quality of transportation services as the pipeline company's own gas, thereby increasing competition among gas sellers and diminishing the market power of pipeline companies.
Department of Transportation	Federal Motor Carrier Safety Administration (FMCSA)	FMCSA sets safety requirements for interstate commercial drivers, such as hours of service requirements limiting how long drivers can be on the road before a mandatory break. During energy shortages, FMCSA can waive these requirements to facilitate the delivery of specific energy products, most often liquid fuels, or to facilitate the movement of utility crews, trucks, and other resources involved in the restoration of electric power.
	Pipeline and Hazardous Materials Safety Administration (PHMSA)	PHMSA regulates pipelines and rail tank cars to advance the safe transportation of petroleum, natural gas, and other hazardous materials. The agency establishes national policy, sets and enforces standards, educates, and conducts research to prevent incidents. The agency also prepares the public and first responders to reduce consequences if an incident does occur. During pipeline incidents (explosions or spills), PHMSA investigates and issues corrective action orders to pipeline operators before

[1] FERC has no jurisdiction over pipeline safety or security; however, FERC works to ensure that the pipelines certified by the Commission comply with standards of the Department of Transportation and other agencies responsible for safety and security issues.

DEPARTMENT / AGENCY		ENERGY SECURITY / EMERGENCY RESPONSE ROLE
		pipeline service can resume. During energy shortages, PHMSA can issue emergency special permits and waivers of certain regulations to facilitate the pipeline supply of fuel to the affected region. PHMSA also regulates rail tank cars that carry petroleum, biofuels, or liquefied natural gas. Public Law 90-481, the Natural Gas Pipeline Safety Act of 1968, forms the basis for Federal pipeline safety rules. According to the Federal OPS official web site: The U.S. Department of Transportation's (DOT) PHMSA acting through OPS, administers the Department's national regulatory program to assure the safe transportation of natural gas, petroleum, and other hazardous materials by pipeline. OPS develops regulations and other approaches to risk management to assure safety in design, construction, testing, operation, maintenance, and emergency response of pipeline facilities. Since 1986, a user fee assessed on a per mile basis on each pipeline operator OPS regulates has funded the entire pipeline safety program.
Internal Revenue Service (IRS)		IRS collects federal motor taxes on diesel fuel used for on-highway transportation. Diesel used for off-highway purposes (heavy machinery, generators, farm equipment, etc.) is not subject to tax and is dyed red. In coordination with EPA, the IRS can choose to not collect the penalty typically imposed on using non-highway diesel in on-road vehicles (although the IRS still collects tax on this fuel).
Nuclear Regulatory Commission (NRC)		The NRC is involved in emergency preparedness and response involving nuclear facilities or materials. The NRC also publishes a daily status report on all nuclear power reactors.
U.S. Environmental Protection Agency (EPA)		EPA sets standards for certain fuels, including regulating the vapor pressure of gasoline, requiring reformulated gasoline in certain markets, and specifying the sulfur content in diesel fuel. These fuel specifications can be waived during emergencies to facilitate the supply of fuel into the affected region, or to provide fungibility of available supply within the affected region. EPA also regulates air emissions from energy infrastructure, including power generating facilities and fuel storage terminals. During events, EPA may choose not to enforce these regulations to facilitate power supply and fuel supply in the affected region.
Department of Defense	U.S. Army Corps of Engineers (USACE)	USACE assists FEMA during disaster response, including installing generators and delivering generator fuels in communities through its Temporary Emergency Power Mission and sending responders to assist in disasters and provide situational awareness.
Department of Justice	Federal Bureau of Investigation (FBI)	The FBI leads investigations into cyber attacks and intrusions. The FBI collects and shares intelligence and engages with victims while working to unmask those committing malicious cyber activities.
Department of the Interior	Bureau of Safety and Environmental Enforcement (BSEE)	BSEE has responsibility for the safety of the environment and conservation of offshore resources. BSEE administers the Oil Spill Preparedness Program and provides support for oil spill response efforts. During hurricanes and other inclement weather in the Gulf of Mexico, BSEE publishes data on the offshore oil and gas rigs that have been evacuated, as well as the amount of production that has been temporarily shut in. BSEE also leads the development of workplace safety and environmental compliance strategies for offshore renewable energy projects on the Federal Outer Continental Shelf.

Energy Security Planning and Preparedness

State Energy Office Roles and Responsibilities

STEADY STATE

As the Virginia State Energy Office, Virginia Energy coordinates steady state energy planning and policy development efforts through established programs and partnerships. Partnerships include collaborative work with the State Corporation Commission (SCC), VDEM, representatives from solar, wind, energy efficiency and transportation sectors, natural gas and electric utilities, consumer, environmental, manufacturing, forestry and agricultural organizations, and Virginia citizens. Many of these stakeholders engage in additional independent activities that reduce risk through research, analysis, or direct mitigation activities that contribute to improved energy security and resilience. A core group of these stakeholders formed the Integrated Planning Team (IPT) for the development of this Plan to ensure integration of energy sector and emergency management doctrine and practices.

Virginia Energy supports the maintenance of critical bulk fuel information and critical energy infrastructure within Virginia and in the region. They are also the lead agency for the Governor's Virginia Energy Plan development and implementation, which is a strategy to guide the State's energy future.

The Commonwealth, through the Virginia Department of Energy, permits all natural gas wells within the state and associated facilities to gather and transport that natural gas to the point of sale. The agency inspects all these facilities to assure safety and environmental protections. Under the revision of the Virginia Gas and Oil Act that occurred in 1990, correlative rights of landowners were protected by uniform unit development that would allow developers to drill wells and pay affected landowners a standard royalty. This caused a significant uptick in well drilling in Virginia by allowing producers to pay royalties into a state fund to account for disputed ownership of coalbed methane. Once that ownership was resolved, the royalties would be released to the owner. That ownership issue was eventually resolved by the General Assembly and most funds have been released from the escrow.

RESPONSE OPERATIONS

Virginia Energy is a part of the VEST, and functions as a subject matter expert within ESF 12 during response operations. ESF 12, as described in the COVEOP, "serve(s) as the focal point within the Commonwealth for receipt of information on actual or potential damage to energy supply and distribution systems" in any emergency that necessitates a VEST activation. Specialized support has included real time data collection and interpretation, restoration prioritization, cross-sector collaboration and coordination, and decision support for VEST Command and General Staff. Although considered supporting agencies within ESF 12, Virginia Energy and the SCC are critical sources of both data and decision support.

In response operations, VEST coordinates the efforts of the Command and General staff, as well as any necessary ESFs. Organized under the Operations Section, ESF 12 is recognized as part of the Infrastructure Protection Branch. ESF 12 partners will be responsible for monitoring response efforts and providing status reports on progress, unmet needs, and potential obstacles to recovery. Although ESF 12 is specifically responsible for Energy Sector

coordination, ESF 12 efforts may support the efforts of ESFs in the Infrastructure Protection, Human Services, or Emergency Services Branches.

The Virginia ESF-12, led by VDEM, divides operational oversight between Virginia Energy and the SCC, with Virginia Energy overseeing emergency response related to petroleum products and SCC overseeing emergency response pertaining to electricity and natural gas.

Virginia Energy both gathers information and remains in contact with stakeholders in the petroleum industry. In the event of a petroleum shortage or other incident, Virginia Energy is expected to work with both U.S. DOE and VDEM. Industry representatives may also serve as advisors to VEOC. The ESF-12 requires Virginia Energy to "coordinate with a network of contacts between industry and government to ensure an efficient State response."

In the event of a petroleum or coal shortage, Virginia Energy would do the following:

- Receive requests from fuel oil suppliers, transporters or trade associations to implement vehicle weight and driver hours of service (HOS) waivers and communicate these requests to VDEM.
- Coordinate with trade associations to share information and prepare needs assessments.
- Maintain current contact information with the liquid fuel industry partners.
- Provide data regarding supplies and use of liquid fuel obtained from:
    - DOE, EIA
    - Virginia Energy Patterns and Trends web site
    - Other sources as necessary
- Coordinate regional contacts. Renew key contacts annually or more often as needed. Listed are:
    - Neighboring Jurisdictions - District of Columbia, Maryland, West Virginia, Kentucky, Tennessee, and North Carolina
    - Metropolitan District of Columbia Council of Governments
- Advise the Governor during an energy emergency on conservation measures and other actions.
- Assist and provide technical expertise as needed to VEOC during an energy emergency.

Roles of Other State Entities Relating to Energy Security

Given the unique nature of the State Energy Security Plan (SESP) as a functional annex of the COVEOP and a comprehensive state energy security plan covering prevention, protection, and mitigation, this section cover both roles and responsibilities during steady state and during response operations.

ESWG stakeholders share steady state responsibilities for individual agency and collaborative efforts in:

- Preparedness (planning, protection, and prevention);
- Recovery;
- Mitigation activities; and
- Training and Exercises.

Exhibit 52 includes an overview of key responsibilities by agency, while Exhibit 53 provides a more comprehensive listing by steady state emergency management mission areas. Training and exercise recommendations are included in Attachment 2.

Exhibit 52: Table of State Agency Roles in Energy Security and Emergency Response

AGENCY	KEY RESPONSIBILITIES
VDEM	**Steady State:** ▪ Ensure VEST readiness ▪ Maintain Situational Awareness Unit (SAU) operations 24/7 ▪ Coordinate periodic review and update of the COVEOP and SESP, conduct periodic training and exercises to test **Response Operation:** ▪ Activate the COVEOP and ESP as recommended by ESWG in the event of an actual or potential energy emergency ▪ Assess the need and activate ESF-12, a limited VEST activation, or a full VEST activation ▪ Coordinate VEST activities to unify state agencies, private sector partner, and NGO response efforts ▪ Coordinate situational awareness calls at the request of Virginia Energy or SCC ▪ Determine need for additional reporting efforts and reporting schedule. ▪ Prepare staff for potential emergency declaration, if recommended by Virginia Energy or SCC ▪ Direct Communication by establishing a Joint Information Center (JIC) to coordinate communications with media and public information. ▪ Ensure inclusive and equitable service delivery
SCC	**Steady State:** ▪ Maintains regulatory authority over jurisdictional electric utilities to ensure safe and reliable service at reasonable rates. Establishes quality of service standards and resource planning guidelines to ensure that electric utilities have sufficient resources. ▪ Ensures that electric utilities prepare for prompt restoration of service in the event of an outage, regardless of the cause. ▪ Assess resource capacity adequacy to serve each utility's load. ▪ Prescribe and enforce compliance with safety standards for jurisdictional gas and hazardous liquid companies (intrastate pipelines, 130 natural gas master meter systems, one liquified natural gas plant, and three propane gas storage facilities) with the adoption of Parts 191, 192, 193, 195, and 199 of Title 49 of the Code of Federal Regulation as minimum pipeline safety standards in Virginia. Inspect facilities, review records, and investigate incidents.[xliv] ▪ Inspects and oversees pipeline safety within the Commonwealth through the SCC Division of Utility and Railroad Safety, acting on behalf of PHMSA as a Federal Interstate Agent for hazardous liquid pipelines as well as certain interstate gas pipelines in Virginia.

AGENCY	KEY RESPONSIBILITIES
	Response Operation: ▪ Support ESF 12 operations as the operational oversight for electricity and natural gas emergencies. ▪ Monitor natural gas and electric power supplies; establish alert points where increased emergency preparedness would be taken. Provide guidance on energy supply, demand, and conservation. ▪ Provide liaison with federal agencies and the electric and natural gas industry to provide the earliest possible warning of shortages. Gather intelligence and establish regular receipt of situational awareness. ▪ Work with utilities to implement a restoration strategy in situations where widespread system infrastructure damage occurs. ▪ Coordinate information sharing. ▪ Keep the public fully informed on all matters pertaining to an electric power or natural gas shortage. ▪ Develop and maintain priorities and rules for curtailment and allocation procedures. ▪ Develop and maintain priorities and rules for voluntary and mandatory conservation procedures. ▪ Develop and maintain procedures for special hardship appeals of curtailment and conservation procedures. ▪ Assist in determination of waiver approvals. ▪ Assist with the legal interpretations of all orders as the VEOC requests. ▪ Assist natural gas users in obtaining alternate supplies. ▪ Develop and maintain procedures for special hardship appeals of curtailment and conservation orders.

The VEST, as the "whole of state government" emergency management mechanism, is comprised of the stakeholders listed above and many more.

The ESWG, as a subset of the VEST representing ESF 12 stakeholders, supports the Plan by:

- Engaging in prevention, protection, recovery, and mitigation activities,
- Providing recommendations related to energy security planning.
- Contributing to Plan testing, exercising, and revisions.

As noted in the Planning Assumptions and Policies sections of the Plan, localities, state agencies, and relevant stakeholders are expected to maintain appropriate plans, policies, and procedures that can coordinate with the COVEOP and related annexes. Additionally, local, tribal, and non-ESF 12 stakeholders may contribute comments, suggestions, or recommendations for the improvement of the Plan.

Exhibit 53 provides a quick reference for energy security activities by steady state emergency management phases, including mitigation, preparedness, and recovery. The table also highlights agency and stakeholder responsibilities for each set of tasks.

Exhibit 53: Table of Energy Security Activities with Relevant Entities

TASK	RESOURCE (Primary/Secondary)
MITIGATION	

TASK	RESOURCE (Primary/Secondary)
Identify areas where public education programs detailing energy-related issues are needed	SCC Virginia Energy
Assist VDEM (and energy companies if mutually acceptable) with public information regarding energy supplies.	SCC Virginia Energy
Provide guidance or assistance with public information on energy supply, demand, and conservation.	SCC Virginia Energy Utilities PJM VPCMA Virginia Propane Gas Association (VAPGA)
PREPAREDNESS	
Assist in determination of State and Federal energy regulations.	SCC Virginia Energy VDEM
Discuss and agree upon procedures for notifying Investor-owned Utilities (IOU), Rural Electric Cooperatives and Municipal Utilities in case of disrupted energy services.	Virginia, Maryland & Delaware Association of Electric Cooperatives (VMDAEC) Municipal Utilities
All Virginia energy public sector stakeholders are advised to learn about utility procedures for restoring power and natural gas, which is the responsibility of a primary energy provider (natural gas and petroleum supply pipeline; electric generators are dispatched under the ISO, PJM rules) to providers in affected area(s).	SCC Utility preparedness plans *In coordination with State officials as appropriate*
Establish and maintain a link to coordinate with non-regulated power generators to ensure activities and operations are synchronized during emergencies.	SCC Industry control area operators
Assist in developing and maintaining a list of critical bulk fuels and energy infrastructure facilities affecting Virginia. The list may include facilities outside Virginia but that serve customers in the Commonwealth and includes pipelines, refineries, terminals, liquid product trucking companies, and water related terminals.)	Virginia Energy VPCMA VAPGA *Seek assistance of Virginia Department of Taxation* *VDEM*
Develop list of bulk fuel providers and transporters to facilitate acquisition of fuel in the event of infrastructure outage or closure.	Virginia Energy VPCMA VAPGA *Coordinate with Petroleum Industry* *VDEM*
Cybersecurity for the pipeline industry and LNG storage falls under the oversight of the PHSMA establishes requirements for participating state programs such as the SCC. PHMSA has a	SCC Department of Homeland Security's Transportation Security Administration (TSA)

TASK	RESOURCE (Primary/Secondary)
Memorandum of Understanding with TSA for coordinating cybersecurity matters discovered during certain inspection activities, This MOU would also apply through delegated authority and certification to the SCC's Pipeline Safety Program. Through SCC, PHMSA, TSA, and CISA outreach and training, pipeline operators are aware of cybersecurity best practices, including the TSA's Security Directive 2021-02 (revised July 2023 following the Colonial Pipeline Cyber Attack).[xlv]	Cybersecurity and Infrastructure Security Agency (CISA).
Maintain ESF-12 procedures for energy providers to contact VDEM if a significant energy service disruption occurs (e.g., a loss of 10% service)	SCC VDEM Virginia Energy Utilities, VMDAEC, PJM
RECOVERY	
Assist VDEM as needed in the determination of State and Federal energy regulations.	SCC Virginia Energy
Utilize SCC data, EIA data and Virginia energy stakeholder data as available to provide guidance concerning energy supply, demand and conservation information.	SCC Virginia Energy EIA Utilities, VMDAEC, Municipal Utilities VDEM Public Relations VPCMA, VAPGA
Coordinate with SCC on monitoring procedures for restoring electricity and natural gas. Coordinate with petroleum associations on the progress of the petroleum supply and distribution companies on procedures of liquid and gas providers in affected area(s).	SCC Virginia Energy Utilities, VMDAEC, Municipal Utilities PJM *Petroleum companies* VPCMA, VAPGA

Role of Energy Security Working Group

Unlike other hazard specific or support annexes to the COVEOP, the ESP is not maintained solely by VDEM. For example, there are provisions within the bipartisan Infrastructure Investment and Jobs Act (IIJA) section 40108 regarding recommended content for all SESPs.[xlvi] To facilitate this process, VDEM and Virginia Energy will coordinate the activities of the Energy Security Working Group (ESWG) to ensure the Plan is tested, trained, and updated annually. The ESWG is comprised of VDEM, Virginia Energy, the Virginia State Corporation Commission (SCC), utility provider partners, with additional local, tribal, or private sector partners needed to address specific concerns.[2]

[2] For the 2022 transition from the 2012 Energy Assurance Plan to the Energy Security Plan, this group of stakeholders was identified as the Integrated Planning Team (IPT). This group will begin using the newer nomenclature with the 2023 revision cycle.

Exhibit 54: Entities Making Up the ESWG

LEAD AGENCIES	SUPPORT AGENCIES AND ORGANIZATIONS
Virginia Department of Emergency Management (VDEM)	Virginia Department of Agriculture and Consumer Services (VDACS)
Virginia Energy	Virginia Department of Transportation (VDOT)
State Corporation Commission (SCC)	Virginia Department of Environmental Quality (DEQ)
	Virginia Electric Cooperatives
	Dominion Energy
	Appalachian Power Company

ESWG stakeholders engage in routine efforts to maintain situational awareness of lingering or emerging threats and hazards. ESWG state agencies collect threat intelligence, develop plans and policies, and conduct regulatory and compliance activities; asset owners and operators may engage in intelligence collection and analysis as well as facility inspections and maintenance as a part of normal operations. Stakeholders also engage in training and exercise activities to enhance energy resilience. Energy security recovery efforts are aligned with the VEST Recovery Plan; energy security and resilience specific mitigation recommendations and resources are included in the Energy Resiliency and Hazard Mitigation section of this plan.

Tribal Coordination

Energy security is uniquely important to tribes in Virginia due to the vulnerabilities residents face on and off reservations relative to the rest of the state, as well as the isolated and outdated nature of energy infrastructure within tribal communities. According to DOE, Native Americans face the highest level of energy burden compared to other racial/ethnicity groups in the United States. In Virginia, available data shows that energy costs among tribal communities exceed state averages. The DOE's LEAD Tool shows that tribal communities face 15% higher energy costs while earning 28% lower incomes than the rest of the state.[xlvii] This is not simply caused by the rural nature of many of the reservations and tribal communities. When comparing the available tribal communities to the counties they are located in, energy costs are relatively equal while salaries are 15% lower. These factors result in an average energy burden (the share of a household's income spent on energy needs) of 3.1% for tribal communities compared to 2% for the state overall. Virginia contains 7 federally recognized tribes and 4 state-only recognized tribes, but only 5 communities were included in the DOE's database. These included the federally recognized Chickahominy, Eastern Chickahominy, Pamunkey, and Rappahannock, as well as the state-recognized Mattaponi.

The federally recognized Pamunkey and state recognized Mattaponi are the only two tribes to have some of their population residing on reservations. Other communities, including the

Monacan, Nansemond, Upper Mattaponi, Nottoway, Cheroenhaka Nottoway, and Patawomeck, host community centers and much of the tribal citizens living relatively nearby. 80% of the Patawomeck, for instance, live within ten miles of each other.[xlviii] The reservations and main community centers are mapped in Exhibit 55, and tribes' populations are described in Exhibit 56. Population density within reservations is very low, and in many cases, communities and households are isolated and even become inaccessible by road during emergency events, such as flooding from hurricanes and other storms or roads blocked by ice storms. These residents are especially vulnerable during fuel shortages and power outage events.

Each tribe is unique in the infrastructure they rely upon for their electricity needs, but most are connected to local utilities like Dominion Energy and Rappahannock Electric. Heating is a primary energy concern for households, and homes tend to use propane or electric heating sources.

Exhibit 55: Map of State and Federally Recognized Tribes

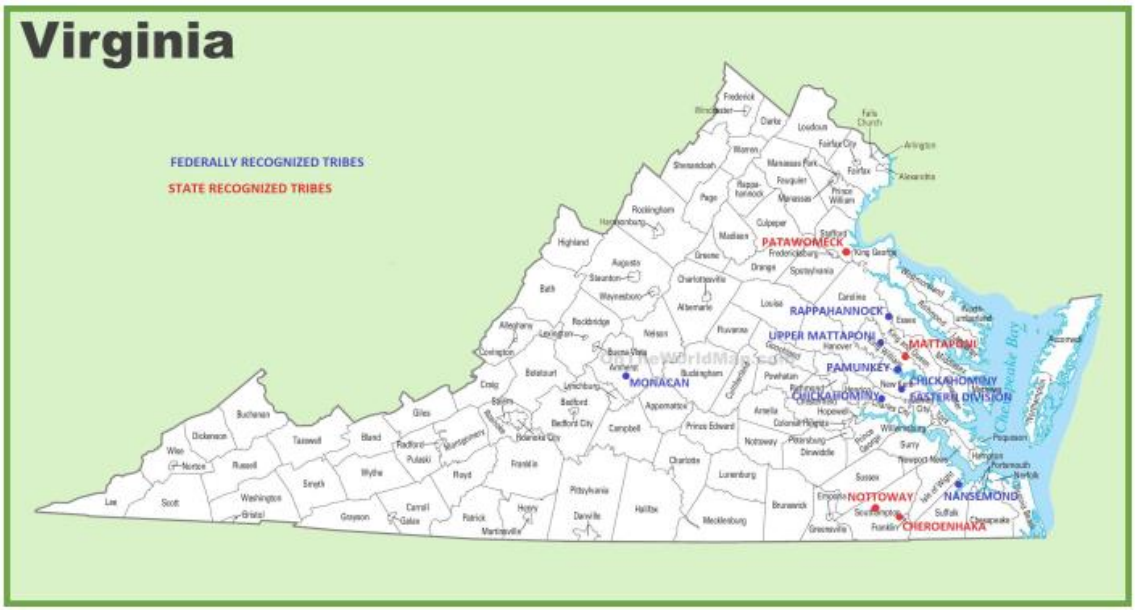


Exhibit 56: Tribe Reported Memberships

TRIBE	POPULATION
Chickahominy	850
Eastern Chickahominy	132
Monacan	2,300
Nansemond	575
Pamunkey*	430
Rappahannock	500
Upper Mattaponi	575
Cheroenhaka Nottoway	400
Mattaponi*	450

TRIBE	POPULATION
Nottoway	400
Patawomeck	2,300

*Note: Only the Pamunkey and Mattaponi tribes have reservations

Resources and response capabilities vary significantly among tribes due to the diversity of tribal mitigation and response efforts. Some tribes rely on non-tribal authorities to assist emergency response efforts, while other tribes have a single tribal emergency manager responsible for coordinating response efforts.

When the role exists, the main point of contact for tribal emergency response is the tribal emergency manager. Across tribes, tribal emergency managers are voluntary, unsalaried positions often taken up by tribal members with existing leadership roles. As a result, tribal emergency managers are strained on time and resources dedicated to emergency management.

Tribal emergency managers are liaisons between local, state, and federal entities prior to and during emergency events. Some of their energy-related responsibilities may include:

- Operating communication lines to receive and send out information relating to power outages and energy emergencies
- Coordinating resources to facilitate fuel delivery, outage repairs, road clearing, and volunteer response
- Monitoring emerging events and planning for potential infrastructure vulnerabilities and threat to tribe members' health and safety
- Developing emergency operations plans and drills to prepare for emergency events
- Facilitating security efforts with localities and industry to protect energy assets from natural and man-made hazards
- Coordinating the evacuation of individuals facing energy emergencies and the deployment of backup generation to shelters

Exhibit 57: Government Roles for Tribes

LOCAL
Initial response to energy emergencies is coordinated through county emergency managers and utilities with land or service territories within and neighboring reservation borders. For instance, in the event of a power outage, tribal emergency managers communicate with the operating utility to restore service if affected infrastructure is not owned or operated by the tribe. If the utility cannot repair damages, tribal emergency managers will enlist additional volunteers internally. In many cases, the same energy assets serve both the tribe(s) and the broader county, fostering necessary coordination between the two entities. This coordination may come in the form of joint planning and response to emergency events and, in some cases, mutual assistance with county management if resources are unavailable. County emergency managers are discussed in County Emergency Managers and Management Organizations section.
STATE
Coordination with state agencies varies by tribe. Tribes reported to be connected with contacts at VDEM and will coordinate with VDEM during energy emergencies.

FEDERAL
Beyond state coordination, Virginia's federally recognized tribes may coordinate disaster planning and relief with FEMA through Region 3 Tribal Liaisonsand, in some cases, the Bureau of Indian Affairs (BIA) and USACE. FEMA's Tribal Policy "outlines a commitment by the Agency to enhance its nation-to-nation relationship with federally recognized Indian Tribal government ("Tribal Nations"), and to ensure FEMA works with tribal nations to build, sustain, and improve their capacity to prevent, protect against, mitigate, respond to, and recover from all hazards." In some cases, the federal government provides grant support and services for reservations. For instance, the BIL was used to purchase land to become future reservation areas and the Indian Community Development Block Grants from HUD were utilized for housing assistance.

Roles of Localities Relating to Energy Security and Emergency Response

Disaster response in Virginia typically starts at the local jurisdiction level. When a local jurisdiction's resources and mutual aid resources become overwhelmed, the local jurisdiction can receive assistance from other local jurisdictions within Virginia or from Virginia state agencies. The Virginia Mutual Aid System is the formal system that directs entities within the state to share resources. In Virginia, such assistance must be authorized or directed by the governor. Examples of resources that could be provided through other local assets are heavy-duty vehicles, emergency generators, and other equipment necessary for energy security and emergency response.

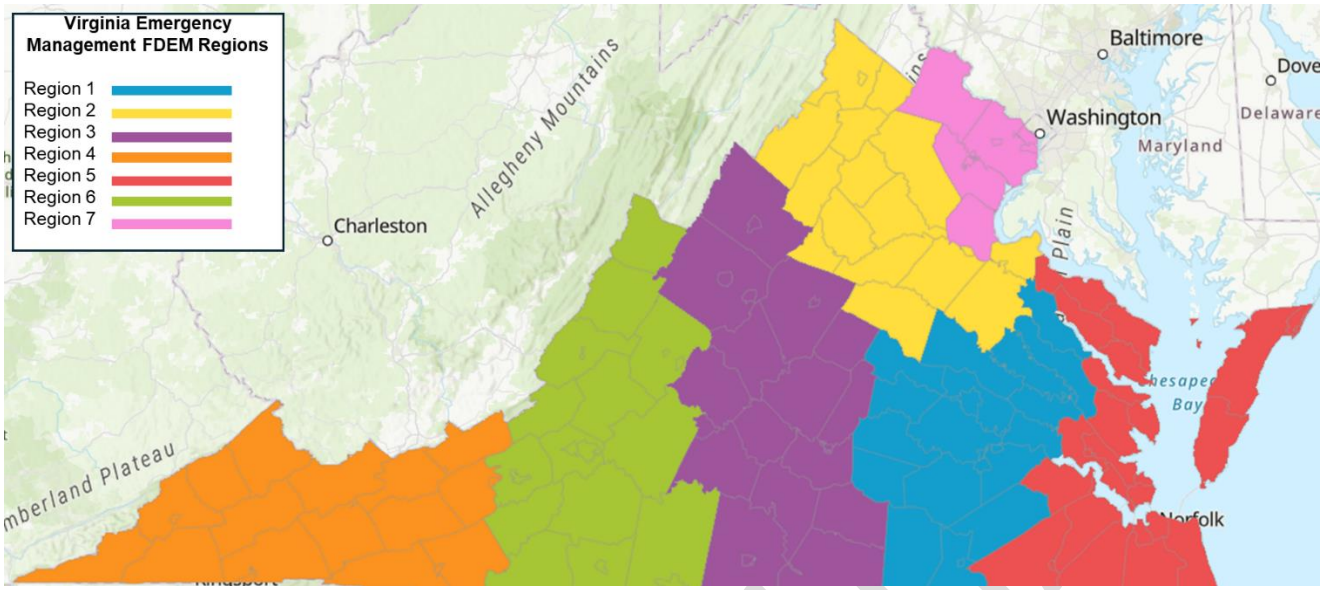
County Emergency Managers and Management Organizations

County emergency managers and associated emergency management organizations directly coordinate with the VDEM and assist in on-the-ground response efforts and emergency preparedness in each county within Virginia. County emergency management organizations range in scale from countywide departments to singular county emergency managers. Some energy-related responsibilities typically include:

- Monitoring incoming hazard events
- Coordinating response efforts with local utilities
- Communicating fuel needs with respective suppliers
- Contacting state agencies for external assistance during unmanageable events
- Preparing emergency response plans for event readiness
- Informing the public about emergencies and response efforts
- Working with tribal emergency managers for threats affecting both reservations and counties

County emergency management organizations develop their own hazard mitigation and emergency response plans in collaboration with existing state mitigation plans and, in some cases, local tribes. These plans are often directly influenced by the Commonwealth's Hazard Mitigation Plan and are written with guidance from VDEM. Additionally, county emergency management organizations work with local public safety officials, such as police and fire departments, to assist in response and recovery efforts. Virginia is grouped into several emergency management regions, as shown in Exhibit 58. Each response region is responsible for connecting county emergency managers with the State Emergency Operations Center (SEOC) through a liaison under VDEM. There is a VDEM regional coordinator in each of the regions who assists county and tribal emergency managers with preparedness and coordination of local EOCs during an incident. These regional coordinators also coordinate the state's homeland security programs.

Exhibit 58: County Emergency Management Regions



Source: VA Emergency Management Localities[xlix]

Role of Private Sector Relating to Energy Security and State Government-Industry Partnerships

Because almost all components of the energy supply chain are privately owned and operated, the first stages of response typically begin internally at those companies. Each company has its own emergency response and preparedness protocols, and they typically begin preparing for a forecasted event before it arrives. Companies typically assess damage, coordinate personnel and resources to make repairs, and restore service to customers. When additional resources are needed, companies may activate mutual aid agreements with sister utilities or via trade associations. If still unfulfilled, resource requests then move up the stages of government from locality to the state.

In the case of petroleum liquid fuels and natural gas disruptions such as pipeline leaks, pipeline shutdowns, terminal outages, etc., industry works to source alternative energy supply to mitigate impacts to customers. Industry may also work to contain the incident, such as stemming a leak and performing environmental remediation, while working simultaneously to sustain supply to consumers until repairs are complete. If the outage duration or extent is more substantial, industry may request state or multistate HOS waivers to allow more fuel from neighbor states to flow by truck.

The private sector is the best source of information for government agencies about on-the-ground conditions. Industry groups monitor anticipated fuel disruptions and market conditions and communicate with state agencies proactively about potential waiver needs. Virginia Energy's relationships with industry stakeholders are critical during an event so that information during emergency responses can readily flow in both directions.

Exhibit 59: Private Sector Actions

ACTION	EXPLANATION
Pre-Event	
Planning, building, purchasing	▪ Continually assess electric capacity needs as customer base changes over time. ▪ Obtain generation capacity through building or purchase. ▪ Create and exercise protocols, working with regional entities (i.e., PJM, SERC, RFC), for emergency power acquisition. ▪ Acquire or identify sources of large and difficult-to-obtain equipment for rapid deployment in the event of component failure.
Training	▪ Maintain staff readiness through ongoing training and instruction.
Protection	▪ Assure infrastructure integrity. ▪ Build to and maintain NERC, SERC, and RFC industry standards for quality and operation. ▪ Maintain and repair equipment, poles, and lines regularly. ▪ Create, maintain, and exercise computer and electronic controls for system operation. ▪ Instruct and encourage customers on the efficient use of power. ▪ Maintain right-of-away (e.g. vegetation control). ▪ Create and sustain mutual aid agreements among all utilities including municipal retail entities that purchase wholesale power for local distribution. ▪ Maintain financial integrity to sustain the company's responsibility to deliver power in compliance with State tariffs and rules. ▪ Ask customers with critical medical needs to notify the company.
Awareness	▪ Monitor for conditions that may create shortage, interruptions, or other incidents. ▪ Analyze system needs and capacity in relation to potential problem, threat, or other potential cause of power loss.
Mobilize	▪ Pre-position repair and technical personnel in advance of known threats, such as a weather emergency. ▪ Prepare in advance for post-incident logistic support.

ACTION	EXPLANATION
Post-Incident Actions	
Incident	▪ Assess damage and impact of incident, especially: ▪ Backbone feeders ▪ Major trunk lines ▪ Critical users with immediate public health and welfare responsibilities ▪ Medical needs as known ▪ Adequacy of rapid response capability ▪ Needs (e.g., personnel, repair equipment, replacement parts) for response support in terms of incident response time to completion ▪ Perform range of response steps relating to the incident such as public appeal, onsite and in-company responder adequacy vs. need to call for mutual aid assistance. ▪ Coordinate and collaborate with other utilities or operational entities, local and State government, and consuming public. ▪ Begin action steps as appropriate (may occur prior to assessment). ▪ Monitor progress of action taken and make necessary adjustments. ▪ Report action and restoration progress to SCC and VDEM as appropriate. ▪ Sustain efforts with logistics support to completion.
Evaluation	▪ Review all aspects of performance in relation to pre-event planning and training. ▪ Review incident response in relation to frequency and location of incidents. ▪ Collaborate with other stakeholders to enhance future response capability. ▪ Make changes to plans and preparatory steps as indicated.

PROJECT ENDEAVOR

The ENDEAVOR-VA working group in Virginia is a collaboration between Emergency Management and the private sector. Its goal is to formalize the partnership between state and private sector partners regarding the enhancement of preparedness, response, and recovery capabilities. ENDEAVOR-VA brings together industry and government to address complex operational issues, fostering resilience in businesses and communities across the state. Industry leaders from various sectors, including energy, participate in this structured planning and response framework, supported by state and local emergency management professionals. They have hosted virtual workshops with topics like re-entry and business access following disasters.

CRITICAL INFRASTRUCTURE WORKGROUP

The purpose of the Critical Infrastructure Workgroup is to ensure the resilience and functionality of vital assets within the Commonwealth of Virginia. This interagency effort, facilitated by the VDEM, involves partners from all levels of government and industry. The workgroup coordinates risk assessments, mitigation, planning, exercising, response, and recovery efforts related to critical infrastructure, including energy, communications, food, shelter, water systems, transportation, financial systems, and networks. Private sector partners can engage directly with the State Working Group or through state agency leads to enhance the Commonwealth's critical infrastructure resiliency. The focus is on preparing for

and adapting to changing conditions, withstanding disruptions, and recovering rapidly from risks and crises.

Virginia Energy represents the State Agency Lead for the energy sector with the SCC as the Sector Risk Management State Agency responsible for optimizing resiliency against emergencies. Virginia Energy's role in the workgroup includes identifying and prioritizing critical energy infrastructure, maintaining situational awareness, providing technical assistance to infrastructure owners, sharing threat information, and collaborating with private sector organizations during steady state to enhance security and resilience.

Regional and Multi-State Structures and Coordination

STATE ENERGY EMERGENCY ASSURANCE COORDINATORS (EEAC) PROGRAM

The EEAC program is a cooperative effort between the DOE CESER, the National Association of State Energy Officials (NASEO), the National Association of Regulatory Utility Commissioners (NARUC), the National Governors Association (NGA), and NEMA. The EEAC program provides a network for states to share and receive information from other states and DOE prior to and during energy emergencies. EEACs include representatives from state energy offices, PUCs, and other state agencies. Additional information about the program can be found in CESER's State Energy Security Plan Optional Drop-In: Energy Emergency Assurance Coordinators (EEAC) Program publication.[I]

NASEO ENERGY SECURITY COMMITTEE

Virginia Energy is a member of the NASEO. NASEO has an Energy Security Committee that conducts monthly meetings of state energy offices where information is shared among the states about ongoing activities being conducted, emerging market issues, and best practices among state energy offices.

EMERGENCY MANAGEMENT ASSISTANCE COMPACT (EMAC)

The EMAC program is a national disaster relief compact that Virginia can leverage when it needs assistance from another state during governor-declared states of emergency or disaster. Additional information about the program can be found in the Emergency Management Assistance Compact.[Ii] The Virginia Legislature's EMAC enactment is found in the state's Codified Laws in § 44-146.28:1.[Iii] Every state has signed onto this compact. Examples of when Virginia may request EMAC assistance include a severe winter storm where search and rescue assets, first responders, and additional EOC staff are needed to assist with mass restoration of power. EMAC support can also be used to request additional ESF-12 staffing.

ALL HAZARDS CONSORTIUM (AHC)

The All Hazards Consortium (AHC) is a non-profit organization with the mission to enhance resilience in critical infrastructure, including the energy sector, by fostering collaboration across various areas, including crisis management, business continuity, risk management, cybersecurity, and homeland security. The AHC facilitates the exchange of sensitive information and aims to expedite recovery efforts for businesses and communities after disruptions or disasters occur. It serves as a network of organizations and individuals working together to prevent, prepare for, respond to, and recover from crises.

VDEM is the state lead for the AHC. Virginia Energy participates in the Consortium for situational awareness, networking to strengthen relationships with private sector partners, and bi-directional information sharing.

The AHC actively engages in initiatives to enhance energy sector resilience, including cooperation with the U.S. Department of Energy's Office of Cybersecurity, Energy Security, and Emergency Response (CESER) in the All Hazards Energy Resilience Program. This program aims to address future challenges, focusing on ensuring that energy continues to flow safely and reliably to communities across the nation, even during disruptions.

PROJECT BLUE BOOK

VDEM received a FEMA Regional Catastrophic Preparedness Grant (RCPG) to facilitate a planning process and address emerging nation-state cyberthreats against the region and in the Commonwealth of Virginia and launched the Blue Book Project in May 2024. This project includes a diverse set of invited participants from local, regional, tribal, state, federal, non-governmental, and private sector critical infrastructure operators. Virginia Energy is participating in this collaborative process to aid in the development of a statewide emergency management plan to manage the consequences of a nation-state actor cyberattack across the State's infrastructure. The Blue Book Project will culminate in a series of exercises designed to test the documented procedures and coordination mechanisms against realistic cybersecurity scenarios. These exercises will involve key stakeholders and simulate various cyber-attack scenarios, allowing for the identification of strengths, weaknesses, and areas for improvement to the developed planning documents.

SOUTHEASTERN PETROLEUM SHORTAGE RESPONSE COLLABORATIVE (SPSRC)

The Southeastern Petroleum Shortage Response Collaborative (SPSRC) was created to facilitate the coordination and development of a regional catastrophic fuel response framework among a subset of southeastern states' emergency management and energy offices, including Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia. This initiative is recognition of the need for nearby states to work together and share resources to best address state and regional petroleum shortage preparedness and response needs. The SPSRC Regional Framework codifies guidance for coordinated response, prioritizes response programs and actions, standardizes information flows, and pre-identifies tools and templates that may be necessary to respond to a petroleum shortage. The Collaborative meets on a quarterly basis during steady-state to provide members an opportunity for peer-sharing and information exchange of lessons learned, preparedness activities, and training and exercises. During a fuel supply disruption, SPSRC can leverage their established network of trusted state collaborators and industry partners for situational awareness and response.

ELECTRICITY MUTUAL AID

Many electric utilities are members of regional assistance groups in addition to intrastate mutual aid. Additionally, most Virginia electric utilities participate in mutual aid agreements through national organizations—the APPA for municipal utilities, the NRECA for cooperative utilities, and the Edison Electric Institute for investor-owned utilities—to receive some assistance from other companies during times of significant damage. Assistance may come in the form of qualified workers and equipment. APPA is also a coordinator in the Electric

Sector Coordinating Council, which includes the Cyber Mutual Assistance program, whereby electric utilities can provide each other with technical assistance based on their experience.

NATURAL GAS MUTUAL AID

Virginia natural gas distribution companies that are members of the American Public Gas Association (APGA) voluntarily participate in the mutual aid program across other APGA members. Three of Virginia's ten natural gas utilities are APGA members, including Richmond Gas Works, City of Charlottesville, and Danville Utilities.[liii] The American Gas Association similarly operates a mutual assistance program for its members, which include Atmos Energy, Columbia Gas, and Washington Gas Light. Similar to electricity mutual aid, qualified workers, technical experts, equipment, mechanical parts, and even fuels may be sent to support gas utilities in need during an emergency event.

Energy Emergency Response

Community Lifelines and Emergency Support Functions

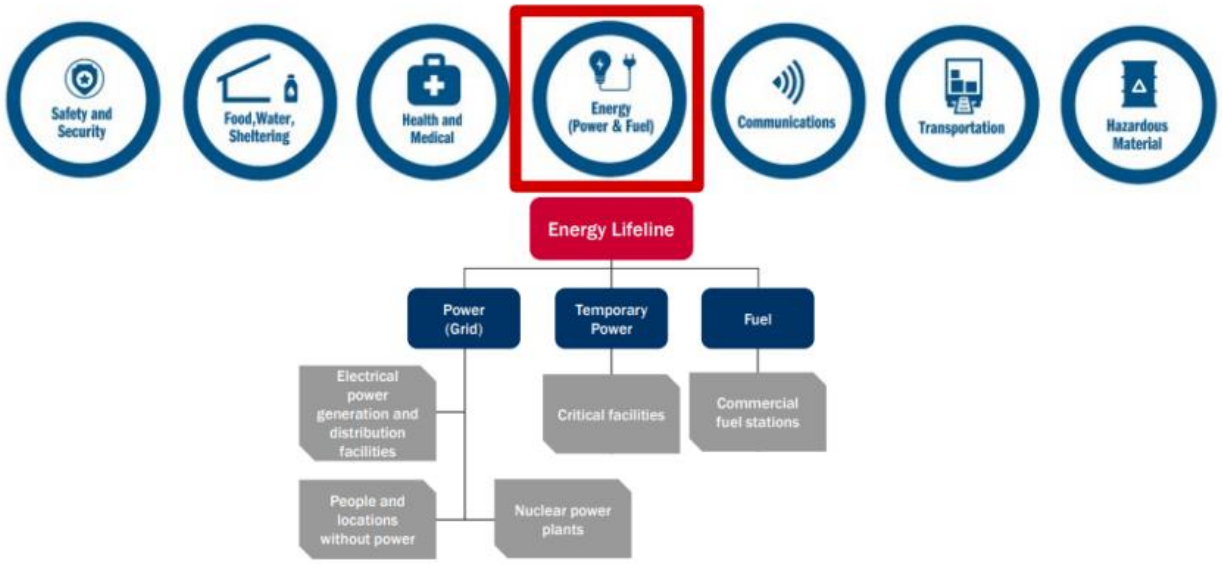
Exhibit 60 includes a list of all 16 Department of Homeland Security (DHS) critical infrastructure sectors that highlights the unique criticality of the Energy Sector. While the four sectors shown in the top two rows are considered lifeline infrastructure foundational to the success of the other 12, even Communications, Transportation, and Water are reliant upon the generation, transmission, and distribution of energy. More detail about lifeline sector interdependencies with the energy sector is described in Section **Error! Reference source not found.**.

Exhibit 60: DHS Critical Infrastructure Sectors

<table>
<tr><td colspan="6">Energy</td></tr>
<tr><td colspan="2">Communications</td><td colspan="2">Transportation</td><td colspan="2">Water</td></tr>
<tr><td>Chemical</td><td>Dams</td><td>Information Technology</td><td>Healthcare and Public Health</td><td>Food and Agriculture</td><td>Emergency Services</td></tr>
<tr><td>Government Facilities</td><td>Defense Industrial</td><td>Financial Services</td><td>Commercial Facilities</td><td>Critical Manufacturing</td><td>Nuclear</td></tr>
</table>

Unlike the DHS lifeline infrastructure sectors highlighted in the exhibit above that focus on industrial continuity, FEMA has also developed a concept of lifelines that focus on emergency response and recovery. The FEMA Community Lifelines, shown in Exhibit 61 below, represent fundamental community services.

Exhibit 61: FEMA Community Lifelines

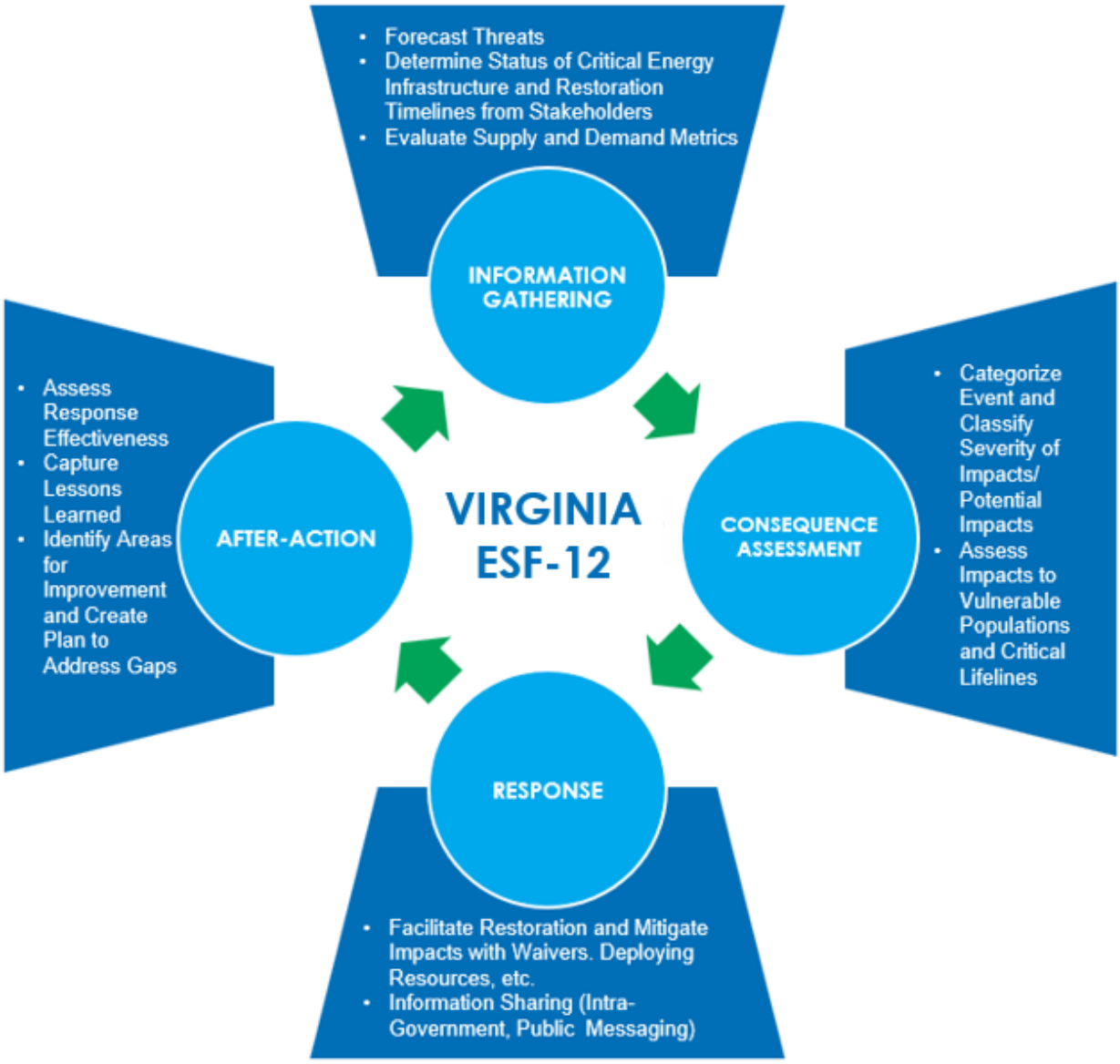


Virginia's energy security response is aligned with ESF 12, the Infrastructure Systems Recovery Support Functions (RSF) and the FEMA Energy Community Lifelines. Lifelines also represent a prioritized approach to emergency response that can promote unity of effort while highlighting interdependencies. As in the DHS critical infrastructure framework, FEMA lifeline frameworks usually prioritize energy restoration as a first line stabilization effort. In Virginia, Community Lifelines have been cross-referenced with the ESFs identified in the COVEOP.

Emergency Response Stages

Responding to energy emergencies involves an iterative process of gathering information, assessing the actual or potential consequences of the incident, and taking action to share critical information, facilitate system restoration, and mitigate impacts to dependent lifeline sectors and consumers. This process is repeated over the course of an emergency with response actions adapting to changing conditions as the situation evolves.

Exhibit 62: Emergency Response Cycle



Activation of the Plan is generally initiated at the recommendation of an ESWG stakeholder, based on actual or emerging shortage or outage event. Due to the flexible and scalable design of the Plan, initial activation may begin with a simple size up call for situational awareness or a full VEST activation. Although detailed information is included in the Roles and Responsibilities section, the general intent for any activation of the Plan includes:

- Promoting situational awareness by contributing relevant information into the Common Operating Picture.
- Coordinating across all ESFs as needed.
- Determining the need for waivers.
- Prioritizing the restoration of impacted areas (based on emergency response and hazard mitigation needs).
- Providing guidance regarding energy supply, demand, and conservation.
- Assessing and continuously analyzing the situation and making course corrections as needed.

- Coordinating public information messaging.

INFORMATION GATHERING

The first stage in emergency response is to gather timely, accurate, and actionable information on threats and impacts to energy systems and services. This information provides the situational awareness needed to inform subsequent steps in the response process (consequence assessment and response actions). The DOE CESER Energy Emergency Response Playbook for States and Territories lists situational awareness resources by energy type and indicates the type of information available.[liv]

Additionally, the State Energy Office developed and maintains several energy supply tracking dashboards that supplement the ESP to help responders understand when to begin data tracking efforts related to a potential or actual shortage. The office also serves on the both the Southeastern and Mid-Atlantic Regional Petroleum Emergency Response Collaboratives that provides the following benefits to member states:

- Formalized sustainable regional petroleum shortage response and coordination guidelines and mechanisms among relevant partners in the region;
- Improved communications between key contacts from state government, the federal government, and petroleum suppliers and other key stakeholders in the region;
- Increased number of states with regional coordination plans, policies, and procedures in their petroleum plans and/or SESPs; and
- Adoption of more formal intrastate and interstate communications protocols in relevant petroleum emergency response plans of participating states.

The State Energy Office gathers information prior to and during energy emergencies by leveraging relationships with industry contacts, industry trade organizations, other state agencies, the federal government, and energy offices in other states. The EEAC list is a primary source of state contacts and can be found on the ISERnet. The NASEO Energy Security Committee and DOE CESER-hosted calls leading up to and during events provide a critical means of sharing information. The list in Attachment 1 – Integrated Planning Team provides a catalog for key contacts for quick reference during energy emergencies.

CONSEQUENCE ASSESSMENT

Throughout the duration of an energy emergency, state energy, and emergency management officials evaluate actual and projected consequences to inform the magnitude, duration, and geographic extent of required response actions. Consequence assessments during response operations require steady state baselining activities. Baselining activities include developing state energy profiles that identify key energy infrastructure and standard volumes of energy supply and demand, as well as understanding typical market dynamics, energy prices, and other metrics to be used as a point of comparison during emergency events, available in the Energy Profile section.

Information to consider during the consequence assessment includes but is not limited to:

1. **Threat information**, including an assessment of how different types of threats impact energy systems. Appendix C: Threats and Potential Impacts to Energy provides a high-level summary of common threats and impacts.

2. **Impacts to energy consumers** (e.g., customer power outages, retail gas station outages), including their magnitude and anticipated duration of impacts (i.e., restoration timelines).
3. **Impacts to lifeline sectors**. The FEMA Community Lifelines (e.g., safety and security, health and medical, transportation) are fundamental community services. Lifelines enable all other aspects of society to function, and there are often interdependencies between lifeline sectors. Energy restoration to lifeline sectors is typically prioritized during event response both to facilitate additional energy restoration and to stabilize broader community services.
4. **Impacts to vulnerable populations**, who are disproportionately affected by energy disruptions. Vulnerable communities may require more assistance to navigate energy events, including additional resources (e.g., backup generators, heating and cooling centers) and targeted outreach.
5. **Impacts to critical energy delivery systems**, including the impacts on supply chains and the availability of alternative supply options.
6. **Impacts to bulk/wholesale energy markets** (e.g., bulk fuel stocks, electric balancing authority reserve margins), including impacts on prices.

Just as energy emergency response can be organized into phases, energy emergencies themselves can be further divided into different levels of severity ranging from normal conditions to severe shortage.

Timing is critical when trying to forecast the depth and duration of a shortage. A determination that would require any level of emergency mobilization would have to be preceded by an examination of the State's supply and demand outlook for the short- and long-term. For example, a mild shortage in heating fuel at the end of winter or in early spring may be managed expeditiously because warm weather is anticipated. On the other hand, a mild shortage of gasoline in the spring may trigger additional monitoring and calls for voluntary conservation in anticipation of summer driving. Foreign petroleum fuel markets would also be monitored for clues to future demand.

Response Tier Crosswalk

Exhibit 63 highlights a general crosswalk between VEST activation levels and the U.S. Department of Energy (DOE) Office of Cybersecurity, Energy Security, and Emergency Response (CESER) tiers utilized for consequence assessment in the Plan.

Exhibit 63: Types of Activation

VEST ACTIVATION LEVELS	NASEO SHORTAGE LEVELS	CESER TIERS	DESCRIPTION / RESPONSE
Green: Steady State	Shortage Level 1: Monitor and Alert	-	• Plans and procedures developed and maintained. • Periodic training and exercises.
Yellow: Increased Monitoring	Shortage Level 2: Mild Shortage	Tier 3: Enhanced Watch	• Response handled by regional staff with limited VEST support. • Limited operational period(s).
Orange: Partial Support	Shortage Level 3: Moderate Shortage	Tier 2: Significant Events	• Some Command and General Staff and ESFs are activated. • Multiple operational periods.
Red: Full Activation	Shortage Level 4: Severe Shortage	Tier 1: Major Event	• All Command and General Staff. • Branches are established. • All ESFs are activated.

NASEO's Four Levels of Shortage

From the NASEO Energy Assurance Guidelines[3], what follows provides a quick reference for assessing an energy shortage. Such shortages could include electricity outages, natural gas supply reductions, or unavailability of petroleum and related products. The spectrum of shortages covered ranges from threats that call for monitoring, to mild shortage conditions, to the most severe levels.

The possible conditions, impacts, reactions, and responses discussed here with respect to each of the four levels of energy emergencies are meant to be suggestive or approximations rather than absolutes. Action steps are suggested, with the understanding that actual circumstances faced by responders must be considered against the conditions and impacts described in the following tables. Furthermore, the intensity of an energy emergency within the Commonwealth may vary by energy sector, by area, and by fuel. For example, natural gas delivery may be interrupted while petroleum product sales remain normal; Richmond may experience a problem while Norfolk enjoys business as usual. Successful management of an energy emergency often rests as much on art as science.

[3] National Association of State Energy Officials (NASEO) *State Energy Assurance Guidelines,* https://www.naseo.org/Data/Sites/1/documents/tk-news/state_energy_assurance_guidelines_version_3.1.pdf

Exhibit 64: NASEO's Four Levels of Shortage

LEVEL	DESCRIPTION
Shortage Level 1 – Monitor and Alert	Characterized by impacts to energy supply chains and/or energy services that are largely remediated by industry with little to no need for support from the state or federal governments. State Energy Offices should enhance situational monitoring to understand if greater response actions are needed.
Shortage Level 2 – Mild Shortage	Although mild shortages may be part of the normal on-going and fluctuating nature of an often-volatile energy market, it is critical at this stage for State officials to be on guard and ready to advise the Governor in the event that a mild shortage matures to the moderate level. NASEO suggests that a mild shortage would be observed when there is a 5 to 10 percent reduction in petroleum supply for a week or more, or a 5 to 10 percent reduction in natural gas nominations4 for interstate pipelines for up to two weeks. The key to discerning the true level of shortage is in predicting how long any shortage will continue. A supply interruption may indeed be dramatic, but energy providers may be able to fix the problem quickly or find alternatives. Similar situations can occur in the electricity sector where the sudden loss of a transmission or local distribution line is quickly remedied. It is unlikely that a shortage at this level would result in an emergency declaration in Virginia unless accompanied by strong evidence that the State will soon experience serious problems. It may also be difficult to react to a mild shortage unless energy stakeholders ask for help.
Shortage Level 3 – Moderate Shortage	The suggested level of deficiency for identifying a moderate shortage is a 10 to 15 percent reduction in petroleum products for three weeks or more, or a 10 to 15 percent reduction in natural gas supply nominations for interstate pipelines is observed. Other conditions may include storm damage to electric transmission/distribution infrastructure or a loss of electric power that will affect a large number of customers for at least 72 hours. An emergency involving natural gas could result in an expansion of curtailment beyond interruptible customers to include firm commercial and even residential customers. Petroleum emergencies could include a major disruption of the pipelines serving the State, major outages at refineries, or even a long-term product loss from foreign crude and offshore refined product suppliers. Monitoring and analytical precautions for this step are the same as noted for a Level 2 – Mild Shortage.

[4] A nomination is a request to move gas from one location to another under a specific contract with a pipeline. It may be made prior to the day of gas flow or at specific times during the flow day.

LEVEL	DESCRIPTION
Shortage Level 4 – Severe Shortage	The suggested level of loss for severe shortage is in the range of 20 to 30 percent and above in petroleum products, natural gas, or electricity for more than two weeks. Events observed might include severe reductions in announced plans for natural gas shipments, widespread electricity outages extending for several weeks, and the inability of the petroleum industry to re-supply local distributors. Hence, Virginia Energy and SCC, as ESF-12 agencies (Virginia Energy, as the agency monitoring petroleum conditions and SCC monitoring utilities), would be expected to consult on a continuing basis together with emergency managers at VDEM and industry representatives, to determine when to recommend that the Governor declare an energy emergency. The determination may be based on the suggested levels of loss as recommended in this Plan or by other indications such as requests from various sectors of the energy industry including electric utilities, LDCs, petroleum product associations and representatives of various economic sectors of the State. Officials should keep in mind that if a severe shortage develops suddenly (as opposed to being the result of a steady progression through levels of loss), events may move rapidly.

CESER's Response Tiers

These industry standard types inform the Response Tiers recommended in the CESER playbook guidance, which aligns with the National Incident Management Systems (NIMS) Incident Complexity Guide and DOE's activation guidance. This crosswalk helps translate industry practices into more common nomenclature for non-energy sector stakeholders and response partners.[5]

Exhibit 65: CESER Response Tiers

RESPONSE TIER	DESCRIPTION
Tier 3: Enhanced Watch	Characterized by impacts to energy supply chains and/or energy services that are largely remediated by industry with little to no need for support from the state or federal governments. State Energy Offices should enhance situational monitoring to understand if greater response actions are needed.
Tier 2: Significant Events	Significant disruptions to energy supply chains and/or energy services with longer timelines for restoration. Response to these events typically exceeds local government resources. Industry will also typically seek state government assistance in the form of waivers and resource management to expedite restoration of energy infrastructure or to mitigate impacts on affected populations or lifeline sectors.

[5] Like the NIMS event types, CESER tiers use an inverted scale, with lower numbers indicating greater event consequences. Tiers 3, 2, and 1 generally correspond to NIMS Types 3, 2, and 1. NIMS event Types 4 and 5 are generally assumed to be energy events requiring minimal involvement from State Energy Offices and are not addressed in the Plan.

RESPONSE TIER	DESCRIPTION
Tier 1: **Major Events**	Characterized by extensive disruption to energy supply chains and/or energy services with extended or indefinite timelines for restoration. Tier 1 events require a massive response at every level of government to assist and expedite restoration and to mitigate the impact on affected populations and lifeline sectors.

The CESER tiers represent an industry-endorsed methodology for assessing and categorizing actual or projected impacts; potential for each tier is presented in the following tables. For events with advance notice, such as hurricanes, the potential consequences of an event may be assessed using forecasts and any available predictive outage or impact-modeling tools. In the immediate aftermath of an event, damage and impact assessments may take time to conduct, and VEST partners may need to act based on incomplete or imperfect information.

During an emergency event, consequences may also vary by energy type. A disruption to a key liquid fuels pipeline, for example, may rate as a Tier 2 event for liquid fuels but may not rate on the scale for electric power or natural gas. The consequence tiers for each energy type relate directly to the response action matrices to follow.

Power Outage/Electricity Shortage Event Tiers

Electricity emergencies generally fall into two categories: (1) service disruptions caused by damage to the transmission and distribution (T&D) grid (e.g., from adverse weather events), or (2) electricity supply shortages due to generation or transmission outages during periods of high demand, which can result in rolling blackouts or grid collapse if not properly managed. Electric utilities are generally well-equipped to deal with common T&D-level outages through internal resources and mutual-aid agreements with other utilities.

Exhibit 66: CESER Response Tiers for Power Outages/Electricity Shortages

TIER	CONSEQUENCES INDICATORS	EXAMPLES
Tier 3: Enhanced Watch	• **Service Disruption:** Localized power outages with short (less than 48 hours) restoration timelines. • Restoration work largely involves repairing fallen or damaged distribution lines and poles. • Lifeline sectors largely maintained with backup generators.	• Common thunderstorms • Common winter and ice storms • Public Safety Power Shutoffs (PSPS) to prevent wildfires
	• **Electricity Shortage:** Imbalance between supply and demand and elevated prices in some load areas. Grid operators issue lower-level communications (e.g., operating condition notices, conservation alerts, control room advisories)	• Heat waves or cold snaps that drive high electricity demands
Tier 2: Significant Event	• **Service Disruption:** Widespread power outages with longer (more than 48 hours) restoration timelines. • Restoration work involves repairing damaged utility wires and structures across T&D systems. • Lifeline sectors experience temporary or intermittent disruptions as backup generator fuel is exhausted and awaits replenishment. • Vulnerable groups that rely on electricity moved to shelters or provided backup generators as needed.	• Hurricane Dorian (2019) • Puerto Rico Magnitude 6.4 earthquake (2020) • Dixie Fire in California (2021)
	• **Electricity Shortage:** Grid operators issue emergency alerts for critical conservation and to maximize generation and transmission resource availability. Sharp price spikes across balancing areas.	• California drought and hydroelectric shortfall (2021)
Tier 1: Major Event	• **Service Disruption:** Widespread power outages with extended or indefinite restoration timelines (a week or longer). • Extensive damage to T&D systems, including damage to substations and other system components that require longer repairs. • Lifeline sectors, including Emergency Response, experience severe impacts from difficulty refueling vehicles and backup generators due to impact of power outages on liquid fuels supply chains.	• Hurricane Sandy (2012) • Hurricane Maria (2017) • Hurricane Laura (2020) • Hurricane Ida (2021)
	• **Electricity Shortage:** Grid operators initiate rolling blackouts to preserve grid stability. Typically associated with large-scale loss of generation resources due to power plant operational outages or power plant fuel shortages.	• Texas extreme cold weather event (2021)

Liquid Fuels Shortage Event

Shortages of liquid fuels (e.g., gasoline, distillate fuels, jet fuel, propane) can be caused by sudden surges in fuel demands and/or by significant disruptions along the fuel supply chain. Demand-driven shortages may develop for gasoline during pre-hurricane evacuations and for heating fuels (diesel, fuel oil and propane) during periods of prolonged cold weather. Supply-driven shortages can be caused by disruptions to crude oil production, oil refining, and/or refined fuel transportation and distribution. Severe shortages often involve both demand- and supply-driven factors. Fuel shortage and fuel accessibility issues may also occur during extended power outages when power-dependent fuel infrastructure is rendered inoperable and when there may be a simultaneous spike in fuel demand for backup generators and emergency response vehicles.

Exhibit 67: CESER Response Tiers for Liquid Fuels Shortages

TIER	CONSEQUENCE INDICATORS	EXAMPLES
Tier 3: Enhanced Watch	• Sporadic fuel outages and delivery delays impacting end users (e.g., gas stations, heating customers) as supply and distribution infrastructure struggles to keep up with sudden spike in demands. • Localized supply shortages at bulk terminals. Distributors begin loading trucks at terminals further away to meet customer needs. • Local or regional fuel inventories fall near or below the bottom of previous five-year range. • Elevated price spreads versus U.S. benchmarks may indicate local or regional issues.	• Localized shortages for heating oil and propane in the Midwest and Northeast during the winter months
Tier 2: Significant Event	• Widespread runouts and/or delivery delays for end users over a period of several days to weeks. • Widespread supply shortages at bulk terminals as suppliers cannot meet all demands. Typically associated with extended outage of one or more critical supply assets. • Sharp declines in local or regional fuel inventories to well below previous five-year lows. • Sharp price spreads versus U.S. or international benchmarks may indicate significant regional issues.	• Midwest propane shortage (2014) • Hurricane Irma evacuation (2017) • Colonial Pipeline cyberattack (2021)
Tier 1: Major Event	• Fuel unavailable or inaccessible to most end users as widespread power outage or other common event renders retail outlets and critical supply infrastructure inoperable. • Lifeline sectors, including Emergency Response, have difficulty finding supply, impacting provision of essential services. • Vulnerable groups that rely on propane/heating oil moved to shelters.	• Hurricane Sandy (2012) • Hurricane Maria (2017)

Natural Gas Shortage Event Tiers

Natural gas supply chains have significant redundancy and excess capacity during most of the year, and shortage events typically only occur during prolonged periods of high demand (e.g., extreme cold weather events) when natural gas transportation infrastructure is fully utilized. However, natural gas demand has grown significantly in recent years due to increased demand from the power sector. Pipeline infrastructure has been unable to keep pace with demand increases in some regions, which increases the potential for shortage events during peak periods. Due to the greater dependence on natural gas for power generation, gas shortages are more likely to have cascading effects on bulk electric system reliability.

Exhibit 68: CESER Response Tiers for Natural Gas Shortages

TIER	CONSEQUENCE INDICATORS	EXAMPLES
Tier 3: Enhanced Watch	• Major transmission pipeline issues Operational Flow Orders (OFOs) to avoid system strain. Usually driven by high-demand cold periods or infrastructure outages or constraints. • High local or regional prices versus U.S. benchmarks may indicate issues. • High prices in affected markets lead to voluntary fuel switching for power sector and industrial customers with the ability to switch.	•Periods of winter peak demand in pipeline-constrained New England
Tier 2: Significant Event	• A major transmission pipeline has an extended unplanned outage during a peak demand period. • Some gas is rerouted into the region on alternate pipelines, but due to capacity constraints, supply is interrupted to power plants and other customers with non-firm contracts. • LDCs urge customers to conserve gas use. • Gas supply disruptions to power generators reduce available generation resources, forcing grid operators to issue emergency advisories or alerts. • Sharp spikes in local or regional prices versus U.S. benchmarks may indicate significant regional issues.	•Bomb cyclone impacting New England (2018)
Tier 1: Major Event	• Severe outage/damage or supply shortage forces transmission pipelines and LDCs to interrupt supply to firm customers. • Loss of pressure in the gas distribution system causing gas to be shut off to firm customers (residential and commercial) • Restoring service is time-consuming, as the LDC must relight each customer's pilot light. • Vulnerable groups that rely on gas heating moved to shelters. • Loss of gas-fired generation leads to severe regional electricity shortages. Grid operators initiate rolling blackouts to preserve grid stability.	•Texas extreme cold weather event (2021)

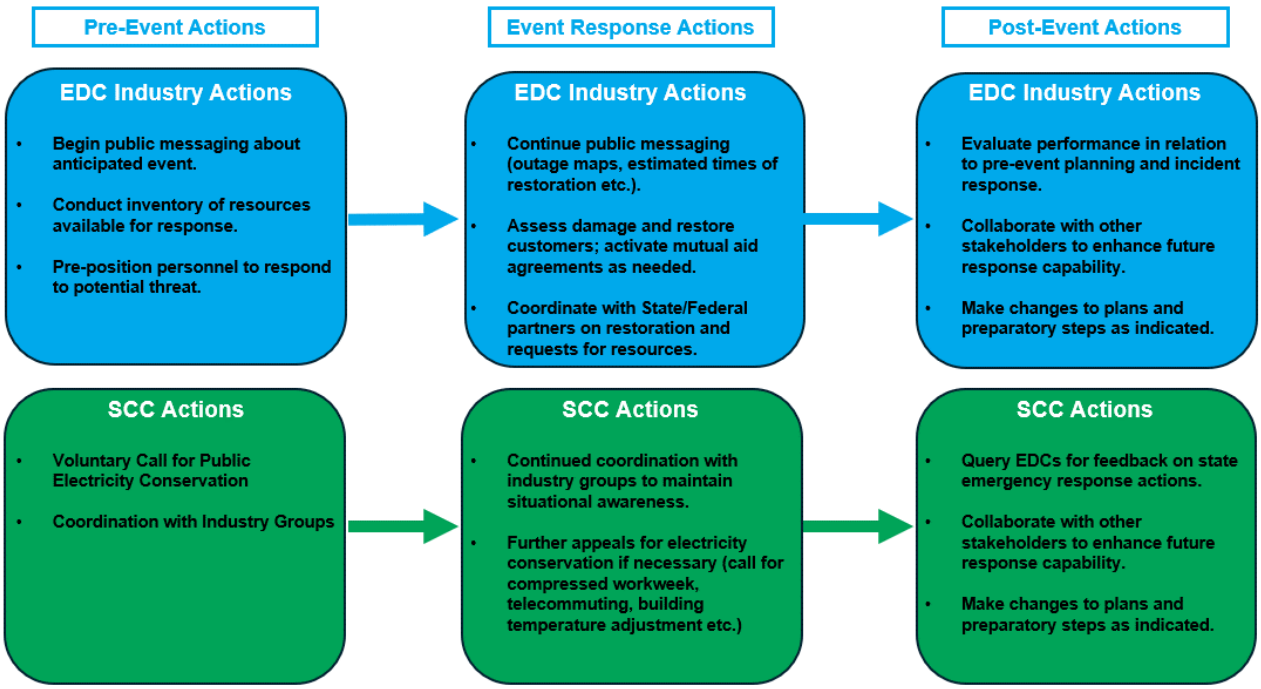
RESPONSE OPERATIONS

Various energy sector stakeholders must take action throughout the course of an energy emergency to facilitate restoration of energy systems and to mitigate the impact of energy disruptions to critical infrastructure, essential services, and vulnerable populations. As part of this response, the EMO may be activated to staff the SEOC during Tier 2 and Tier 3 events. This section outlines the energy emergency response actions of various state and private sector actors.

ESF 12 government representatives are responsible for supporting Command and General staff decision making in resource allocation, public messaging, and coordination. Private energy and utility providers are responsible for the collection of damage assessment information for their respective energy service and facilities following and/or during the response to an incident/disaster. Additionally, private providers will evaluate damage assessment reports and share information on energy, utility, and critical infrastructure damages with the VEST, as well as estimate the impacts on the community. Representatives from public utility companies serve as subject matter experts, communicate with regulatory bodies per state and federal regulations, and are responsible for coordinating delivery of fuels, electricity, data, and communication services for residential, government and commercial customers. Restoration of energy utilities is a private sector responsibility and will be coordinated through ESF-12.

Electricity Sector Emergency Response Actions

Exhibit 69: Flow of Emergency Response Actions in Electricity Sector Disruption



Electric Industry Actions

Exhibit 70 summarizes the basic action any EDC may pursue to mitigate and restore power in the event of a storm or other problem affecting the delivery of electricity.

Exhibit 70: Typical Electric Distribution Company (EDC) Incident Response

ACTION CATEGORIES	STAKEHOLDER RESPONSE
Pre-Event Actions	
Public Messaging	▪ Begin public messaging about the anticipated event and the possibility of outages
Situational Awareness	▪ Monitor for conditions that may create shortage, interruptions, or other incidents. ▪ Analyze system needs and capacity in relation to potential problem, threat, or other potential cause of power loss.
Resource Management and Mobilize	▪ Conduct inventory of resources available for response ▪ Pre-position repair and technical personnel in advance of known threats, such as a weather emergency. ▪ Begin coordination with other utilities and electric industry groups about anticipated mutual aid. ▪ Crews may be evaluated for their safety in advance of an anticipated disaster, and/or staging areas may be relocated away from anticipated disaster area. ▪ Prepare in advance for post-incident logistic support.
Response Actions	
Situational Awareness and Information Sharing	▪ Assess damage and impact of incident, especially to backbone feeders, major trunk lines, and critical user status (CI or medical needs). Determine needs (e.g., personnel, repair equipment, replacement parts) for response support in terms of incident response time to completion. ▪ Establish contact with local and state emergency managers, state ESF-12, or federal ESF-12 as needed. Report action and restoration progress to SCC and VDEM as appropriate. Place personnel at the VEOC.
Public Messaging	▪ Update utility outage maps or other public information-sharing tools. ▪ Develop, publish, and update estimated times of restoration. ▪ If necessary, request voluntary electricity conservation through public appeal.
Resource Management	▪ Activate mutual aid agreements as needed. ▪ Coordinate with State partners on restoration challenges and requests for state resources, or federal ESF-12 on larger scale issues as needed.
Impact Mitigation	▪ Implement rolling blackouts to stabilize grid if needed. ▪ Request and coordinate waiver requests as needed.
Incident	▪ Restore customers according to set prioritization method. ▪ Monitor progress of action taken and make necessary adjustments.
Evaluation	▪ Review all aspects of performance in relation to pre-event planning and training. ▪ Review incident response in relation to frequency and location of incidents. ▪ Collaborate with other stakeholders to enhance future response capability. ▪ Make changes to plans and preparatory steps as indicated.

Source: EDC web sites and various response plans

If PJM is unable to divert sufficient regional supplies of electricity to the State (e.g., due to an increase in regional demand or a failure within the distribution system), area utilities may request SCC and VDEM's help in calling for voluntary conservation measures or even

mandatory measures in extreme events. If PJM determines that rolling blackouts are necessary, Virginia electric utility members would respond. There may not be time to warn customers, although the industry generally tries to provide advance warning.

Restoration Priorities

The electricity delivery infrastructure and the location of a problem within each EDC system dictate power restoration. Curtailment because of a capacity shortage typically defined happens due to the loss of generation capacity or when bulk transmission demand exceeds the supply available from operating units (or both). See Exhibit 71 for curtailment actions.

Exhibit 71: Typical Electricity Curtailment Actions

STEP	ACTION TAKEN IN ORDER LISTED
1	Reduce power manually at all company facilities.
2	Request wholesale power customers to run all available generation and reduce company power use.
3	Request public conservation.
4	Request municipal and other dependent systems implement conservation and curtailment plans.
5	Reduce distribution system voltages up to 5%.
6	Ask industrial and commercial companies to reduce non-essential power.
7	Implement controlled load tariff load reduction.
8	Request industrial and commercial customers substantially reduce power.
9	Open selected circuits for short periods. Implement rolling curtailment as necessary for non-critical customer circuits.

Actions for Dynamic Emergencies

This type of action is taken in response to sudden loss of major infrastructure resulting in the immediate loss of power whenever the system cannot maintain an electric frequency of 60 hertz to satisfy load demand. Steps are illustrated in Exhibit 72.

Exhibit 72: Typical Dynamic Emergency Steps – Electricity

STEP	ACTION
1	Switch off interruptible load and controlled loads per tariff.
2	Reduce distribution system voltages up to 5%.
3	Open selected circuits for short periods. Implement rolling curtailment as necessary for non-critical customer circuits.
4	Selected under frequency relays are tripped. If load tripping is anticipated to last “for a substantial period of time,” implement company load shedding procedures.
5	Totally discontinue service during the emergency to any customer who refuses to comply with procedures outlined in company load shedding procedures list.

Upon the conclusion of any emergency, the company initiates full system restoration and reports to SCC and FERC.

State Actions

In the COVEOP, VDEM is the lead agency for ESF 12 and relies on the State Corporation Commission liaison and regulatory relationship with electric utilities in managing energy emergencies. SCC staff has established contacts with electric utilities to obtain outage information in the event of any service interruption. Virginia electric utilities also provide liaison with the VDEM and meet required filing and regulatory mandates. Direct involvement on behalf of Virginia Energy in electricity outage emergency management is unlikely. However, the VDEM's designated role in planning for and coordinating among stakeholders during energy emergencies does not rule out this agency's ability to provide perspective as requested on electricity shortage matters. In event of a cyber related incident, VDEM is not the primary leader but has stakeholders such as the Virginia Fusion Center (VFC) that primarily handles cybersecurity incidents for the Commonwealth and to a lesser degree the SCC, who does not regulate cybersecurity specifically but works to increase regulated awareness on cyber security matters.

VDEM, as lead ESF-12 agency, may discuss with SCC and VA Energy whether the situation warrants a public information campaign designed to refresh consumer knowledge about ways to reduce energy demand and explain temporary shortage conditions to consumers. SCC, in consultation with others, acting through VDEM may ask the public to implement voluntary conservation measures to reduce demand for affected energy sources. The Governor may also call for a reduction in energy use.

Exhibit 73 contains potential emergency contingency measures that the Commonwealth may apply if utility response actions are overwhelmed or otherwise cannot sufficiently protect the public.

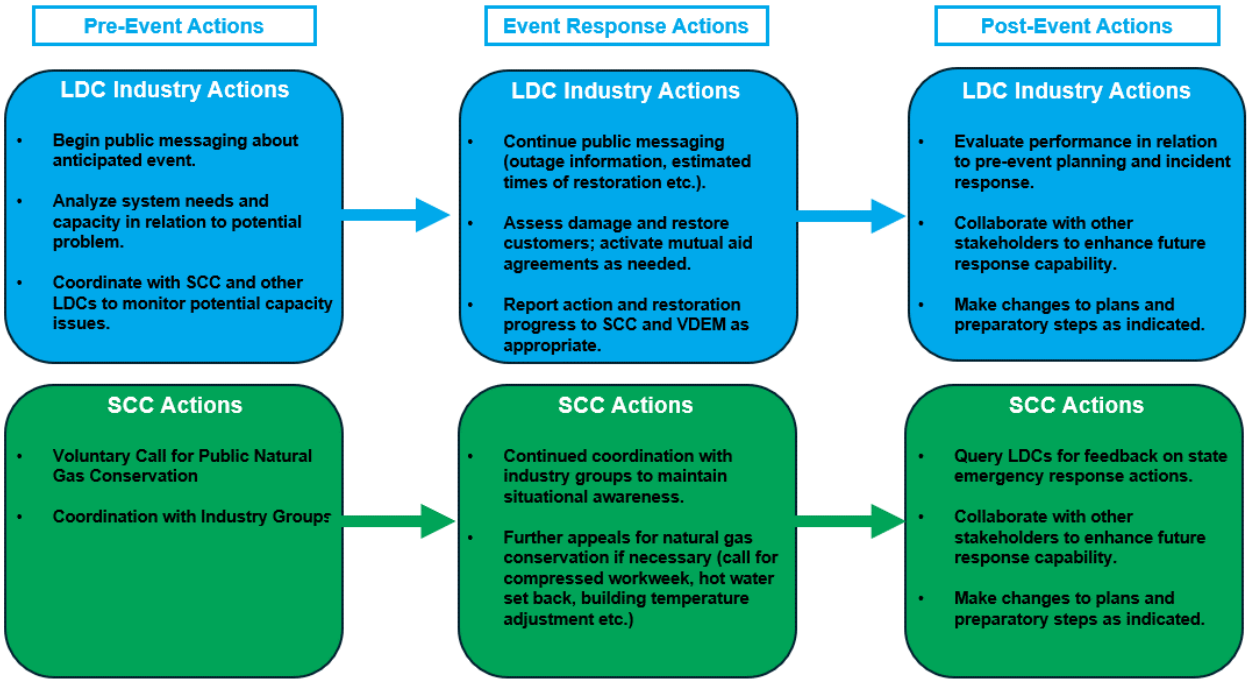
Exhibit 73: Potential State Emergency Measures to Mitigate Electricity Disruption

MEASURE	WHAT IT DOES	TARGET CONSUMERS	RECOMMENDED STEPS FOR STATE RESPONDERS	METRICS
Voluntary Call for Public Electricity Conservation (General, Hot Water Set Back, Building Temperature Adjustment)	Promotes voluntary reduction in energy use to aid recovery and restoration efforts, share limited energy supplies equitably and assure sufficient energy for priority customers. Gives the public specific guidance for type of energy shortage and may stimulate the use of alternatives or efficiency measures.	All users, general public	▪ Use staff knowledge; obtain information from sister States, DOE, NASEO and others to develop conservation guidance. ▪ Coordinate with State electric utilities, and work with their media and public relations professionals. ▪ Develop brochures, handouts, video, audio, Internet and other dissemination materials. ▪ Work with media and others to obtain low cost or free airtime or print space. ▪ Hold public meetings for town energy task forces and citizens. ▪ Provide feedback to legislature and local jurisdictions.	EDC reports lower demand. Query EDC after incident to see if supply availability improved after public information was provided.
Voluntary Telecommuting or Voluntary Compressed Workweek/ Mandatory Government Agency Hours of Operation	Reduces hours of operation for buildings and thus the amount of electricity required	Commercial & Government	▪ Secure assistance from VEDP (Virginia Economic Development Partnerships), business associations, employee unions and groups. ▪ Encourage all business sectors to participate. ▪ Provide technical assistance. ▪ Seek advice and operating procedure help from national and regional telecommuting organizations. ▪ Publicize and explain. ▪ Design this measure for self-administration. ▪ Consider publicized recognition or awards for participating employers. ▪ Coordinate with affected local jurisdictions. ▪ Provide “success stories” to media. ▪ If mandatory, self-enforcement and local code officials. Work with Attorney General to set up enforcement and appeals procedures.	Seek assistance of selected commerce associations (e.g. Chambers of Commerce) to gauge effectiveness. Query EDC after incident to see if supply availability improved after public information was provided.

MEASURE	WHAT IT DOES	TARGET CONSUMERS	RECOMMENDED STEPS FOR STATE RESPONDERS	METRICS
Mandatory Hot Water Set Back	Reduces temperature of hot water at commercial, governmental and industrial facilities.	Commercial, institutional and industrial consumers	▪ Recommend a percentage (e.g., 5% or 10%) reduction in temperature and consult with cross-section of user representatives. ▪ Design this measure for building operator self-certification. ▪ Use local inspectors for random verification. ▪ Notify the public. ▪ Use standard testing procedures. ▪ Arrange media coverage. ▪ Enlist support and technical assistance from plumbing professionals. ▪ Coordinate with local authorities as appropriate. ▪ Enforcement: Self-enforcement and local code officials. See note above re: Attorney General. Work with Attorney General to set up enforcement and appeals procedures	Work with businesses, institutions, and associations to provide regular reporting on reductions implemented. Use DOE or other standard measurements for reducing hot water costs per size of unit, volume of use or other pre-determined measurement.
Mandatory Building Temperature Adjustment	Reduces/restricts space conditioning in commercial, institutional and public facilities.	Commercial, institutional and industrial consumers	▪ Recommend a +/- 5-percent seasonal temperature adjustment in consultation with commercial, institutional and industry representatives. ▪ Use building operator self-certification (building operator keeps log for review by management) for this measure. ▪ Use local inspectors and town energy task forces for random verification. ▪ Work with VEDP for support. ▪ Notify the public. ▪ Establish self-certification and self-enforcement feedback. ▪ Use standard testing procedures. ▪ Arrange media recognition for participating companies. ▪ Coordinate with affected local jurisdictions. ▪ Enforcement: Self-enforcement and local code officials. Work with Attorney General to set up enforcement and appeals procedures.	Work with businesses, institutions, and associations to provide regular reporting on reductions implemented. Work with local jurisdictions and building owner/operator associations to ascertain compliance and numbers participating. Use DOE or other standard measurements for reducing hot water costs per size of unit, volume of use or other pre-determined measurement.

Natural Gas Sector Emergency Response Actions

Exhibit 74: Flow of Emergency Response Actions in Natural Gas Sector Disruption



LDC Actions

Every jurisdictional natural gas pipeline operator has established procedures to restore service in the event of an outage, regardless of its cause, and an emergency response plan filed with the SCC. Specific provisions address restoration of service in the event of an outage. The pipeline operators have executed those procedures on numerous occasions. Other statutory requirements for elements in the emergency response plans include definition of different levels of emergencies, identification of events, response urgency, and procedures, communication protocols with various organizations (public authorities, emergency responders, customers, etc.).

Exhibit 75 summarizes typical Commonwealth natural gas industry response activities.

Exhibit 75: Typical Natural Gas Industry Incident Response

ACTION	STAKEHOLDER RESPONSE
Pre-Event Actions	
Public Messaging	▪ Begin public messaging about the anticipated event and the possibility of outages
Situational Awareness	▪ Monitor for conditions that may create shortage, interruptions, or other incidents. ▪ Analyze system needs and capacity in relation to potential problem, threat, or other potential cause of supply loss.
Resource Management and Mobilize	▪ Coordinate with SCC and other LDCs to monitor potential and imminent capacity issues. ▪ Increase draw from storage, as needed. ▪ Purchase gas from other regions as needed.
Response Actions	
Situational Awareness and Information Sharing	▪ Perform damage assessment and estimate time for restart if applicable. ▪ Establish contact with local and state emergency managers, state ESF-12, or federal ESF-12 as needed. Report action and restoration progress to SCC and VDEM as appropriate.
Public Messaging	▪ Develop, publish, and update estimated times of restoration. ▪ If necessary, request voluntary conservation through public appeal.
Resource Management	▪ Activate mutual aid agreements as needed. ▪ Assess challenges to restoration (e.g., specialized equipment or materials, access issues). ▪ Coordinate with State partners on restoration challenges and requests for state resources, or federal ESF-12 on larger scale issues as needed.
Impact Mitigation	▪ Request voluntary conservation from customers. ▪ LDCs may require conservation from large customers with “interruptible contracts. Invoke Curtailment Plan steps if condition persists. ▪ Industry groups request waivers from state or federal industry.
Incident	▪ Take immediate remediation action, if applicable, and work to fix damage. ▪ Invoke re-lighting procedures if shut-off was required. ▪ Monitor progress of action taken and make necessary adjustments.
Evaluation	▪ Review all aspects of performance in relation to pre-event planning and training. ▪ Review incident response in relation to frequency and location of incidents. ▪ Collaborate with other stakeholders to enhance future response capability. ▪ Make changes to plans and preparatory steps as indicated.

Source: CESER Energy Emergency Response Playbook and various response plans

For the purposes of State responders, one of the most important parts of an LDC’s emergency plan is the priority for curtailing customer usage during a shortage.

Exhibit 76 summarizes typical priorities, illustrating how potential variations between two companies may occur, but lead to similar results.

Exhibit 76: Typical Natural Gas Curtailment Priority List

PRIORITY NUMBER	GROUP 1	GROUP 2
1	Interruptible customers (Typically natural gas power plants and some industrial users)	Interruptible customers (Typically natural gas power plants and some industrial users)
2	Large company customers	Media request for customers to reduce usage
3	Public appeal to reduce consumption	Large company customers (especially where previous use on interruptible tariff indicated alternate fuel source back-up)
4	Isolation and supply shut-off of affected sections at the city gate	Shut off affected communities at the city gate

Source: Company emergency plans and discussion with LDC representatives, 2011.

State Actions

The SCC is the primary State agency designated to work with the State's regulated natural gas utilities and other non-utility regulated pipeline operators in energy emergency management. Virginia operators provide liaison with the SCC to meet required filing and regulatory mandates, and work with VDEM and local jurisdictions, as emergencies require. Virginia Energy may become involved in a natural gas supply emergency because of its responsibility to coordinate stakeholders during an energy shortage. Virginia Energy's coordination and broad interest in many energy areas also can help the agency provide perspective on natural gas issues.

SCC staff has established contacts with natural gas utilities to obtain outage information in the event of any service interruption. In both gaseous pipelines and hazardous liquids pipelines, the SCC receives telephonic notifications of significant events. Additionally, in the event of a major pipeline Incident or Accident, the SCC received preliminary telephonic notification ahead of the pipeline operators report the National Response Center. Additionally, the SCC monitors and receives all National Response Center Reports. The SCC has priority of service rules and communicates with affected gas utilities during incidents to coordinate and enable mutual assistance among responding LDCs. ESF-12 of the State emergency plan identifies interaction with State and emergency officials, including VDEM, to share information. The SCC will deploy to all major Incidents and Accidents and most significant events. SCC also interacts with individual customers to provide information and resolve questions during emergencies or outages.

VDEM, as lead ESF-12 agency, may discuss with SCC and VA Energy whether the situation warrants a public information campaign designed to refresh consumer knowledge about ways to reduce energy demand and explain temporary shortage conditions to consumers. SCC, in consultation with others, acting through VDEM may ask the public to implement voluntary conservation measures to reduce demand for affected energy sources. The Governor may also call for a reduction in energy use.

Exhibit 77: Potential State Emergency Measures to Mitigate Natural Gas Shortage

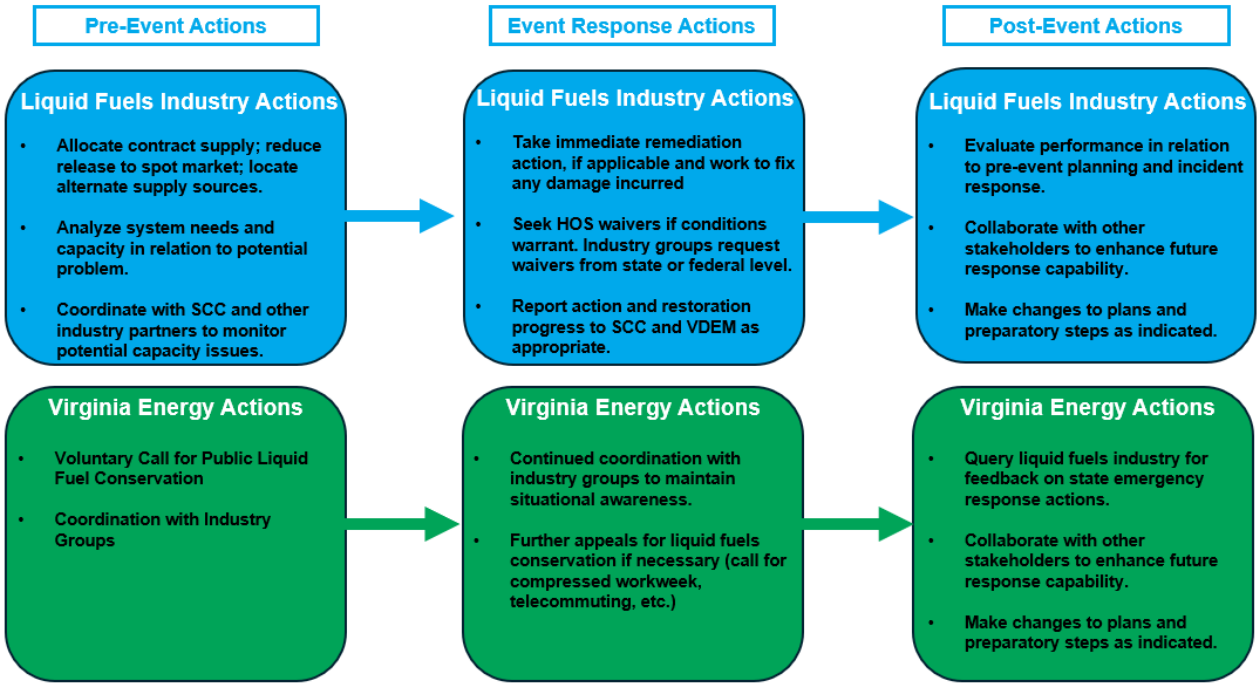
MEASURE	WHAT IT DOES	RECOMMENDED STEPS FOR STATE RESPONDERS	METRICS
Voluntary Call for Public Natural Gas Conservation (General, Hot Water Set Back, Building Temperature Adjustment)	Promotes voluntary reduction in energy use for all users to aid recovery and restoration efforts, share limited energy supplies equitably and assure sufficient energy for priority customers. Gives the public specific guidance for type of energy shortage and may stimulate the use of alternatives or efficiency measures.	▪ Use staff knowledge; obtain information from sister States, DOE, NASEO and others to develop conservation guidance. ▪ Coordinate with State natural gas utilities, and work with their media and public relations professionals. ▪ Develop brochures, handouts, video, audio, Internet and other dissemination materials. ▪ Work with media and others to obtain low cost or free airtime or print space. ▪ Hold public meetings for town energy task forces and citizens. ▪ Provide feedback to legislature and local jurisdictions.	LDC report lower demand. State agencies query LDC after incident to see if supply availability improved after public information was provided.
Voluntary Telecommuting or Voluntary Compressed Workweek/ Mandatory Government Agency Hours of Operation	Reduces hours of operation for commercial and government buildings and thus the volume of natural gas required	▪ Secure assistance from VEDP (Virginia Economic Development Partnerships), business associations, employee unions and groups. ▪ Encourage all business sectors to participate. ▪ Provide technical assistance. ▪ Seek advice and operating procedure help from national and regional telecommuting organizations. ▪ Publicize and explain. ▪ Design this measure for self-administration. ▪ Consider publicized recognition or awards for participating employers. ▪ Coordinate with affected local jurisdictions. ▪ Provide “success stories” to media. ▪ If mandatory, self-enforcement and local code officials. Work with Attorney General to set up enforcement and appeals procedures.	Seek assistance of selected commerce associations (e.g. Chambers of Commerce) to gauge effectiveness. Query LDC after incident to see if supply availability improved after public information was provided.

MEASURE	WHAT IT DOES	RECOMMENDED STEPS FOR STATE RESPONDERS	METRICS
Mandatory Hot Water Set Back	Reduces temperature of hot water at commercial, governmental and industrial facilities.	▪ Recommend a percentage (e.g., 5% or 10%) reduction in temperature and consult with cross-section of user representatives. ▪ Design this measure for building operator self-certification. ▪ Use local inspectors for random verification. ▪ Notify the public. ▪ Use standard testing procedures. ▪ Arrange media coverage. ▪ Enlist support and technical assistance from plumbing professionals. ▪ Coordinate with local authorities as appropriate. ▪ Enforcement: Self-enforcement and local code officials. Work with Attorney General to set up enforcement and appeals procedures.	Work with businesses, institutions, and associations to provide regular reporting on reductions implemented. Use DOE or other standard measurements for reducing hot water costs per size of unit, volume of use or other pre-determined measurement.
Mandatory Building Temperature Adjustment	Reduces/restricts space conditioning in commercial, institutional and public facilities.	▪ Recommend a +/- 5-percent seasonal temperature adjustment in consultation with commercial, institutional and industry representatives. ▪ Use building operator self-certification (building operator keeps log for review by management) for this measure. ▪ Use local inspectors and town energy task forces for random verification. ▪ Work with VEDP for support. ▪ Notify the public. ▪ Establish self-certification and self-enforcement feedback. ▪ Use standard testing procedures. ▪ Arrange media recognition for participating companies. ▪ Coordinate with affected local jurisdictions. ▪ Enforcement: Self-enforcement and local code officials. Work with Attorney General to set up enforcement and appeals procedures.	Work with businesses, institutions, and associations to provide regular reporting on reductions implemented. Work with local jurisdictions and building owner/operator associations to ascertain compliance and numbers participating. Use DOE or other standard measurements for reducing hot water costs per size of unit, volume of use or other pre-determined measurement.

If a natural gas shortage were to continue for an extended time, the State may wish to invoke energy emergency mitigation actions such as those shown in Exhibit 77.

Liquid Fuels Sector Emergency Response Actions

Exhibit 78: Flow of Emergency Response Actions in Liquid Fuels Sector Disruption



Industry Actions

Exhibit **79** summarizes the basic actions that are commonly taken by liquid fuel operators to mitigate and restore fuel supply and distribution in the event of a storm or other problem affecting the supply chain.

Liquid fuel response activities are based off the specific emergency event at hand and the specific infrastructure impacted. For example, petroleum product distributors request HOS waivers during cold snaps or suppliers impose fuel allocations in response to supply/demand imbalance. Potential specific response measures taken by petroleum companies are listed in Exhibit 79.The development of the issue/response list in Exhibit 79 occurred in conversation with representatives of the petroleum industry. Not all participating companies heed every response action in this list.

Exhibit 79: Typical Liquid Fuel Industry Incident Response

ACTION	STAKEHOLDER RESPONSE
Pre-Event Actions	
Situational Awareness	▪ Monitor for conditions that may create shortage, interruptions, or other incidents. ▪ Notify state or federal ESF-12 on precautionary actions taken.
Resource Management and Mobilize	▪ Assess staffing capabilities in advance of the event. ▪ Stage any back-up generation or other resources in advance of the event.
Impact Mitigation	▪ Industry groups request waivers from state ESF-12 and other state agencies (primarily state hours-of-service waivers) and identify need or anticipated need for federal waivers (hours-of-service waivers, RVP/RFG waivers), if applicable.
Response Actions	
Situational Awareness and Information Sharing	▪ Perform damage assessment and estimate time for restart if applicable. ▪ Establish contact with local and state emergency managers, state ESF-12, or federal ESF-12 as needed. Report action and restoration progress to Virginia Energy and VDEM as appropriate.
Public Messaging	▪ Pipeline or terminal company may communicate status and restoration timelines with the public although this is rarer than the other two sectors.
Resource Management	▪ Assess challenges to restoration (e.g., specialized equipment or materials, access issues). ▪ Coordinate with State partners on restoration challenges and requests for state resources, or federal ESF-12 on larger scale issues as needed.
Impact Mitigation	▪ As terminal stocks lower, distributors work to identify alternate fuel sources. ▪ Companies request additional federal waivers, such as Jones Act waivers to facilitate fuel movement into the affected region. ▪ Prioritize allocations of limited amounts of fuel to critical customers. ▪ For cyber events, investigate the scope of the intrusion and its impact on infrastructure; take action to identify the source of the breach and prevent the situation from escalating.
Incident	▪ Take immediate remediation action, if applicable, and work to fix damage. ▪ Monitor progress of action taken and make necessary adjustments.
Evaluation	▪ Review all aspects of performance in relation to pre-event planning and training. ▪ Review incident response in relation to frequency and location of incidents. ▪ Collaborate with other stakeholders to enhance future response capability. ▪ Make changes to plans and preparatory steps as indicated.

Source: CESER Energy Emergency Response Playbook and various response plans

Exhibit 80: Sample Supply Issues Affecting the Petroleum Industry

ISSUE	PETROLEUM INDUSTRY RESPONSE
Supply Issues and Response	
Weather forecast Temperature extremes Wind conditions Rain/flood conditions Ocean storms Snow/Ice	▪ Allocate contract supply; reduce release to spot market. ▪ Add distribution capacity as price increases. ▪ Prepare/protect distribution infrastructure. ▪ Seek alternative routes and delivery means. ▪ Reroute ships, seek alternative supply market. ▪ Equip local delivery vehicles. Request HOS waivers.
Geologic events Earthquake	▪ Allocate contract supply; reduce release to spot market. ▪ Assess damage to infrastructure (pipelines and tank farms), send repair crews as required, reroute deliveries as needed.
Electromagnetic events Solar flares	▪ Electronic and computer systems may be vulnerable. It is unlikely that efforts to reduce this threat will be reported or discussed with State officials.
Supply system issues Embargo, Production field exhaustion, Environmental hazard, Equipment failure, Refinery fire or other outage, Pipeline flow issues, Storage tank failure, Regulations, Tank integrity, Bottoms (shipping), Tankers not available, Jones Act restrictions, Ocean storms	▪ Allocate contract supply; reduce release to spot market. ▪ Seek assistance from Federal authorities. ▪ Explore and produce new locations – an ongoing activity. ▪ Reduce hazard and adjust prices to cover cost or close facilities. ▪ Assess, repair, replace, reroute, allocate. ▪ Meet safety obligations as required, adjust prices to cover costs. ▪ Maintain, assess, repair, replace or shutdown. ▪ Seek new ships as market permits. ▪ Work with Federal government to modify, eliminate.
Regional Transportation Issues Highway interruption, Port and river issue, Weather conditions, Insufficient trucking available, Terminal queuing, Railroad Issues (related in particular to ethanol)	▪ Seek assistance of Virginia Department of Transportation (VDOT), operate State and local EOCs, reroute. ▪ Participate with port authorities, constantly assess and inform. ▪ Pre-fill customers, maintain large contract customer base; locate alternate supply sources. ▪ Seek HOS waivers if conditions warrant.
Human Instigated Issues Worker strikes Lack of experienced workforce Terrorism Cyber-attack (IT risk) Workplace mistakes Training	▪ Work with unions, have back-up contractors to replace, allocate. ▪ Expand and train as economics permit. ▪ Harden infrastructure, supply information to DHS. ▪ Assess, turn to IT and security professionals. ▪ Train personnel, monitor, prepare media response. ▪ Results are the best barometer and seen at supply level. Refinery workers are highly trained and drilled regularly. Distributor organizations provide and encourage employee training.

ISSUE	PETROLEUM INDUSTRY RESPONSE
Commodities	▪ Companies use a variety of in-house and ETRM consultants to evaluate and manage the sale and purchase of crude oil and petroleum products.
Distribution Issues and Response	
Spot-market purchases increase as major suppliers/refiners reduce direct retail ownership (i.e., "branded" outlets).	▪ Branded outlets are less vulnerable than spot-market fuel stations due to supply contracts reducing risk during shortage. ▪ Spot-market outlets enjoy price advantage while supply is abundant. ▪ The petroleum industry anticipates that higher prices will "clear" or re-balance the market.
Reduction in storage for all petroleum fuels is related primarily to economics.	▪ Reduced local storage increases customer risk when supply is tight. ▪ Major petroleum suppliers approve of storage reduction to manage demand signals and prices efficiently. ▪ State propane dealers see reduced secondary storage as a disadvantage.
Federal law requires electronic and manual (every 30 days) tank integrity monitoring.	▪ Some dealers complain, but all seem to understand safety implications. ▪ Attention to safety reduces insurance risk and potential legal exposure.
Some gasoline retailers and large users increase automatic fill ordering via electronic equipment on tanks.	▪ Many retail dealers continue to enter orders into the system manually.
The petroleum industry employs many contract protocols and cost plans that are reflected in retail pricing rather than reliability risk. An example would be zone pricing (in which an area is priced as a unit to maximize profit).	▪ A dealer's ability to remain in business is a market/private sector decision. ▪ Overall, the loss of a dealer is quickly compensated by a purchase or expansion by another. ▪ Reliability does not appear to diminish.
Product allocation applies to contract or branded outlets but affects spot-market outlets as well.	▪ When supply diminishes, excess product supplying unbranded sellers is reduced. ▪ When supply is tight, spot buyers bid up the price to acquire fuel in a tight market.
Major propane delivery is by truck from out-of-State. If HOS waivers are needed, relief from Federal rules is required.	▪ If HOS waivers are necessary, interstate coordination with neighboring North Carolina propane representatives and the North Carolina State energy office are a given.
Significant propane shipments occur via HAZMAT rail	▪
HOS waivers are granted by state and federal officials based on verification by product distribution associations	▪ Associations ask many questions and work with retail dealers to find alternatives for HOS waivers requests
Dealer consolidation is occurring in the retail propane industry.	▪ Interstate companies hold increasing market share. ▪ Reliability does not appear to diminish.

Sources: Interviews with petroleum distribution association and industry representatives, 2022.

State Actions

In most cases, State responders obtain details about supply issues and infrastructure problems more easily from local jobbers and distributors than from major petroleum suppliers. For example, if there is an upstream problem with petroleum products and the VPCMA learns about it, VPCMA is more likely than the supply company to inform Virginia Energy. State officials first should contact VPCMA, the VAPGA, and the Virginia Petroleum Council (VPC) to obtain further information.

In the case of significant fuel supply shortages, the state may potentially implement a Priority End-User Program to assure petroleum supplies for essential public services. This kind of program is designed to ensure the health, safety, and wellness of the general public, and to provide a framework to prioritize fuel disbursements during shortages. Exhibit 81 below illustrates how liquid fuel supply would be prioritized in a shortage situation under a Priority End-User Program.

Exhibit 81: Prioritization of Fuel Disbursements During Liquid Fuels Shortages

PRIORITY TIERS	TREATMENT DURING SEVERE FUEL SUPPLY SHORTAGES
Tier 1: Essential Public Services • Law Enforcement, Fire Departments, Emergency Medical Services, Water Systems • VDEM and Local Emergency Management Agencies • ESF Primary State Agencies • Any other essential service providers determined by Virginia or legal authorities.	Liquid fuels suppliers would be required to provide sufficient liquid fuels to meet the needs of Tier 1 customers. If needed, sales for contractual obligations and noncontract customers would be discontinued to prioritize available supply to meet Tier 1 needs. Supply volumes to Tier 1 customers would be based on an average of contract volumes or historical purchases. Tier 1 customers may need additional supplies based on the nature and scope of the shortage (for example, fuel for backup generators supporting water systems and hospitals).
Tier 2: Contract Customers	When available supply adequately meets the needs of Tier 1 customers, suppliers can then prioritize remaining supply to meet contractual obligations. If the remaining supply is still less than contractual obligations, they would need to allocate fuel proportionately typically based on percent of contract volumes.
Tier 3: Noncontract Customers	When available supply exceeds what is needed to supply Tier 1 customers and contractual obligations, suppliers may resume sales to noncontract customers.

While petroleum industry and government officials usually cooperate in responding to an energy emergency, State government may wish to take additional steps. With the

identification of a petroleum problem, public relations and communications may provide market price signals as well as allow industry recovery efforts the time needed to reduce or manage demand. When supply is tight, the petroleum industry will often call for HOS waivers.

HOS waivers are also used when supplies of transportation fuels becomes tight, such as during the Colonial Pipeline cyberattack in 2021. With coordination of VDOT, Virginia Energy, and VDEM to evaluate the necessity, the Virginia HOS waiver is granted in an emergency declaration signed by the governor (see resources in APPENDIX D: State Waiver Checklist and Templates). Industry or the Virginia government may contact the FMCSA, part of the U.S. Department of Transportation, which may grant regional HOS waivers as needed during widespread events.

Propane distribution companies often request HOS waivers from federal driver safety rules[1] before an actual shortage, when supplies are tight. This reduction in supply occurs when propane dealers encounter extraordinary demand during the coldest periods of winter. The basic premise of HOS waivers is to permit professionally trained drivers to remain at the wheel longer than highway safety regulations allow. Because tanker trucks transport much of Virginia's propane from the Apex LPG terminal in North Carolina, interstate coordination with North Carolina propane dealers and the North Carolina Energy Office is essential.

Exhibit 82 provides some of the mitigation measures contained in earlier Virginia plans, which are similar to those suggested by the NASEO/NARUC Energy Assurance Guidelines. The measures suggest a progression from voluntary actions to mandatory rationing. The table suggests implementation steps and other agencies or groups that may be involved. Measures such as the Virginia Petroleum Set-Aside require a formal Declaration of Emergency. The table includes these measures so that responders can consider a range of options as events unfold. For most events, only the least stringent voluntary measures will be necessary. Mandatory measures involve process and political decision that may be unrelated to ES. Selecting appropriate measures is a matter of judgment.

[1] Virginia abides by the Federal HOS regulations: Federal Motor Carrier Safety Administration (FMCSA) Regulations (49 CFR 395) and FMCSA (49 CFR 390.23).

Exhibit 82: Potential State Emergency Measures to Mitigate Liquid Fuel Shortage

MEASURE	WHAT IT DOES	RECOMMENDED STEPS FOR STATE RESPONDERS	METRICS
Voluntary Call for Public Liquid Fuel Conservation	Promotes voluntary reduction in liquid fuel use, share limited energy supplies equitably and assure sufficient energy for priority customers.	▪ Utilize extensive store of State agencies staff knowledge; obtain information from sister States, DOE, NASEO, and others to develop conservation guidance. Give the public specific guidance for liquid fuel shortage and try to stimulate the use of alternatives. ▪ Coordinate with State fuel distribution associations working with their media and public relations professionals. ▪ Develop impactful dissemination materials. ▪ Work with media and others to obtain low- cost or free airtime or print space. ▪ Hold public meetings for concerned citizens. ▪ Provide feedback to legislature and local jurisdictions.	Transport trucks spend less time at terminal racks. Seek assistance of VPCMA and/or VAPGA to survey jobbers and retail dealers to determine if customer emergency calls and complaints have dropped and observation of “closer to normal” fuel purchase activity.
Voluntary Telecommuting or Voluntary Compressed Workweek	Reduces vehicle miles traveled (VMT) for workforce to reduce motor gasoline and diesel consumption	▪ Work with State personnel management and State and local government leadership and private employers, unions, and other employee organizations to enlist support. Coordinate with Virginia Economic Development Partnership (VEDP) and State agencies. Determine which businesses/agencies are capable of participating. ▪ Assist participants in coordinating with out-of-State entities, if necessary. ▪ Coordinate with affected local jurisdictions.	Transport trucks spend less time at terminal racks. Seek assistance from VPCMA to survey service stations for observation of “closer to normal” fuel purchase activity.
Voluntary Variable Work Hours	Reduces traffic congestion, fuel lost in idling and stop-and-go driving. Encourage greater use of mass transit and carpooling	▪ Solicit business sectors to participate. Seek active help of business associations, employee unions and groups. ▪ Publicize and explain. Provide “success stories” to media. ▪ Coordinate with and obtain assistance from relevant State agencies. ▪ Provide technical assistance to participants. ▪ Coordinate feedback with affected local jurisdictions	Transport trucks spend less time at terminal racks. Seek assistance from VPCMA to survey service stations for observation of “closer to normal” fuel purchase activity.

MEASURE	WHAT IT DOES	RECOMMENDED STEPS FOR STATE RESPONDERS	METRICS
Voluntary or Mandatory Reduction of Government Agency Hours of Operation	Creates a short workweek for State and local government to reduce heating fuel consumption and divert tight fuel supplies to critical and residential consumers.	▪ Chief elected official, cognizant agencies and other bodies as needed; approval and coordination required. ▪ Develop criteria to identify agencies/buildings to reduce hours or close. ▪ Develop criteria for return to normal operations. ▪ Coordinate with employee unions, if applicable. ▪ Attend to employee issues, such as criteria for any wage/salary changes, impact on benefits, such as sick leave and vacation time. ▪ Provide timely notice to employees.	Transport trucks spend less time at terminal racks. Seek assistance of VPCMA and/or VAPGA to survey jobbers and retail dealers to determine if customer emergency calls and complaints have dropped.
Mandatory or Voluntary School System Fuel Conservation	Reduce VMT and motor gasoline consumption in the education sector. This is similar to other ride sharing actions.	▪ Requires approval and cooperation of local government and school boards. Coordinate through appropriate associations and local school systems. ▪ State agencies coordinate to lay groundwork. ▪ Assist school districts with planning and technical support as needed. ▪ School officials address scheduling, services, meals, extra-curricular activities and post-school day use of facilities. Determine rules for high school students who drive motor vehicles to school, such as minimum number per auto. ▪ State agencies coordinate and monitor school-related programs. ▪ School District officials and local public safety agencies coordinate enforcement at local level.	Transport trucks spend less time at terminal racks.
Voluntary or Mandatory Employer-Based Travel Assistance	Reduces consumption of motor gasoline by increasing average vehicle occupancy. Also reduces VMT and queuing. This action could be used in conjunction with high occupancy vehicle (HOV) lanes. May be coordinated with telecommuting action	▪ Recruit State agencies and companies over predetermined size (e.g., 100 employees). ▪ Coordinate with State planners and companies to set up employee car, vanpool or busing arrangements, including schedules and access locations. ▪ Employers determine applicability of staggered or flexible work hours, guaranteed ride home feature, preferred parking, company rewards, subsidy, or other inducements. ▪ Employers handle insurance questions and State agencies assist in obtaining information on government safety requirements. ▪ Coordinate with affected local jurisdictions. Encourage self-enforcement in cooperation with associations. Promote rewards and competitive compliance achievement in the business community.	Transport trucks spend less time at terminal racks. Seek assistance from VPCMA to survey service stations for observation of “closer to normal” fuel purchase activity.

MEASURE	WHAT IT DOES	RECOMMENDED STEPS FOR STATE RESPONDERS	METRICS
		▪ If mandatory, work with the Attorney General to set up enforcement and appeals procedures. Monitoring for compliance would require assistance from the Attorney General, additional paperwork and personnel effort.	
Modified Fuel Purchase Times Mandate	Pacing sales to avoid depleting supply until resupply occurs aids in the equitable distribution of motor gasoline and is designed to alleviate long lines at retail gasoline stations. This measure may be used in conjunction with the odd/even actions.	▪ Cooperation of VPCMA and service stations is vital. Coordinate with VPCMA and VPC to obtain agreement among participant organizations and dealers. ▪ Obtain agreement about the number of hours retail outlets will remain open (e.g., 4 to 6/day). Encourage retail outlets within the same area to stagger hours in coordination with their associations. ▪ Set retail outlet weekend operations with distribution association agreement (e.g., 1st or last digit of tax number designates day). ▪ Determine if flag or other identification system is useful. ▪ The Attorney General's assistance is required to work outside of State and Federal anti-trust laws. The Attorney General needs to obtain Federal permission to allow its representatives to monitor and keep discussions focused on action management. Local police departments enforce to ensure that retail outlets adhere to hours.	Transport trucks spend less time at terminal racks.
Enhanced Speed Limit Enforcement Mandate	Achieves maximum energy savings through increased compliance with existing speed limits to reduce motor gasoline/diesel fuel consumption.	▪ Requires political approval and approval by the State and local government law enforcement. ▪ State agencies may work with law enforcement agencies to develop public education and information campaign. ▪ Enhanced enforcement may require increased appropriations for labor needs. ▪ State agencies work with law enforcement to monitor effectiveness of action. ▪ Enforcement: by VSP and local police departments.	Transport trucks spend less time at terminal racks. Seek assistance from VPCMA to survey service stations for observation of "closer to normal" fuel purchase activity.
Prevention of Tank Topping Mandate	Prevents panic buying by heating oil and propane customers. This action is similar to minimum and maximum purchase action (see odd/even).	▪ Requires active cooperation of jobbers, heating oil and propane dealers and needs VPCMA promotion and oversight for success. ▪ Consult with VPC. ▪ Coordinate with jobbers and dealers to set procedures. ▪ State agencies and associations prepare media material to inform the public. ▪ Coordinate with local jurisdictions and law enforcement. ▪ The Attorney General needed to set up enforcement and appeals procedures. Oil and Propane dealers keep record of customer fill and refuse to make top-off deliveries. Retail outlets screen will-call and make determination.	Transport trucks spend less time at terminal racks. Seek assistance of VPCMA a VAPGA to survey jobbers and retail dealers to determine if customer emergency calls and

MEASURE	WHAT IT DOES	RECOMMENDED STEPS FOR STATE RESPONDERS	METRICS
		▪ Consider sharing a list of abusers with VPCMA and VAPGA to identify panic purchasers.	complaints have dropped.
Odd/Even, Carless Day & Minimum/Maximum Purchase Mandates	Discourages panic fuel purchases and risk of increasing local shortage due to topping off motor fuel tanks.	▪ Requires support from VPC, VPCMA and petroleum retail outlets plus coordination with local government. Public acceptance is crucial. ▪ Develop detailed implementation plan in coordination with retail outlets and petroleum associations. ▪ Determine minimum/maximum purchase levels if minimum/maximum option is added. ▪ Set license plate or other protocol for identifying status of vehicles. ▪ Determine days of operation (e.g., workweek only, set number of days, rotating weekend control). ▪ Notify the public; explain to the media. Prepare reference materials for use by retail outlets and for State agency staff when answering inquiries. ▪ Set up extra telephone or computer response banks to answer questions. ▪ Secure emergency funding for staff time, if necessary. ▪ Determine exemptions such as medical emergency, public safety, agriculture vehicles, common carriers, energy company vehicles, personal vehicles (motorcycles, mopeds, etc.), rental vehicles, sanitation vehicles, and telecommunications vehicles. ▪ Carefully weigh potential rules for dealing with motorists identifying other motorists as violators. ▪ Coordinate with affected local jurisdictions, especially law enforcement for enforcement. ▪ Attorney General's assistance is required to work outside of State and Federal anti-trust laws. Attorney General needs to obtain Federal permission to its representatives to monitor and keep discussions focused on action management.	Transport trucks spend less time at terminal racks. Seek assistance from VPCMA to survey service stations for observation of "closer to normal" fuel purchase activity.
State Petroleum Fuel Set-Aside	Assists petroleum product suppliers in providing product to designated priority end-users in circumvention of Federal non-discriminatory	▪ The maximum percentage of incoming product set aside by major suppliers, and reallocated to priority users, to be determined by Governor in coordination with petroleum industry. Suggested monthly set aside levels could be 5% motor gasoline, 4% middle distillates (diesel and heating oil, 3% propane, 5% aviation gasoline, and 2% kerosene ▪ Governor may designate certain geographic areas as suffering from supply imbalance and redirect product as needed.	This is not a fuel savings action. It is designed to ensure that critical users can obtain fuel to serve critical needs of the public. It may be possible to survey critical end

MEASURE	WHAT IT DOES	RECOMMENDED STEPS FOR STATE RESPONDERS	METRICS
	marketing rules and assure that priority end-users have fuel available for vital public services. This action also can be used to establish fueling priorities for guiding retail dealers in selling fuel to specified users.	▪ Suggested priority users' order to be determined at time Set-Aside is recommended: ▪ Agricultural production; aviation ground support; cargo, freight & mail; emergency services; energy production; health care; passenger transportation; sanitation; and telecommunications ▪ VDEM and Virginia Energy coordinate with petroleum stakeholders to generate information for media including press releases. ▪ Determine where applications can be picked up (e.g., local government offices or via the Internet) and how it is returned for investigation, verification and evaluation (e.g., facsimile, E-mail, hand delivery, regular mail). Applicants include jobbers for sale to direct customers and resale to retail dealers and their end-users. ▪ Provide access and operation information to potential applicants using services of distribution associations, media, and Internet. ▪ Establish processing order (e.g., first come, first served) and protocol for releasing remaining set aside volumes if conditions dictate/permit. ▪ Maintain coordination and communications with petroleum stakeholders, VDOT, VEDP, law enforcement and participating local jurisdictions. ▪ Monitor imported fuel supply using State, Federal and private sector data. ▪ Obtain prototype forms from NASEO. Ascertain geographic area(s) of operations. ▪ Attorney General's assistance is required to work outside of State and Federal anti-trust laws. Attorney General needs to obtain Federal permission to allow its representatives to monitor and keep discussions focused on action management. ▪ Attorney General enforcement when false information has been provided to obtain set-aside fuel. ▪ May require additional local enforcement personnel at retail outlets if motor gasoline is allocated to filling stations to meet critical need groups (e.g. medical personnel at a nearby hospital).	users to determine if their needs are being met.

Public Information – Communication Protocols

Energy shortages and emergencies require public explanations. If the State is called upon to respond to an energy outage or an emergency, the first suggested response action after monitoring is public information. Small events may not be reported in the media. However, any event can come to the media's attention regardless of how many customers are affected or the time it takes to restore the system. For example, a small event in Richmond may be reported while a similar event elsewhere might be ignored. People will turn to the media for answers, and the media may query both company and State officials.

The public will expect energy companies and the government to provide accurate information. Most citizens can cope with short-term outages and will be patient. Over the years, most energy companies and government agencies have learned the value of being forthright when discussing energy interruptions. Lack of candor can turn public opinion against energy providers and government, thus diminishing cooperation during restoration.

Media Preparation

The keys to successful media relations are planning, preparation, and training. Maintaining updated information on normal energy consumption patterns is the first step toward accurate reporting. When an energy shortage occurs, the State Corporation Commission may first contact affected energy-provider trade associations to learn the cause and assess the situation. If an energy shortage develops slowly, State officials will have time to prepare and check facts. Such preparation permits government responders to interpret what is learned from energy companies and trade associations, which enhances government's perspective and ability to assist as, needed.

Regular staff training that includes practice in media relations is valuable. This involves gathering data under pressure, analyzing rapidly, and conveying complex information effectively.

Coordinating Information

The State Corporation Commission will work with VDEM and others to brief senior State officials in response to questions from the media. The SCC would not directly contact the media. Energy providers and associations will also respond to the media. The Governor may choose to meet the media as well. VDEM is prepared to coordinate to avoid contradictory and confusing statements. Virginia Energy's role may be providing subject matter expertise and situational awareness to VDEM while they craft public messages.

Preparing and coordinating public relations materials and protocols for an energy shortage are common across the various energy sectors. The SCC should anticipate that not all stakeholders would be equally prepared or sufficiently knowledgeable to speak about or provide advice on energy matters. It is always prudent to coordinate and cooperate to provide a timely and consistent message for the Governor, to the public, and neighboring states.

Emergency Alert System

The Emergency Alert System (EAS) enables state and local government officials, with the voluntary cooperation of area broadcasters, to advise the public directly in the event of life-threatening emergencies.

If an energy emergency occurs, Virginia Energy could become involved, either through the coordination efforts of the SCC or VDEM, or by the Governor's directive because of the

declaration of a fuel and energy state of emergency. In the event that Virginia ESF 12 partners should become involved in assisting the Governor with public information related to energy shortage or interruption, suggested actions are contained in Exhibit 83. Actions in lower tiers should be maintained in the more severe tiers.

Exhibit 83: Public Information Steps for State Government – Energy Disruption

TIER	SUGGESTED ACTIONS
Enhanced Watch	• Review and reinforce communications within the State, and ascertain that everyone understands their role, what can and cannot be said, and by whom. • Be aware of cross-cutting shortage impacts such as gasoline fuel pump or natural gas pipeline pump failure due to an electricity outage. • Work with State agencies to keep Governor's staff and legislative offices informed. • Review/prepare graphic energy market presentations and other materials to explain consumption patterns and anomalies. • Coordinate with State agencies on media contacts to help reporters (especially newly assigned) understand basic energy facts and issues. • Work with State agencies to provide helpful conservation and mitigation advice to the public. • Provide public relations officers with regular updates approved by the SCC as needed.
Significant Event	• Consider public meetings and use of the Internet/social media as appropriate. • The Governor may make announcements to assure the public and to encourage continued cooperation and compliance. • Share State energy data with distribution industry associations, other States, NASEO and DOE as needed. • Coordinate with State agencies to draft energy conservation recommendations if shortage/disruption is predicted to increase. • Prepare briefings on possible supply and demand restraint actions should shortage intensify. • For heating issues, work in coordination with State agencies and electric utilities/natural gas utilities or VPCMA or VAPGA (for propane issues) to provide media advisories on setting back thermostats, using cooking fuel wisely, checking heating equipment and conserving hot water. • For vehicle issues, provide driving tips in coordination with appropriate State agencies and Virginia petroleum industry organizations including: VPCMA, VAPGA and VPC.
Major Event	• Develop follow-up messages from Governor to assure public and to maintain compliance. • Coordinate with the Governor's office or others to announce enforcement actions if any. • Assist with media briefings (sometimes in conjunction with energy stakeholder representatives).

AFTER ACTION

After an event, typically VDEM will run an after-action review (AAR) to thoroughly examine the State's preparations, mobilization, and response processes and capture observations from the event and lessons learned. The goal is to pinpoint areas for improvement and assign

responsible parties to address those gaps. Virginia Energy would be involved to collaborate and assess performance as it relates to the restoration of energy services.

The AAR process begins by defining its purpose and setting clear expectations. Key stakeholders come together to discuss the scope of the review. This includes determining the boundaries of the analysis, roles and responsibilities, timeline, and any budget considerations. Once the scope is established, data is collected and then analyzed. Various sources are tapped to gather relevant information. These sources may include incident reports, firsthand observations, feedback from team members, and documentation. Quantitative and qualitative methods are used to identify trends, patterns, and areas for improvement. The goal is to gain insights into what worked well and what didn't during the emergency response.

Based on the analysis, observations are formulated. These observations highlight specific aspects of the response—both positive and negative. Root causes of any issues are explored. The focus is on learning from the experience. Subject matter experts review the observations. Their expertise ensures that the findings are accurate and relevant. They may also provide additional insights or suggest corrective actions.

The AAR team compiles the observations, lessons learned, and recommendations into formal products, typically an After-Action Report, which is then shared with relevant stakeholders, including organizational leadership. The insights gained from the review drive deliberate changes and improvements.

Energy Resiliency and Hazard Mitigation

This section presents the State of Virginia's proposed strategy for enhancing its energy reliability and resilience and reducing the potential impacts or consequences of energy disruptions. This mitigation strategy serves as the long-term blueprint for reducing the risks identified in the Risk Profile, supporting hazard mitigation commitments shared across local communities, and advancing Virginia's existing energy resiliency priority initiatives.

Specifically, this section describes the state's:

- Energy Security Goals to provide strategic direction for the State and its private sector partners, including demonstrating alignment to other relevant plans;
- Existing storm season readiness and energy reliability policies and initiatives to enhance State energy security and resilience;
- Other potential mitigation measures to reduce or eliminate current and potential future risk; and
- A framework for evaluating and prioritizing implementation of cost-effective, environmentally sound, and technically feasible mitigation measures.

Note the State's mitigation approach differs from an implementation plan—which is not a required element of the SESP—that typically describes when and how the final mitigation measures will be implemented, including the responsible organizations and resources. There is a variety of funding and program support available for energy resilience, and once mitigation measures are prioritized, resource needs can be linked to available funding opportunities.

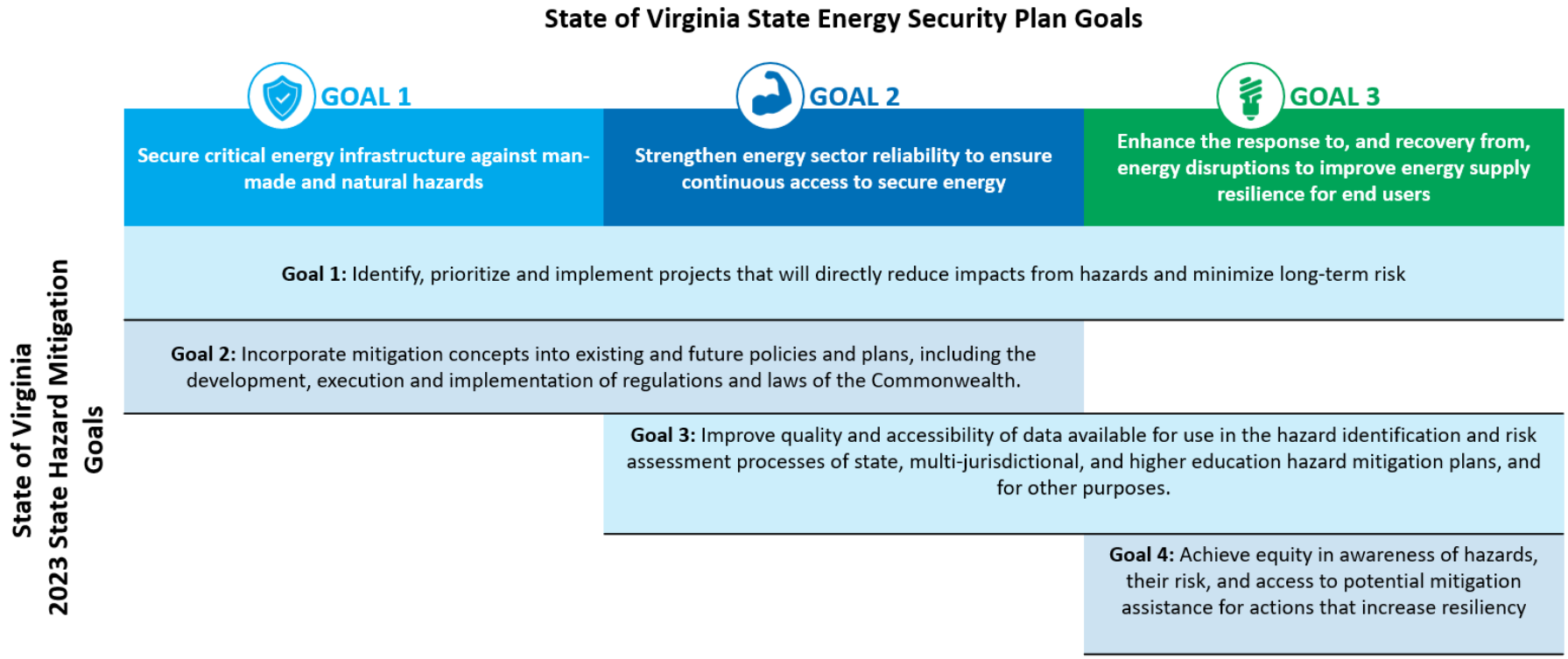
State Energy Security Goals

The following goals – derived from the 2021 Bipartisan Infrastructure Law (BIL) Section 40108 (State Energy Security Plans) and codified by the U.S. Department of Energy (DOE) within the *State Energy Security Plan Guidance* – will guide the actions of Virginia's energy security program to ultimately enhance energy reliability, security, and end-use resilience. These goals are broad, long-term policy and vision statements that explain what is to be achieved by implementing this mitigation strategy.

- Goal 1 – Secure critical energy infrastructure against man-made (e.g. physical, cybersecurity threats) and natural hazards
- Goal 2 – Strengthen energy sector reliability to ensure Virginians have continuous access to low-cost, secure energy
- Goal 3 – Enhance the response to, and recovery from, energy disruptions to improve energy supply resilience for end users

Virginia's Energy Security Goals are closely aligned with and support the hazard mitigation goals outlined in the 2023 Commonwealth of Virginia Hazard Mitigation as shown in Exhibit 84.

Exhibit 84: State of Virginia Energy Security Plan Goals



Goal Alignment with Other Initiatives

In addition to aligning with the Hazard Mitigation Plan, the Virginia Energy Security Goals align with other initiatives and programs. The Legislature has directed the State Corporation Commission to adopt goals and requirements that encourage the use of efficient and cost-effective demand-side renewable energy systems and conservation measures. These goals promote the adoption of solar energy, renewable sources, highly efficient systems, cogeneration, and load-control systems.[lv] By doing so, Virginia aims to address specific challenges, including managing electric consumption growth rates and weather-sensitive peak demand.

Virginia's commitment to energy efficiency and resilience is evident through programs like the Virginia Fiscally Constrained Energy Efficiency Program, a competitive grant program dedicated to enhancing energy security and maximizing energy efficiency[lvi]. Through these efforts, Virginia aims to build a robust and sustainable energy future for its residents.

Existing Mitigation Measures

This section presents an overview of the existing mitigation measures currently implemented in Virginia. These programs and initiatives are integral components of Virginia's strategy to enhance energy resilience. Each represents important steps towards securing Virginia's energy future, demonstrating Virginia's commitment to infrastructure fortification, energy source diversification, and innovation in energy technologies. Exhibit 85 outlines these. Details on these measures are provided below.

Exhibit 85:Existing Mitigation Measures Alignment with Energy Security Goals

EXISTING MEASURE	GOAL 1	GOAL 2	GOAL 3
Resource Planning for Electric Distribution	x	x	
PJM Mitigation Strategies		x	x
Virginia Integrated Resource Plans	x	x	
Virginia Electric Utility Regulation Act		x	
Steps to Advance Virginia's Energy (SAVE) Program	x	x	x

Resource Planning for Electric Distribution

All utilities have plans to mitigate energy interruptions and distribution problems. Regulated utilities report to the SCC; municipal utility reports to their boards of directors and local jurisdiction authorities. Mitigation involves identifying potential problems in light of future demand, changing markets, and any other factors that lead to a loss of power.

A principal instrument in this process is an integrated resource plan (IRP). IOUs are required by statute to submit a 15-year IRP at intervals prescribed by § 56-599[1] of the Code. Requirements contained in this section require utilities to evaluate:

- Entering short-term and long-term electric power purchase contracts.

[1] https://law.lis.virginia.gov/vacode/title56/chapter24/section56-599/

- Owning and operating electric power generation facilities.
- Building new generation facilities.
- Relying on purchases from the short-term or spot markets.
- Making investments in demand-side resources, including energy efficiency and demand-side management services.
- Taking such other actions, as the Commission may approve, to diversify its generation supply portfolio and ensure that the electric utility is able to implement an approved plan.
- Identifying the methods by which the electric utility proposes to acquire the supply and demand resources in its proposed integrated resource plan.
- Identifying the effect of current and pending state and federal environmental regulations upon the continued operation of existing electric generation facilities or options for construction of new electric generation facilities.
- Identifying the most cost-effective means of complying with current and pending state and federal environmental regulations, including compliance options to minimize effects on customer rates of such regulations.
- Identifying long-term electric distribution grid planning and proposed electric distribution grid transformation projects.
- Developing a long-term plan for energy efficiency measures to accomplish policy goals of reduction in customer bills, particularly for low-income, elderly, and disabled customers; reduction in emissions; and reduction in carbon intensity.
- Developing a long-term plan to integrate new energy storage facilities into existing generation and distribution assets to assist with grid transformation.

PJM MITIGATION STRATEGIES

Following the Winter Storm Elliot of 2022[lvii], PJM implemented several mitigation strategies to ensure resource adequacy and performance during energy emergency events. This strategy includes:

- **Enhancements to Market Rules:** PJM addressed winter risk by making improvements to market rules, accreditation, forecasting, and modeling. This included refining the rules for energy trading and capacity markets to better handle extreme weather conditions. These enhancements aimed to ensure that the market could respond effectively to the increased demand and supply challenges posed by severe winter conditions.
- **Improving Generator Performance:** PJM implemented winterization requirements, unit status reporting, and testing/verification. These measures aimed to ensure that power generation units could operate reliably during severe winter conditions. By improving generator performance, PJM aimed to reduce the risk of power outages during winter storms.
- **Robust Monitoring:** This was increased to involve tracking the progress of power plants and other facilities in meeting standards designed to ensure reliable operation during winter. By closely monitoring the implementation of these standards, PJM can identify and address potential issues before they lead to power outages.
- **Natural Gas Infrastructure Improvements:** Further mitigation involves improvements to reliability for U.S. natural gas infrastructure. Given the critical role of natural gas in power generation, ensuring the reliability of gas infrastructure is crucial for maintaining power supply during winter storms. These improvements could

include measures to prevent freezing of gas pipelines and to ensure sufficient gas supply during periods of high demand.

- **Increased Transmission Flow Management:** During the storm higher transmission flows resulted in constraints that were mitigated by electric grid operators' actions. PJM, MISO, TVA, Southern, and SPP used generation redispatch and post-contingency mitigation procedures to alleviate most transmission constraints. By effectively managing transmission flows in this way, operators will be able to maintain the stability of the power grid despite the increased demand during future events.

VIRGINIA INTEGRATED RESOURCE PLANS

In Virginia each Investor-Owned Utility (IOU) is required to a file an IRP with the SCC in accordance with § 56-599 of Virgina State Law. Each IOU is required to file an annual update to the plan which includes information on planned retirements and additions of generation units, transmission upgrades and various other projects that the utility plans to use its funds for. Exhibit 86 outlines projects from these plans to improve resilience and reliability of each IOU's systems.

Exhibit 86: Integrated Resource Plan Projects

INTEGRATED RESOURCE PLANS	APPALACHIAN POWER COMPANY	DOMINION ENERGY
Upgraded circuit breakers to increase operational flexibility and reliability	x	
Upgraded transformers to increase system capacity	x	
Improved vegetation management	x	
Moving to distribution automation circuit reconfiguration	x	
Installation of advanced metering infrastructure	x	x
Increasing energy storage projects	x	x
Hardening transmission infrastructure against natural hazards such as wind, vegetation, and extreme temperature.	x	x
Relocating high risk lines that have a history of damage	x	
Rebuilding of damaged transmission lines		x
Construct additional substations to meet load demands		x

STATUS REPORT: IMPLEMENTATION OF THE VIRGINIA ELECTRIC UTILITY REGULATION ACT

The Status Report is filed annually in compliance with § 56-596 B of Virginia State Law. This document captures projects put forth by the IOUs to increase electricity reliability in their service territories.

Exhibit 87: Status Report Projects

STATUS REPORT: IMPLEMENTATION OF THE VIRGINIA ELECTRIC UTILITY REGULATION ACT	APPALACHIAN POWER COMPANY	DOMINION ENERGY
New Solar Projects		x
Demand Side Management Programs		x
Broadband Capacity Projects	x	x
Distribution Grid Transformation Projects		x

STEPS TO ADVANCE VIRGINIA'S ENERGY (SAVE) PROGRAM

Chapter 26 of Title 56 in Virginia Law establishes the Steps to Advance Virginia's Energy Plan (SAVE) Act. This act allows gas companies to propose projects that improve safety, reliability, and reduce greenhouse gas emissions. These projects, which must not increase revenues by connecting to new customers, are called "eligible infrastructure replacements". The costs of these projects, including return on investment, taxes, depreciation, and costs of enhanced leak detection and repair programs, can be recovered through a mechanism called the SAVE rider. The gas company can file a SAVE plan, which includes a timeline, estimated costs, and a recovery schedule for these projects. The State Corporation Commission reviews and approves these plans. If a plan is rejected, the gas company can refile an amended plan. Every year, the gas company must reconcile the difference between the actual costs and the amounts recovered under the SAVE rider and adjust the SAVE rider accordingly. Costs recovered through this act are in addition to all other costs the gas company is allowed to recover.

Proposed Mitigation Measures

This section proposes additional mitigation measures – building from the ongoing energy security initiatives already being implemented as outlined above – to address risks identified within the Risk Assessment. These measures represent potential, priority investment areas in the medium-to-long-term. Measures have been compiled from a variety of sources, shown in the table below which represent existing mitigation commitments and industry best practices sourced from:

1. Plan research (e.g., State and local hazard mitigation plans, the State Energy Plan, etc.);
2. Stakeholder interviews; and
3. Open-source mitigation action repositories, including the DOE CESER State Energy Security Plan Optional Drop-In: Energy Sector Risk Mitigation Measures (2022) and FEMA's Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards (2013).

Proposed measures, found in

Exhibit 89, below, are mapped to relevant hazards and vulnerabilities, the measure source, organizations likely to be involved in implementation (proposed), and the State's Energy Security Goals. Most of the measures are multi-benefit and will advance more than one of the State's Energy Security Goals. Note that the vulnerabilities and their respective measures are prioritized by relevance to the Risk Assessment.

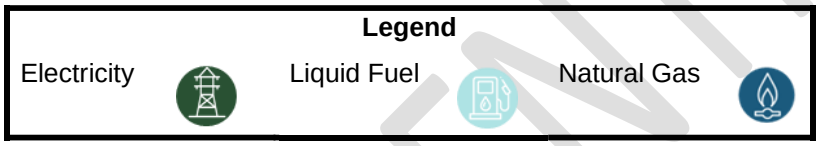
The list of proposed mitigation measures is intended as a living document and may be amended as risks, State and local personnel, resources, and technologies change over time. Though funding and support may not be immediately available for every measure proposed, including the measures in the plan may lead to future opportunities for implementation.

The following table provides a list of measures to help build resilience within the state. Measures have been compiled from a variety of sources, shown in Exhibit 88.

Exhibit 88: Source of Proposed Mitigation Measures

SOURCE	ICON
State Energy Assurance Plan, 2023 Virginia State Hazard Mitigation Plan, Virginia State Corporation Commission dockets	
Local Mitigation Strategies (Fairfax, Richmond, Virginia Beach, Thomas Jefferson Region, Middle Peninsula Planning District).	
Lessons learned, best practices, IIJA requirements, or risk assessment outcomes	
Stakeholder feedback	

Exhibit 89: Proposed Mitigation Measures



	MITIGATION MEASURES (PROPOSED)	SOURCE	RELEVANT ENERGY SECTOR	PARTICIPATING ORG(S) *(PROPOSED)*	STATE ACTION(S)	HAZARD(S) ADDRESSED	THREAT	VULNERABILITY	CONSEQUENCE	ADVANCES GOAL 1	ADVANCES GOAL 2	ADVANCES GOAL 3
	1. Colonial Pipeline is susceptible to impacts from multiple hazards (e.g. power outages at pump stations, flooding, cyber-attacks, physical attacks, and aging infrastructure)											
1.1	Collaborate with industry on measures to reduce impacts during a disruption on the Colonial Pipeline (e.g. prompt HOS waivers, long-term planning initiatives).			Industry, VDEM, VDOE	Coordination and Convening, Planning and Studies,	All Hazards		✓		✓		
1.2	Utilize remote monitoring units to evaluate in real time the risk of corrosion to the pipeline.			Industry	Planning and Studies	All Hazards	✓			✓		
	2. Increasing severe weather due to climate change poses threat to energy infrastructure											
2.1	Explore mechanisms to increase hardening activities such as undergrounding lines and weatherizing critical assets.			SCC, Utility	Incentive Programs, Policy	Wind, Winter Weather		✓		✓		
2.2	Collaborate with electric power providers to assess the vulnerabilities in the grid to severe storms, and the potential service impacts of these storms.			Local Government, Utility	Coordination and Convening, Planning and Studies	Wind, Winter Weather	✓	✓	✓	✓		

	MITIGATION MEASURES (PROPOSED)	SOURCE	RELEVANT ENERGY SECTOR	PARTICIPATING ORG(S) *(PROPOSED)*	STATE ACTION(S)	HAZARD(S) ADDRESSED	THREAT	VULNERABILITY	CONSEQUENCE	ADVANCES GOAL 1	ADVANCES GOAL 2	ADVANCES GOAL 3
	3. Aging electric infrastructure needs to be updated to maintain reliability and handle forecasted load											
3.1	Coordinate with public utilities to protect or retrofit transformers, critical infrastructure and overhead power lines.[lviii]			Utility, VDOE	Coordination and Convening, Grants and Direct Funding.	Wind, Winter Weather		✓		✓		
3.2	Identify vulnerable structures and implement infrastructure retrofit projects, to reduce risk to existing utility systems, roads, and bridges.[lix]			DOT, SCC	Planning and Studies, Grants and Direct Funding	All Hazards		✓				
3.3	Expedite approvals of transmission line projects.[lx]			SCC	Policy	Wind, Winter Weather		✓		✓		
	4. Electric infrastructure is impacted by vegetation											
4.1	Coordinate with public utilities to use City resources to trim trees in the public right-of-way.[lxi]			Utility, Local government	Coordination and Convening, Grants and Direct Funding	Wind, Winter Weather	✓	✓		✓		

	MITIGATION MEASURES (PROPOSED)	SOURCE	RELEVANT ENERGY SECTOR	PARTICIPATING ORG(S) *(PROPOSED)*	STATE ACTION(S)	HAZARD(S) ADDRESSED	THREAT	VULNERABILITY	CONSEQUENCE	ADVANCES GOAL 1	ADVANCES GOAL 2	ADVANCES GOAL 3
4.2	Increase resident and emergency responder safety during severe winter ice storm events by developing a public education campaign to inform residents about the importance of keeping tree limbs away from their homes and electric lines.[lxii]			Local government	Coordination and Convening	Wind, Winter Weather	✓			✓		
4.3	Identify and mitigate hazards along high traffic evacuation routes throughout the State. Examples may include removal of utility poles and burying utility lines along evacuation routes to reduce congestion during adverse weather.[lxiii]			DOT, Utility	Planning and Studies, Grants and Direct Funding	All Hazards	✓	✓		✓		
	5. Increased cyber protections are needed as threats from cyberattacks become more common											
5.1	Conduct a risk assessment of energy sector-dependent IT and OT assets. Develop plans to address specific asset vulnerabilities.			VDOE	Planning and Studies,	Cyber	✓	✓				✓

	MITIGATION MEASURES (PROPOSED)	SOURCE	RELEVANT ENERGY SECTOR	PARTICIPATING ORG(S) *(PROPOSED)*	STATE ACTION(S)	HAZARD(S) ADDRESSED	THREAT	VULNERABILITY	CONSEQUENCE	ADVANCES GOAL 1	ADVANCES GOAL 2	ADVANCES GOAL 3
5.2	Foster and maintain industry relationships to communicate threats and best practices.			VDOE	Coordination and Convening,	Cyber	✓					✓
5.3	Encourage federal and state cybersecurity best practices. As regulatory frameworks shift, industries should be prepared to implement new mitigation measures and prepare for potential attacks.			VIT	Regulation	Cyber	✓		✓			✓
	6. Energy infrastructure operating in flood plains, near rivers, or exposed to significant precipitation may have operations impacted from flooding											
6.1	Protect energy infrastructure from natural hazard damage, including acquiring, relocating, retrofitting or elevating flood prone property.[lxiv]			VDEM	Grants and Direct Funding,	Flood			✓	✓	✓	
6.2	Investigate energy infrastructure in flood prone areas to evaluate their resistance to flood, consider elevating at-risk infrastructure. [lxv]			SCC, Utility	Planning and Studies	Flood		✓		✓	✓	✓

	MITIGATION MEASURES (PROPOSED)	SOURCE	RELEVANT ENERGY SECTOR	PARTICIPATING ORG(S) *(PROPOSED)*	STATE ACTION(S)	HAZARD(S) ADDRESSED	THREAT	VULNERABILITY	CONSEQUENCE	ADVANCES GOAL 1	ADVANCES GOAL 2	ADVANCES GOAL 3
6.3	Implement structural and nature-based flood control projects in flood prone areas, such as tide gates, berms, constructed wetlands, roadway elevations, etc.[lxvi]			VDEM, DOT	Grants and Direct Funding	Flood			✓	✓	✓	
6.4	Develop computer model analysis and implement identified drainage projects.[lxvii]			VIT	Planning and Studies	Flood		✓	✓			✓
6.5	Using future conditions modeling, identify and preserve/protect wetlands and floodplains needed to store or convey floodwaters under future flooding and sea level rise scenarios. Preserve a variety of wetland types in an effort to prevent destruction of vulnerable habitat.[lxviii]			DCR	Planning and Studies,	Flood	✓					✓
6.6	Fit natural gas pipelines with collars at river crossings to limit damage from flooding.			Natural Gas Industry	Grants and Direct Funding,	Flood	✓	✓	✓	✓		

	MITIGATION MEASURES (PROPOSED)	SOURCE	RELEVANT ENERGY SECTOR	PARTICIPATING ORG(S) *(PROPOSED)*	STATE ACTION(S)	HAZARD(S) ADDRESSED	THREAT	VULNERABILITY	CONSEQUENCE	ADVANCES GOAL 1	ADVANCES GOAL 2	ADVANCES GOAL 3
6.7	Collect data on the number of high-risk river crossings and evaluate methods to reduce risk.			VDOE, VDEM	Planning and Studies,	Flood	✓					✓
	7. As fossil fuel generators are retired there will be an increasing need for dispatchable energy solutions and increased electrification											
7.1	Develop energy storage projects.[lxix]			Utility	Grants and Direct Funding,	All Hazards	✓				✓	
7.2	Explore programs that connect with residents and private businesses to determine the best way to improve energy storage adoption. [lxx]			VDOE, SCC	Coordination and Convening,	All Hazards	✓	✓			✓	
7.3	Provide funding and programs for microgrids, with renewable power generation and long duration battery storage (e.g., to community-based organizations particularly in frontline communities).[lxxi]			VDOE, SCC	Grants and Direct Funding	All Hazards	✓				✓	

	MITIGATION MEASURES (PROPOSED)	SOURCE	RELEVANT ENERGY SECTOR	PARTICIPATING ORG(S) *(PROPOSED)*	STATE ACTION(S)	HAZARD(S) ADDRESSED	THREAT	VULNERABILITY	CONSEQUENCE	ADVANCES GOAL 1	ADVANCES GOAL 2	ADVANCES GOAL 3
	8. Increasing electrification efforts energy delivery capacities need to be increased to account for future expansion											
8.1	Support accelerated grid transformation that goes beyond the renewable energy requirements set forth by the VCEA.[lxxii]			VDOE, Utility	Incentive Programs, Policy	All Hazards	✓				✓	
	9. Loss of power to critical lifeline facilities may pose significant threats to the population served by those facilities											
9.1	Develop and expand district energy and combined heat and power systems to support the islanding of microgrids. [lxxiii]			Industry	Planning and Studies, Grants and Direct Funding,	All Hazards	✓	✓	✓	✓	✓	
9.2	Work with private companies to advance continuity of operations, including but not limited to power, gas, and water service restoration.[lxxiv]			Local Government and Industry	Coordination and Convening, Grants and Direct Funding,	All Hazards	✓	✓	✓		✓	✓
9.3	Install electrical hook-ups, wiring, and switches to allow quick connects to backup generation, at county owned			Local Government, Utility	Grants and Direct Funding,	All Hazards		✓		✓	✓	

	MITIGATION MEASURES (PROPOSED)	SOURCE	RELEVANT ENERGY SECTOR	PARTICIPATING ORG(S) *(PROPOSED)*	STATE ACTION(S)	HAZARD(S) ADDRESSED	THREAT	VULNERABILITY	CONSEQUENCE	ADVANCES GOAL 1	ADVANCES GOAL 2	ADVANCES GOAL 3
	critical facilities, including for example, shelters and pump stations.[lxxv]											
9.4	Increase fuel storage at reverse osmosis water plant, allowing for extended operations during emergency situations and reducing risks associated with disruptions in fuel supply chain. [lxxvi]			Local Government and Industry	Grants and Direct Funding,	All Hazards		✓	✓	✓		
9.5	Evaluate and install emergency power generators sufficient to maintain critical business and research functions within vulnerable buildings.[lxxvii]			Local Government	Grants and Direct Funding,	All Hazards		✓		✓	✓	
9.6	Encourage adoption of transfer switches at terminals for backup generation.			VDOE, DOT	Grants and Direct Funding,	All Hazards		✓	✓	✓		

10. Data centers require stable electricity levels to maintain functionality

	MITIGATION MEASURES (PROPOSED)	SOURCE	RELEVANT ENERGY SECTOR	PARTICIPATING ORG(S) *(PROPOSED)*	STATE ACTION(S)	HAZARD(S) ADDRESSED	THREAT	VULNERABILITY	CONSEQUENCE	ADVANCES GOAL 1	ADVANCES GOAL 2	ADVANCES GOAL 3
10.1	Evaluate the feasibility of battery storage systems at data center facilities.			Utility, Industry	Planning and Studies,	All Hazards		✓	✓	✓		
	11. Electric substations can be targets for vandalism and malicious damage.											
11.1	Encourage fencing and other security upgrades at substations.			Utility	Planning and Studies,	Physical Attack	✓		✓	✓		
11.2	Evaluate the feasibility of adding additional transformers at Voltage Islands to create redundancy on the grid and reduce outage restoration times for customers. (Voltage Islands are communities served by single-transformer substations)			Utility	Planning and Studies	Physical Attack	✓		✓	✓		

	MITIGATION MEASURES (PROPOSED)	SOURCE	RELEVANT ENERGY SECTOR	PARTICIPATING ORG(S) *(PROPOSED)*	STATE ACTION(S)	HAZARD(S) ADDRESSED	THREAT	VULNERABILITY	CONSEQUENCE	ADVANCES GOAL 1	ADVANCES GOAL 2	ADVANCES GOAL 3
11.3	Encourage the monitoring of substation control centers, including all entrances through electronical monitoring and where possible, covered by closed-circuit television (CCTV) systems. All doors should be metal and fitted with an intrusion detection system (IDS); any windows should be covered with metal bars and shatter-resistant film.			SCC, Utility	Coordination and Convening	Physical Attack	✓		✓	✓		
	12. Insiders may steal materials or cause damage to energy assets with the intent of harming the utility											
12.1	Identify and prioritize physical vulnerabilities of structures, infrastructure and natural resources to human-caused hazards. Implement activities to mitigate potential consequences from human-caused events.[lxxviii]			VDEM	Planning and Studies, Grants and Direct Funding,	All Hazards		✓	✓	✓		
	13. Improved hazard data can help properly future planning for evolving hazards											

	MITIGATION MEASURES (PROPOSED)	SOURCE	RELEVANT ENERGY SECTOR	PARTICIPATING ORG(S) *(PROPOSED)*	STATE ACTION(S)	HAZARD(S) ADDRESSED	THREAT	VULNERABILITY	CONSEQUENCE	ADVANCES GOAL 1	ADVANCES GOAL 2	ADVANCES GOAL 3
13.1	Continue to improve the quality, detail and availability of data used to prepare effective hazard assessments and vulnerability analyses[lxxix]			VDOE	Planning and Studies,	All Hazards		✓				✓
13.2	Strengthen system of coordinating, collecting, storing and transmitting damage assessment data for each natural hazard event which causes death, injury, and/or property damage.[lxxx]			SCC	Planning and Studies,	All Hazards		✓				✓
13.3	Consider installing comprehensive atmospheric monitoring equipment, including but not limited to: air temperature, road temperature, wind speed & direction, rainfall, lightning strike, humidity, road surface and bridge surfaces conditions.[lxxxi]			SCC	Planning and Studies, Grants and Direct Funding,	All Hazards	✓	✓				✓

	MITIGATION MEASURES (PROPOSED)	SOURCE	RELEVANT ENERGY SECTOR	PARTICIPATING ORG(S) *(PROPOSED)*	STATE ACTION(S)	HAZARD(S) ADDRESSED	THREAT	VULNERABILITY	CONSEQUENCE	ADVANCES GOAL 1	ADVANCES GOAL 2	ADVANCES GOAL 3
13.4	Continue ensuring data collected on flood risk and buildings located in the floodplain become available, are incorporated into the Virginia Flood Risk Information System (VFRIS).[lxxxii]			VDEM	Planning and Studies,	All Hazards		✓				✓
13.5	Explore funding pathways for GIS layers that identify areas at higher risk for damage from landslides and debris flows, suitable for emergency and land use planning purposes. Target areas with a high susceptibility to landslides. Identify and map landslides using newly available 1-meter LIDAR data.[lxxxiii]			VDOE	Grants and Direct Funding, Incentive Programs	All Hazards	✓					✓

Process Used to Evaluate and Prioritize Mitigation Measures

To evaluate and determine the feasibility of the proposed mitigation measures, the state will leverage the Virginia State Hazard Mitigation criteria which evaluates each mitigation project based on the seven criteria as outlined in Exhibit 90. **This criterion is used to determine impact and feasibility of implementation.**

Exhibit 90: Prioritization Criteria

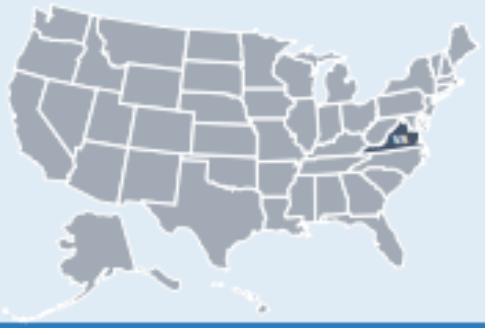
CRITERIA	DESCRIPTION
Human Health and Safety	Action protects human health, enhances public safety, protects vulnerable populations, or mitigates significant damage potential
Continuity of Operations	Action protects the Commonwealth's ability to maintain continuity of operations, communications, critical infrastructure, and emergency management functions during a disaster
Cost and Feasibility	Action is technically feasible and environmentally sound in terms of cost-effectiveness, ability to be completed in a timely fashion, availability of expertise and technical support, and ease of implementation
Loss Reduction and Economic Recovery	Action will reduce long-term financial losses and promote rapid economic recovery
Benefits multiple agencies and organizations	Action benefits several groups, communities, or state agencies covering a large geographic area
Multi-Hazard Mitigation	Action mitigates damage to critical resources from more than one hazard
Focused Educational Efforts	Strategies for educational efforts will be carried out in a timely and relevant manner, messages are consistent, simple, and straightforward and in the appropriate media format, including alternative formats for people with different needs, and are directed toward people and property that are located within high hazard areas.
Benefits Disadvantaged Communities	Action benefits communities that are considered disadvantaged.

Virginia will utilize a committee to evaluate mitigation measures. This committee is made up of various agencies gathered for an in-person workshop. These agency representatives are split up across tables to discuss each measure and how it should be prioritized taking into consideration the above criteria to group mitigation activities into high, medium and low priorities while evaluating which efforts will best align with Virginia's energy needs.

APPENDIX C: Virginia Energy Risk Profile

State of Virginia
ENERGY SECTOR RISK PROFILE

U.S. DEPARTMENT OF ENERGY
Cybersecurity, Energy Security, and Emergency Response



Virginia State Facts

POPULATION	HOUSING UNITS	BUSINESS ESTABLISHMENTS
8.52 M	3.54 M	0.20 M

ENERGY EMPLOYMENT: 55,305 jobs
PUBLIC UTILITY COMMISSION: Virginia State Corporation Commission
STATE ENERGY OFFICE: Virginia Department of Mines, Minerals and Energy – Division of Energy
EMERGENCY MANAGEMENT AGENCY: Virginia Department of Emergency Management
AVERAGE ELECTRICITY TARIFF: 9.48 cents/kWh
ENERGY EXPENDITURES: $3,215/capita
ENERGY CONSUMPTION PER CAPITA: 272 MMBtu
(32nd highest out of 50 states and Washington, D.C.)
GDP: $532.9 billion

Data from 2020 or most recent year available.
For more information, see the Data Sources document.

ANNUAL ENERGY CONSUMPTION

ELECTRIC POWER: 118,960 GWh
COAL: 6,500 MSTN
NATURAL GAS: 665 Bcf
MOTOR GASOLINE: 77,400 Mbbl
DISTILLATE FUEL: 33,100 Mbbl

ANNUAL ENERGY PRODUCTION

ELECTRIC POWER GENERATION: 162 plants, 96.8 TWh, *29.9 GW total capacity*
- **Coal:** 6 plants, 3.4 TWh, *3.0 GW total capacity*
- **Hydro:** 25 plants, 1.5 TWh, *0.8 GW total capacity*
- **Natural Gas:** 29 plants, 58.0 TWh, *14.9 GW total capacity*
- **Nuclear:** 2 plants, 29.5 TWh, *3.7 GW total capacity*
- **Petroleum:** 38 plants, 0.3 TWh, *2.7 GW total capacity*
- **Wind & Solar:** 27 plants, 0.9 TWh, *0.6 GW total capacity*
- **Other sources:** 35 plants, 3.2 TWh, *4.1 GW total capacity*

COAL: 13,700 MSTN
NATURAL GAS: 110 Bcf
CRUDE OIL: 0 Mbbl
ETHANOL: 1,500 Mbbl

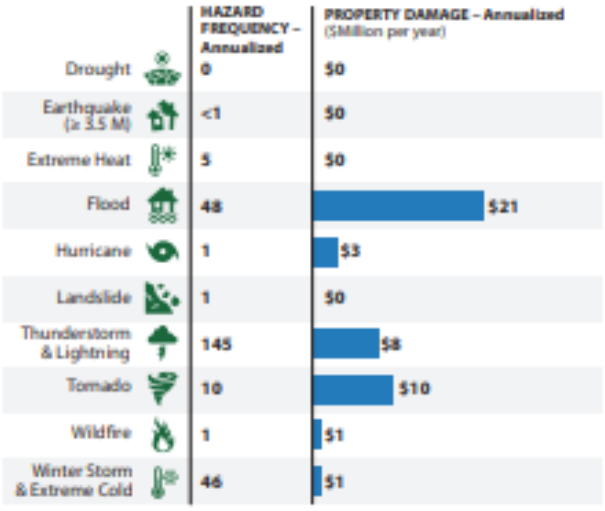
Data from EIA (2018, 2019).

This State Energy Risk Profile examines the relative magnitude of the risks that the state of Virginia's energy infrastructure routinely encounters in comparison with the probable impacts. Natural and man-made hazards with the potential to cause disruption of the energy infrastructure are identified. Certain natural and adversarial threats, such as cybersecurity, electromagnetic pulse, geomagnetic disturbance, pandemics, or impacts caused by infrastructure interdependencies, are ill-suited to location-based probabilistic risk assessment as they may not adhere to geographic boundaries, have limited occurrence, or have limited historic data. Cybersecurity and other threats not included in these profiles are ever present and should be included in state energy security planning. A complete list of data sources and national level comparisons can be found in the Data Sources document.

Virginia Risks and Hazards Overview

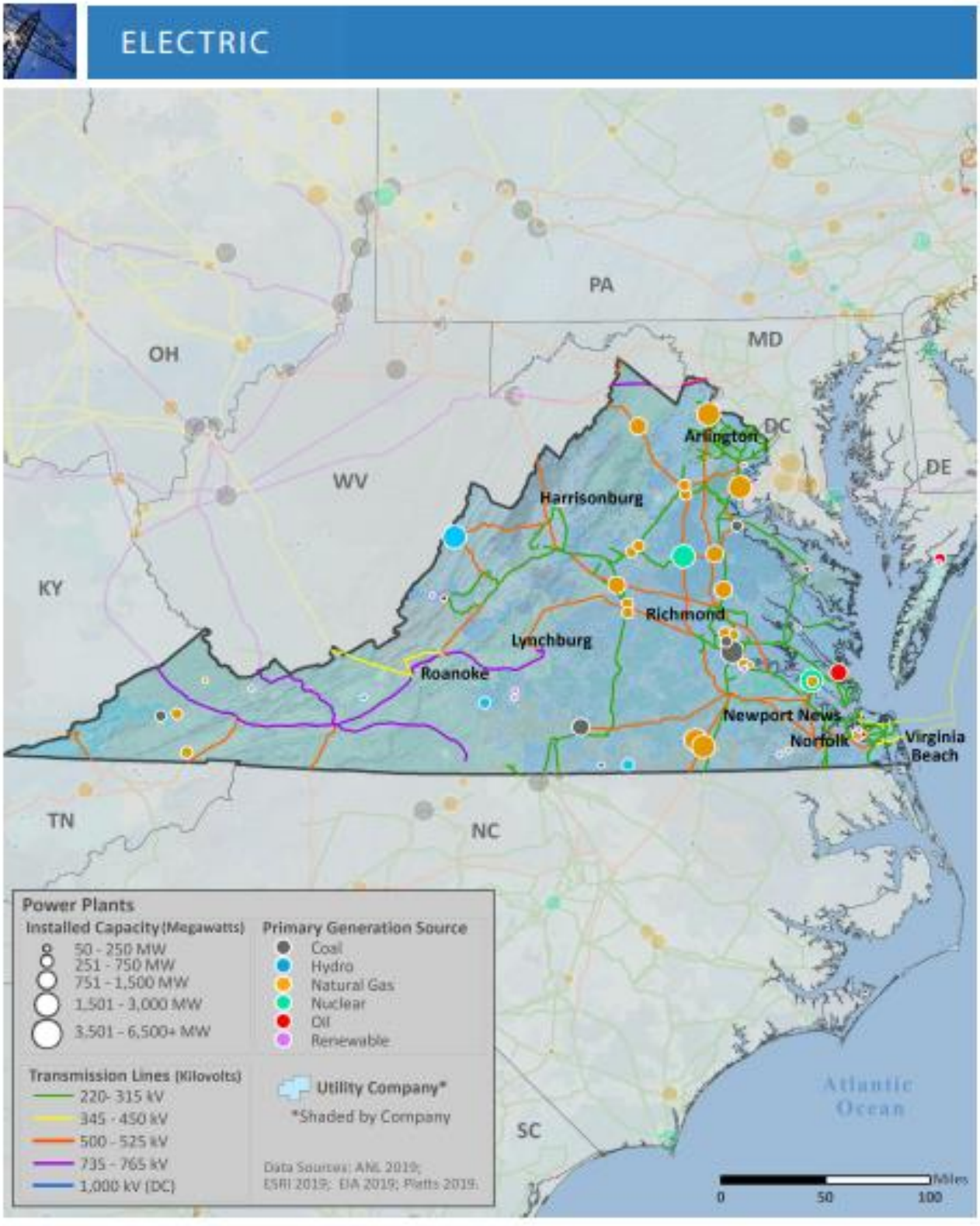
- The natural hazard that caused the greatest overall property loss between 2009 and 2019 was **Flooding** at $21 million per year *(leading cause nationwide at $12 billion per year).*
- Virginia had 108 Major Disaster Declarations, 134 Emergency Declarations, and 0 Fire Management Assistance Declarations for 5 events between 2013 and 2019.
- Virginia registered 16% fewer Heating Degree Days and 40% greater Cooling Degree Days than average in 2019.
- There are 2 Fusion Centers in Virginia. The Primary Fusion Center is located in North Chesterfield.

Annualized Frequency of and Property Damage Due to Natural Hazards, 2009 – 2019



Data Sources: NOAA and USGS

State of Virginia | ENERGY SECTOR RISK PROFILE



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State of Virginia | ENERGY SECTOR RISK PROFILE

Electric Infrastructure

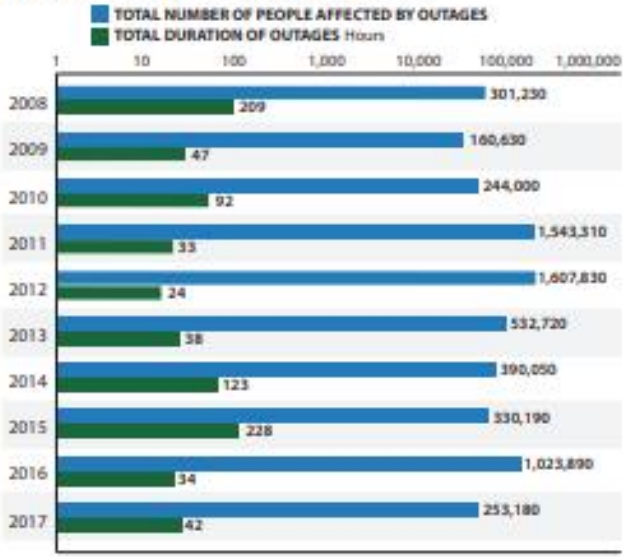
- Virginia has 35 electric utilities:
  - *1 Investor owned*
  - *13 Cooperative*
  - *15 Municipal*
  - *6 Other utilities*
- Plant retirements scheduled by 2025: 25 electric generating units totaling 2,078 MW of installed capacity.
- In 2018, the average Virginia electric customer experienced 1.8 service interruptions that lasted an average of 8.5 hours.
- In Virginia, between 2008 and 2017:
  - *The greatest number of electric outages occurred in* ***October*** *(5th for outages nationwide)*
  - *The leading cause of electric outages was* ***Weather or Falling Trees*** *(leading cause nationwide)*
  - *Electric outages affected 638,703 customers on average*

Electric Customers and Consumption by Sector, 2018

	CUSTOMERS	CONSUMPTION
Residential	89%	41%
Commercial	11%	44%
Industrial	<1%	15%
Transportation	<1%	<1%

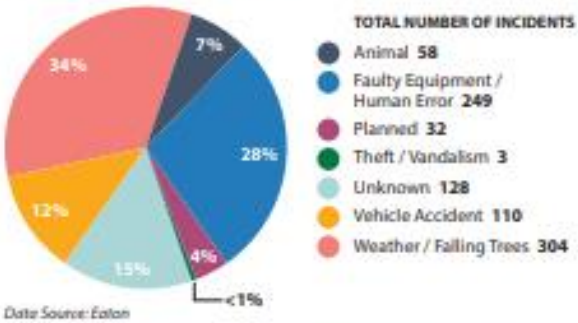
Data Source: EIA

Electric Utility Outage Data, 2008 – 2017



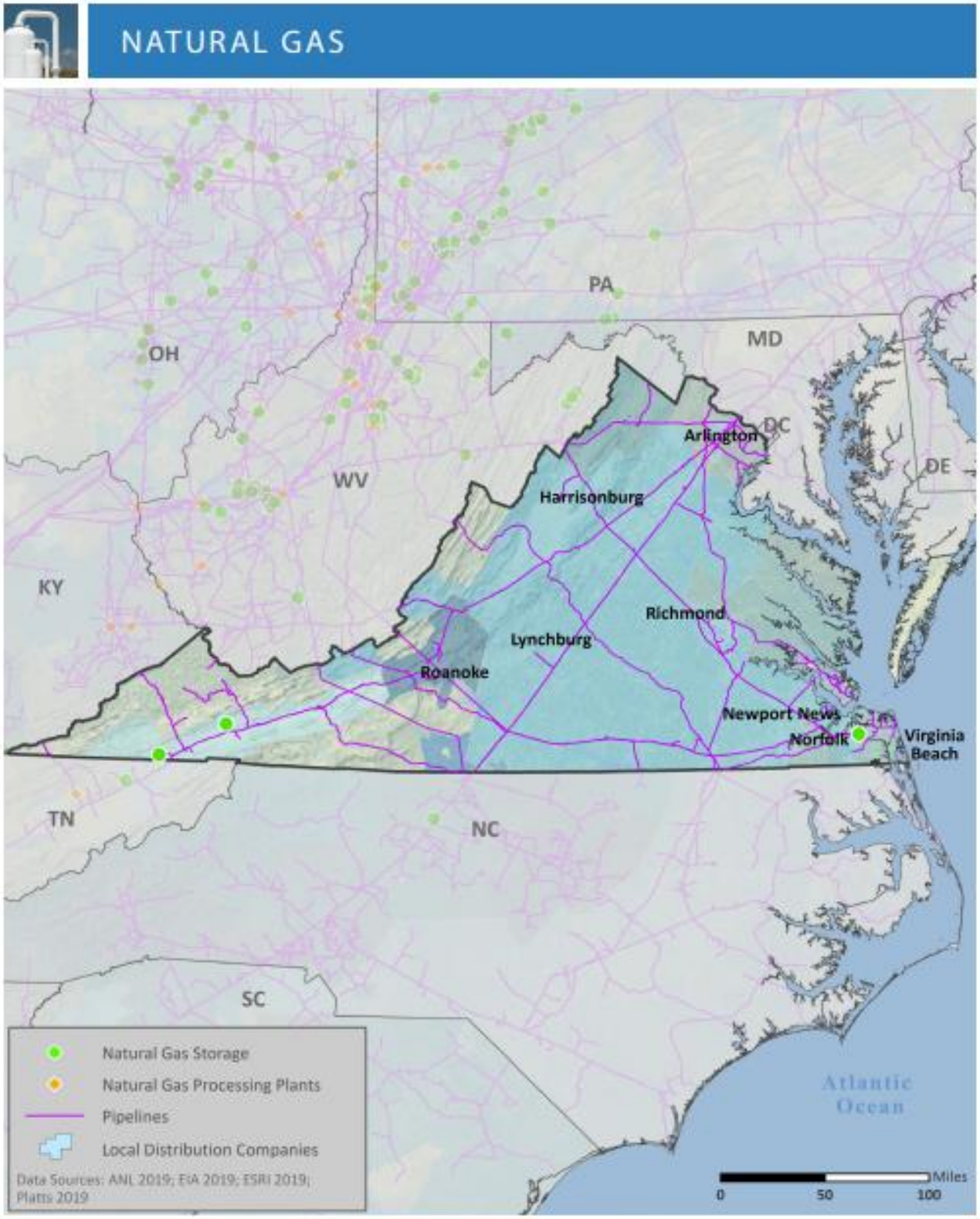
Note: This chart uses a logarithmic scale to display a very wide range of values.
Data Source: Eaton

Electric Utility-Reported Outages by Cause, 2008 – 2017



Data Source: Eaton

State of Virginia | ENERGY SECTOR RISK PROFILE



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Natural Gas Transport

Top Events Affecting Natural Gas Transmission and Distribution, 1984–2019

Data Source: DOT PHMSA

- As of 2018, Virginia had:
  - *3,173 miles of natural gas transmission pipelines*
  - *21,774 miles of natural gas distribution pipelines*
- 58% of Virginia's natural gas transmission system and 27% of the distribution system were constructed prior to 1970 or in an unknown year.
- Between 1984 and 2019, Virginia's natural gas supply was most impacted by:
  - ***Corrosion** when transported by transmission pipelines (4th leading cause nationwide at $20.15M per year)*
  - ***Miscellaneous or Unknown** events when transported by distribution pipelines (2nd leading cause nationwide at $67.89M per year)*

Natural Gas Processing and Liquefied Natural Gas

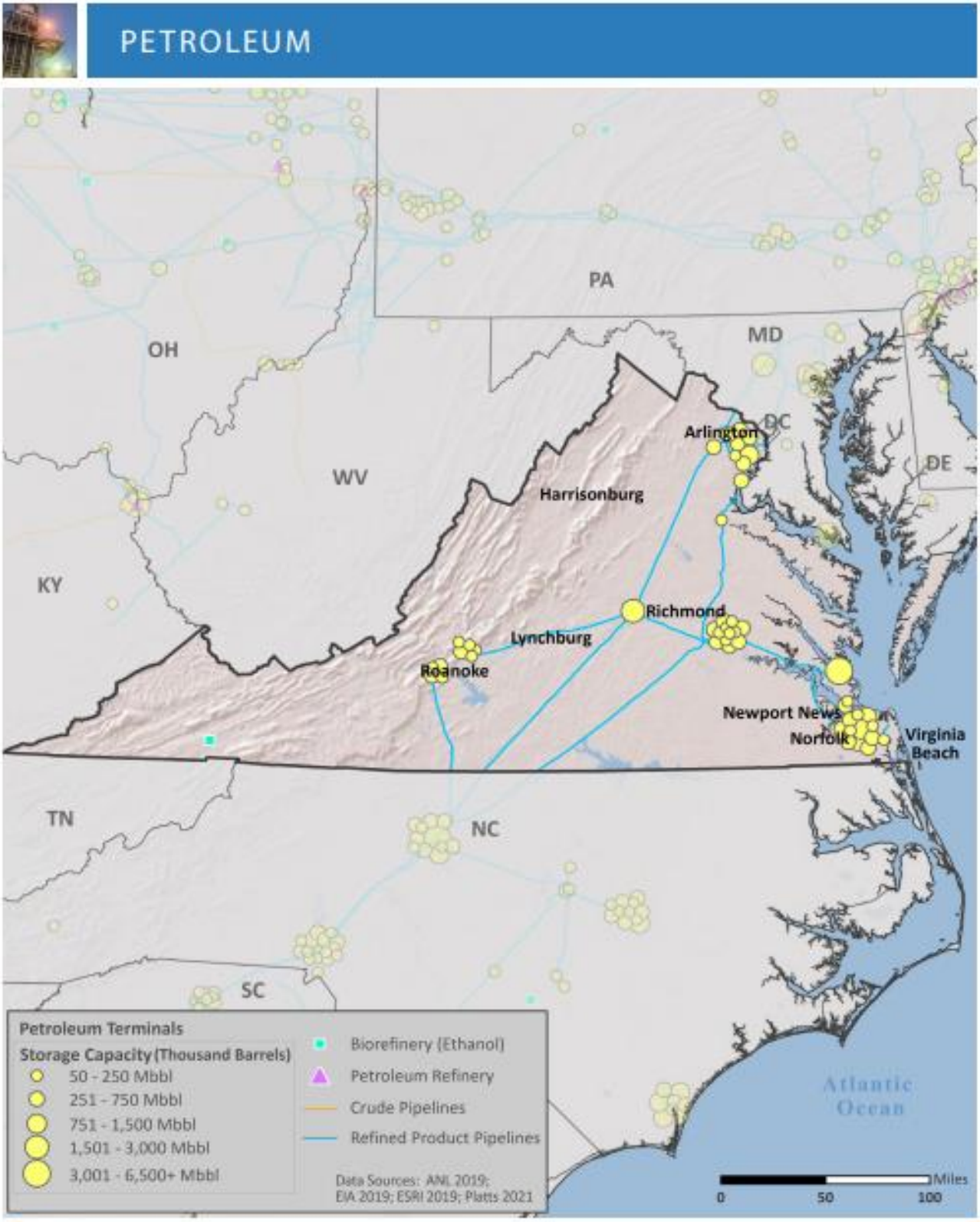
Natural Gas Customers and Consumption by Sector, 2018

	CUSTOMERS	CONSUMPTION
Residential	92%	14%
Commercial	8%	12%
Industrial	<1%	16%
Transportation	<1%	<1%
Electric Power	<1%	58%
Other	<1%	<1%

Data Source: EIA

- Virginia has 0 natural gas processing facilities.
- Virginia has 2 liquefied natural gas (LNG) facilities with a total storage capacity of 407,200 barrels.

State of Virginia | ENERGY SECTOR RISK PROFILE



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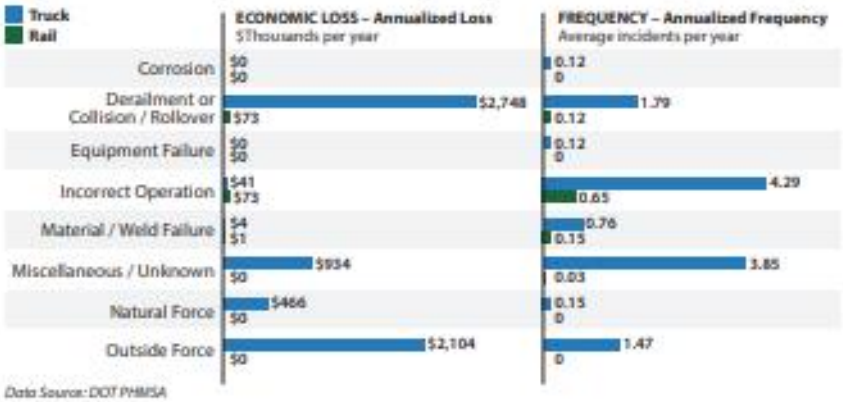
Petroleum Transport

Top Events Affecting Petroleum Transport by Truck and Rail, 1986 – 2019



Data Source: DOT PHMSA

Top Events Affecting Crude Oil and Refined Product Pipelines, 1986 – 2019

Data Source: DOT PHMSA

- As of 2018, Virginia had:
  - *0 miles of crude oil pipelines*
  - *1,146 miles of refined product pipelines*
  - *0 miles of biofuels pipelines*
- 72% of Virginia's petroleum pipeline systems were constructed prior to 1970 or in an unknown year.
- Between 1986 and 2019, Virginia's petroleum supply was most impacted by:
  - ***Derailments, Collision, or Rollovers*** *when transported by truck (8th leading cause nationwide at $0.07M per year)*
  - ***Incorrect Operations*** *when transported by rail (4th leading cause nationwide at $2.02M per year)*
  - ***Material Failures*** *when transported by product pipelines (4th leading cause nationwide at $9.47M per year)*
- Disruptions in other states may impact supply.

Petroleum Refineries

- There are no operating petroleum refineries in Virginia.

APPENDIX D: State Waiver Checklist and Templates

The Governor of Virginia and the Virginia Departments of State Police, Transportation, and Motor Vehicles may issue a variety of waivers or other regulatory relief actions to facilitate the delivery of energy during a disruption.

During fuel shortages, certain requirements for commercial motor vehicles may be waived to facilitate fuel supply into a region. These requirements focus around the hours that commercial drivers may legally drive as well as restrictions on commercial vehicle weight.

WAIVER	LEAD AGENCY	DESCRIPTION	EXAMPLE OF PAST USE
Transportation Waivers			
Hours Of Service (HOS)	Governor's Office issues via State of Emergency Coordination by DMV, VDOT, and VSP	HOS requirements are safety requirements that limit how long commercial drivers may drive before resting. During a fuel emergency, these requirements can be waived to allow drivers to complete more deliveries or pick up fuel from farther away without stopping. Virginia DMV has authority over intrastate HOS regulations applying to commercial drivers operating within state boundaries. To obtain a waiver for intrastate HOS regulations, the Governor's Office must declare that a state of emergency or transportation emergency is interrupting the delivery of essential services or supplies or threatening human life or public welfare. Industry associations typically request these waivers on behalf of motor carriers. Once declared, a transportation emergency and associated intrastate HOS waiver lasts the duration specified in the emergency declaration or the duration of the emergency (whichever is shorter), although the Virginia DMV can renew the transportation emergency and HOS waiver in the duration specified in the emergency declaration increments for up to the maximum duration. Once Virginia has declared an emergency and issued an intrastate HOS waiver, interstate HOS requirements may also be waived for drivers supporting emergency response efforts, including for drivers passing through other states to assist Virginia's response. Note that interstate HOS waivers may also be granted separately at the federal level by FMCSA for emergencies affecting multiple states. Even if FMCSA issues a regional interstate waiver prior to action at the state level, Virginia will usually also issue its own state HOS waiver through emergency declaration to cover intrastate commercial transportation.	COVID 19 Virginia HOS emergency waiver for delivery of emergency and essential supplies

WAIVER	LEAD AGENCY	DESCRIPTION	EXAMPLE OF PAST USE
Weight Restriction	Virginia Departments of State Police and Transportation (VDOT)	After a presidential emergency or federal major disaster is declared, Virginia – with coordination from the FMCSA - may issue special permits to allow vehicles to carry divisible loads above legal weight limits in interstate commerce. Weight restrictions exist to ensure road safety for truck drivers and other drivers on the road, as heavier loads are more unwieldy and increase wear and tear on infrastructure. Temporarily waiving this requirement during emergencies allows tanker trucks to carry more fuel per trip. In Virginia, weight restriction waivers often take the form of a 20,000 – 90,000 pounds tolerance above statutory weight limits depending on the axel type. These are most commonly granted through a Governor's declaration of emergency. The period of weight tolerance for the interstate highway system cannot exceed the period deemed necessary by the issuing authority. Vehicles crossing through multiple states must comply with permitting requirements in every state in which they exceed the weight limits.	COVID 19 Virginia HOS emergency waiver for delivery of emergency and essential supplies
Fuel Specification Waivers			

WAIVER	LEAD AGENCY	DESCRIPTION	EXAMPLE OF PAST USE
State RVP and RFG	Department of Agriculture and Consumer Services, in coordination with the Department of Agriculture and Forestry	Commissioner of Agriculture and Consumer Services regulate the quality of fuels sold in Virginia. Gasoline fuel specifications can be found in regulation 2 VAC 5-425 et seq. of the Virginia Administrative Code.[lxxxiv] Among other requirements, the RVP of gasoline is regulated to reduce evaporative emissions and improve air quality. Gasoline RVP is regulated federally during the summer ozone season (June 1 to September 15), and Virginia's regulations go beyond the federal RVP requirements to specify year-round RVP requirements. Fuel specifications vary by month and by region. Conventional gasoline in the state varies from a high RVP of 15 pounds per square inch (psi) in winter months, down to a low RVP of 9 psi in the summer.[lxxxv] RFG, which is required in 28 Virginia jurisdictions, has the same winter RVP requirement as conventional gasoline but must not exceed an RVP of 7.4 psi during the summer. RVP requirements can be waived to help expand the supply of fuel available to be used in the state. Waivers of RFG requirements allow conventional gasoline to be brought into RFG-areas for sale and use. Waivers of RVP requirements granted at the end of the summer often allow distributors and retailers to switch to winter gasoline blends earlier. In the spring months, waivers may delay the transition to summer gasoline. Typically, supply at terminals becomes tighter around the transition months, as suppliers empty their storage tanks in anticipation of the switch. Waivers allow for some fungibility of gasoline during these periods. Since the EPA regulates RVP during the summer months and Virginia has adopted EPA's RVP standards, the Commissioner of Agriculture and Consumer Services usually must waive the state's RVP requirements when EPA issues a fuel waiver that involves RVP requirements. The Commissioner of Agriculture and Consumer Services can issue state-specific waivers during the spring and winter, should supply conditions warrant a waiver.	Virginia RVP Waiver for Colonial Pipeline Cyberattack & Shutdown

WAIVER	LEAD AGENCY	DESCRIPTION	EXAMPLE OF PAST USE
Red Dye Diesel Fuel Penalty	Virginia Department of Environmental Quality (VDEQ) in coordination with the U.S. Internal Revenue Services	In keeping with federal regulations, Virginia state law specifies that non-highway diesel fuel must be dyed red and cannot be used in any on-highway vehicle. This state law can in theory be waived during fuel emergencies. Because federal fuel specifications are adopted into Virginia law, the Virginia Department of Environmental Quality (VDEQ) would need to issue an additional waiver of state red dye diesel penalties for federal waivers to go into effect. The federal Internal Revenue Services (IRS) must also issue a fuel penalty relief in times of emergency when dyed diesel requirements are waived by the state. However, in practice the VDEQ has rarely waived red dye diesel regulations at the state level. Red dye can remain in tanks long after waivers expire, complicating enforcement in on-highway vehicles. Red dye waivers also are not believed to have a major impact on diesel supply in the state. As such, there are no recent examples of this waiver's use, and it has not been a primary tool for response in Virginia.	N/A

Emergency Waiver Execution Checklist

1. Identify the Type of Waiver Needed

- ☐ Hours of Service (HOS) Waiver
- ☐ Weight Restriction Waiver
- ☐ Fuel Specification Waiver (RVP and RFG)
- ☐ Red Dye Diesel Fuel Penalty Waiver

2. Gather Necessary Information

- ☐ **Nature of the Emergency**: Description of the event causing the disruption (e.g., natural disaster, fuel shortage due to out-of-state disruption).
- ☐ **Affected Areas**: Specific regions or counties impacted.
- ☐ **Duration of the Emergency**: Estimated time frame for the emergency situation.
- ☐ **Current Regulations**: Existing state regulations that need to be waived.
- ☐ **Stakeholder Requests**: Requests from industry associations or other stakeholders for specific waivers.

3. Coordinate with Relevant Entities

- ☐ **Virginia State Police**: For HOS and weight restriction waivers.
- ☐ **Virginia Department of Transportation**: For HOS regulations
- ☐ **Virginia Department of Motor Vehicles**: For intrastate HOS regulations.
- ☐ **Federal Motor Carrier Safety Administration (FMCSA)**: For interstate HOS regulations.
- ☐ **Commissioner of Agriculture and Consumer Services**: For fuel specification waivers.
- ☐ **Virginia Department of Environmental Quality (VDEQ)**: For red dye diesel fuel penalty waivers.
- ☐ **Office of the Governor**: For state of emergency declarations and potential executive actions.
- ☐ **State Coordinator of Emergency Management**: For overall coordination and support.

4. Prepare and Submit Waiver Requests

- ☐ **Draft Waiver Request**: Include all gathered information and specify the type of waiver needed. Utilize the templates below.
- ☐ **Submit to Appropriate Agency**: Ensure the request is sent to the correct agency or department for approval.
- ☐ **Follow Up**: Maintain communication with the agency to track the status of the waiver request.

5. Implement Waiver Once Approved

- ☐ **Publicize the Waiver**: Announce the waiver through official channels, including the Virginia Department of Emergency Management website and industry groups.
- ☐ **Monitor Compliance**: Ensure that all relevant parties are aware of and comply with the waiver conditions.

- **Document Usage**: Keep records of how the waiver is being used and any issues that arise.

6. Review and Renew Waivers as Needed

- **Assess the Situation**: Regularly review the emergency situation to determine if the waiver needs to be extended or modified.
- **Coordinate Renewals**: Work with the issuing agency to renew the waiver if necessary.
- **Update Stakeholders**: Keep all stakeholders informed about the status of the waiver and any changes.

7. Post-Emergency Review

- **Evaluate Effectiveness**: Assess the effectiveness of the waiver in addressing the emergency.
- **Identify Improvements**: Note any areas for improvement in the waiver process for future emergencies.
- **Report Findings**: Prepare a report summarizing the use and impact of the waiver during the emergency.

Hours of Service (HOS) Waiver Request Template

Lead Agency: Virginia Department of Motor Vehicles, and State Governors Office

Description: HOS requirements limit how long commercial drivers may drive before resting. During a fuel emergency, these requirements can be waived.

Request Details:

- **Nature of Emergency:**
- **Affected Areas:**
- **Duration of Emergency:**
- **Current Regulations to be Waived:**
- **Stakeholder Requests:**

Approval:

- **Authorized By:**
- **Date:**

Weight Restriction Waiver Template

Lead Agency: Virginia Departments of State Police and Transportation (VDOT)

Description: Allows heavy commercial vehicles to carry loads above legal weight limits during emergencies.

Request Details:

- **Nature of Emergency:**
- **Affected Areas:**
- **Duration of Emergency:**
- **Current Regulations to be Waived:**
- **Stakeholder Requests:**

Approval:

- **Authorized By:**
- **Date:**

State RVP and RFG Waiver Template

Lead Agency: Commissioner of Agriculture and Consumer Services

Description: Waives requirements for the chemical composition of fuel to expand supply.

Request Details:

- **Nature of Emergency:**
- **Affected Areas:**
- **Duration of Emergency:**
- **Current Regulations to be Waived:**
- **Stakeholder Requests:**

Approval:

- **Authorized By:**
- **Date:**

Red Dye Diesel Fuel Penalty Waiver Template

Lead Agency: Virginia Department of Environmental Quality (VDEQ)

Description: Waives penalties for using non-highway diesel fuel in on-highway vehicles during emergencies.

Request Details:

- **Nature of Emergency:**
- **Affected Areas:**
- **Duration of Emergency:**
- **Current Regulations to be Waived:**
- **Stakeholder Requests:**

Approval:

- **Authorized By:**
- **Date:**

APPENDIX E: Risk Mitigation Actions

The Commonwealth's energy infrastructure and delivery system are vulnerable to a variety of hazards, including severe weather (hurricanes, winter weather, flooding, tornados, wildfires, etc.), systems and infrastructures failures, pandemics, deliberate physical, cyber, attacks and other events. While the owners and operators are responsible for their energy infrastructures and delivery systems, it is the responsibility of state and local officials to work with energy providers and stakeholders from other localities, government agencies, businesses, and related organizations, to reduce consequences and assure public safety, and provide for rapid recovery. In the longer term, the Commonwealth, tribes, and localities should work toward reducing risk and vulnerabilities to critical energy infrastructure.

Mitigation Approach

Through this collaboration, strategies are developed that mitigate hazards, strengthen the energy sector's reliability, enhance energy supply resilience for end users, and secure critical energy infrastructure. Part of the strategy considers prioritizing funding to conduct risk assessments that examine the consequences of energy disruptions and the loss of critical infrastructure and key assets. The risk assessment also considers cross-sector interdependencies between the energy sector and the other sectors and between different energy sub-sectors (electricity, liquid fuels, and natural gas). Appendix C discusses cross-sector interdependencies in more depth. Understanding the interconnectedness of energy infrastructure and the interdependencies can help identify the possible cascading impacts of a disruption.

Energy infrastructure is typically constructed to safety, security, and reliability standards set by the North American Electric Reliability Corporation, Pipeline Hazardous Materials and Safety Administration, and other federal, state, and industry regulating bodies. To mitigate impacts from evolving threats including climate change, states and energy infrastructure operators may consider risk mitigation technologies and operational measures that enhance system resilience beyond the standards set by regulators.

When evaluating whether to invest in new risk mitigation measures, infrastructure operators evaluate the cost of the measures against the level of risk and the potential benefits of greater system reliability and faster recovery after emergency events. For regulated electric and natural gas utilities, these investments may require approval from state public utility commissions.

Measures are categorized into two main groups: *All Hazards* measures can apply to a range of threats; and *Hazard-Specific* measures are designed to mitigate a specific threat or risk, such as cold weather or wildfires. All Hazard measures are divided into categories that align with three of *the infrastructural qualities* outlined in the Department of Homeland Security's Resilience Framework:

Robustness – measures that strengthen a system to withstand external hazards without degradation or loss of functionality;

Redundancy – measures that allow for alternate options, choices, and substitutions when a system is under stress; and

Rapid Detection/Recovery – measures that accelerate the time it takes to overcome a disruption and restore energy services.

All-Hazards Risk Mitigation Measures

ROBUSTNESS

MEASURE	DESCRIPTION	SECTOR
Demand response programs	Demand response programs relieve pressure on electric or natural gas delivery systems by reducing or time-shifting customer energy usage. Demand reduction during peak periods reduces the chance of system overload and service failure. In addition to enhancing reliability, demand response can also help reduce generator or supplier market power and lessen price volatility.	
System segmentation	Energy systems (power grids, gas pipeline networks, and liquid fuels pipeline networks) can be sub-divided to more efficiently isolate damaged areas, allowing undamaged segments to continue serving customers. By segmenting networks, service isolations can be more targeted and affect fewer customers.	
Undergrounding power lines	Placing power lines underground protects them against external threats, including high winds and falling branches, wildfires, extreme heat or cold, icing, dirt/dust/salt accumulation, and animals. Buried lines may be more vulnerable to flooding if located in low-lying areas and may be more difficult and expensive to maintain and repair.	
Electric Distribution Grid Hardening	(i) Replacing and rebuilding targeted feeder segments based on performance, condition and architecture; (ii) Implementing new design and construction standards; (iii) Implementing new loading standards and adding new sources of service; (iv) Implementing new vegetation management programs; and (v) Proactively upgrading components. (See Dominion's 2023 GT Plan – PUR-2023-00051).	

Legend

REDUNDANCY

MEASURE	DESCRIPTION	SECTOR
Backup generators	Fixed or portable backup generators can provide backup power to critical facilities when grid-supplied power is interrupted. Backup generators may be designed to power emergency functions, such as emergency lighting, fire suppression, or stormwater removal, or may be designed to power some or all of a facility's operational functions. Mobile generators can power utility or emergency responder base camps (sites where response personnel and equipment are staged). Backup generators require adequate fuel supply to operate.	
Battery storage	Battery energy storage can be used to provide backup power during electric grid outages. Batteries can be deployed at utility-scale as front-of-the-meter systems, providing services like utility load peak shaving or behind-the-meter by customers. Batteries are often paired with solar photovoltaic systems and included in microgrid designs.	
Microgrids	A microgrid is a group of interconnected loads and distributed energy resources that acts as a single controllable entity with respect to the grid. It can connect and disconnect from the grid to operate in grid-connected or island mode. Microgrids can improve customer reliability and resilience to grid disturbances.	
Ties between gas pipelines	Increased interconnection between varied gas supplies, amongst various transmission lines, and peak shaving plants can help aid additional supplies to distribution systems. Further interconnection and bi-directional feeds within the systems can add additional resiliency from line breaks and outages.	

Legend

RAPID DETECTION/RECOVERY

MEASURE	DESCRIPTION	SECTOR
Advanced distribution management systems	Advanced distribution management systems integrate numerous utility systems and provide automated outage restoration and optimization of distribution grid performance. These functions improve the resilience of the distribution system and decrease the length of customer outages.	
Artificial intelligence analysis	Artificial intelligence analysis can augment the abilities of subject matter experts to prioritize transmission line operations, identify defects, and update asset management systems.	
Distribution automation	Distribution automation uses 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.	
Drones for asset inspection	The use of drones to inspect pipelines, transmission lines, or other assets allows for safer and more frequent inspections, enhanced asset information, reduced operational costs and failure rates, and extended asset lifetimes.	
LiDAR for vegetation management	Vegetation is the primary cause of overhead power line outages. "Light Detection and Ranging" (LiDAR), is remote-sensing technology that can measure how close vegetation is to power lines. LiDAR units can be deployed on the ground, drones or aircraft, to enable more effective vegetation management reducing the impact of storms on electric infrastructure.	
Remote-operated valves	Remote-operated valves more efficiently isolate systems during disruptions or peak event load management (e.g., temporarily disconnecting gas customers).	
Advanced Metering Infrastructure	Advanced metering infrastructure (AMI) is an integrated system of smart meters, communications networks, and data management systems that enables bi-directional communication between utilities and customers. Smart meters can provide near-real-time visibility into customer outages and help utilities allocate resources and restoration activities more efficiently.	
Supply chain resilience planning	Assessing current supply chains and working with relevant stakeholders to strategically plan for the continuity and rapid restoration of those supply chains after major disruptions improves supply chain resilience.	

HAZARD-SPECIFIC – COLD WEATHER

MEASURE	DESCRIPTION	SECTOR
Heating & pitch adjustment for wind turbines	Wind turbine blades and lubricant housings can be fitted with heating elements that prevent ice accumulation that could otherwise impair operations. Wind turbines can also be configured to operate in winter ice operation mode, which changes the pitch of the blades to allow continued operation as they accumulate ice.	
Thermal enclosures	Instrumentation can be enclosed and heated to ensure functionality and operational continuity during extreme cold conditions.	

Legend

HAZARD-SPECIFIC – EXTREME HEAT & DROUGHT

MEASURE	DESCRIPTION	SECTOR
Advanced water-cooling technologies	Power plants require significant volumes of water for thermoelectric cooling. Asset owners can employ approaches to reduce their water use to make them more resilient to drought conditions. Alternative approaches include recirculating cooling, dry cooling (highlighted below), and wet-dry hybrid cooling technologies. Cooling equipment capable of using alternative water sources (e.g., brackish water, wastewater) can reduce the impact of droughts.	
Dry cooling	Nearly all thermal generation, including nuclear and coal-fired power plants, requires large quantities of water for 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 technologies use air-cooled heat exchangers and other technologies to significantly reduce water use.	
Hydropower reservoir capacity	Increasing reservoir storage capacity at hydroelectric power plants can offset the effects of precipitation variability.	
Turbine efficiency	Higher-efficiency hydroelectric turbines require less water per unit of electricity generated and are more resilient to drought.	

Legend

HAZARD-SPECIFIC – FLOOD

MEASURE	DESCRIPTION	SECTOR
Elevate equipment	Elevating equipment located in low-lying areas can protect it from flooding that would otherwise damage or destroy it.	
Environmental management	Preserving certain kinds of natural habitats (e.g., coastal wetlands) provides a natural barrier to lessen the impact of storm surge.	
Flood walls/gates	Installing flood walls, gates, and/or barriers can protect essential equipment in flood prone areas from water intrusion and avoid restoration delays after major storms and floods.	
Relocate assets	Relocating energy assets away from flood-prone areas can reduce or eliminate their exposure to flooding and inundation threats.	
Stormwater pumps	Stormwater pumps can remove flood water and help prevent equipment from being submerged.	
Submersible equipment	Equipment located in flood-prone areas, such as underground power distribution systems in low-lying areas, can be modified or replaced with equipment that is designed to continue functioning when subjected to flooding from water containing typical levels of contaminants such as salt, fertilizer, motor oil, and cleaning solvents.	
Vent line protectors	A vent line protector (VLP) protects gas regulator vent lines from encroaching water. The VLP is usually open, but if water enters the vent line via the VLP, a float will seal the vent line shut. The float will drop when the water recedes, re-opening the vent to its normal position.	
Vented manhole covers	In flooding scenarios, manhole covers can dislodge, and the exposed manhole creates a hazard for pedestrians and vehicles. Proper vent design can allow for the flow of excess water without dislodging the cover.	

Legend

Electricity | Liquid Fuel | Natural Gas

HAZARD-SPECIFIC – SEISMIC PROTECTION

MEASURE	DESCRIPTION	SECTOR
Base isolation transformer platform	Substation transformers can be placed on platforms designed to absorb the shaking from earthquakes that would otherwise damage the equipment.	
Flexible joints	Flexible joints between steel pipe segments absorb the deformations caused during an earthquake and lessen the damage caused to pipeline infrastructure.	

Legend

HAZARD-SPECIFIC – WILDFIRE PROTECTION

MEASURE	DESCRIPTION	SECTOR
Covered conductors	To mitigate wildfire risk, utilities can replace bare wire overhead conductors on distribution lines with conductors that have a plastic covering (also called tree wire). Covered conductors greatly reduce the number of faults, and the risk of ignition. Similar products include spacer cables and aerial cables.	
Fire-resistant poles	Wood poles can be replaced with ones made from fireproof materials, or wrapped in fireproof sheaths (e.g., wool-ceramic fiber).	
Line-break-protection systems	Automated monitoring equipment, called phasor measurement units, installed on transmission and distribution lines can detect a voltage change associated with the breakage of a power line. The system can respond in near real-time by de-energizing that segment of the transmission line so that the broken power line does not spark a fire as it falls to the ground.	
Pre-treat assets in path of fire	Pre-treating infrastructure (e.g., by applying flame retardant coatings or wrapping assets such as utility poles in flame retardant sheaths) decreases wildfire damage and expedites restoration of service.	
Reconductoring	Reconductoring is the process of installing new conductor wires on existing towers to increase transmission capacity, thus reducing propensity for high loads to cause excessive line sag, which can cause ignition. Reconductoring typically involves replacing traditional steel-reinforced lines with composite core lines.	

Legend

HAZARD-SPECIFIC – WIND PROTECTION MEASURES

MEASURE	DESCRIPTION	SECTOR
Breakaway service connectors	A breakaway service connector is designed to disconnect when the power line it is attached to is pulled by a falling limb or other debris. This avoids damage caused when a service wire is pulled down in a way that damages the meter receptacle. Meter receptacles are not typically owned by the utility, and a private electrician is needed to first make repairs, delaying service restoration.	
Dead-end towers	Dead-end towers (also called anchor towers or anchor pylons) are self-supporting structures made with heavier material than suspension towers. Dead-end towers are used at the end of a transmission line; where the transmission line turns at a large angle; on each side of a major crossing such as a large river or highway, or large valley; and at intervals along straight segments to provide additional support. Suspension towers are typically used when the transmission line continues along a straight path. When weaker suspension towers are compromised or toppled, the stronger dead-end structures can stop a domino effect that takes down multiple towers. Reducing the spacing between dead-end structures can limit the impacts of domino effect failures.	
Stronger utility poles	This can involve reinforcing wood poles, replacing wood poles with concrete ones, or replacing wood cross-arms with fiberglass ones.	
Vegetation management	Clearing vegetation away from transmission and distribution lines helps prevent damage (e.g., falling tree branches) to power lines that cause outages.	

Legend

General Resources

Mitigating impacts from hazards to the energy system is a topic that is constantly being reevaluated, and the guidance for best practices is ever-changing. The following reports focus on ways to increase the resilience of energy systems. Note: this is not a comprehensive list of resources.

Institute of Electrical and Electronics Engineers (IEEE). 2020. Resilience Framework, Methods, and Metrics for the Electricity Sector: This report provides an overview of resilience definitions (including its relationship with reliability), the existing frameworks for holistically defining resilience planning and implementation processes, and the metrics to evaluate and benchmark resilience. It also evaluates technologies, tools, and methods to improve electrical system resilience.

National Renewable Energy Laboratory. 2019. Energy Resilience Assessment Methodology: This report presents a replicable energy resilience assessment methodology for sites, military bases, and campuses to assess energy risks and develop prioritized solutions to increase site resilience.

National Renewable Energy Laboratory. 2019. Power Sector Resilience Planning Guidebook: A Self-Guided Reference for Practitioners: This guidebook introduces policymakers, power sector investors, planners, system operators, and other energy-sector stakeholders to the key concepts and steps involved in power sector resilience planning.

U.S. Climate Resilience Toolkit. 2019. Building Resilience in the Energy Sector: Examines climate change challenges for the energy sector, possible actions to mitigate risk and links to resources.

U.S. Department of Homeland Security. 2019. National Mitigation Investment Strategy.: The National Mitigation Investment Strategy ("NMIS"), developed by the Mitigation Framework Leadership Group is a single national strategy for advancing mitigation investment to reduce risks posed by natural hazards and increasing the nation's resilience to natural hazards. This report outlines the investment strategy and how federal and non-federal partners can coordinate community mitigation investments.

National Academies of Sciences, Engineering, and Medicine. 2017. Enhancing the Resilience of the Nation's Electricity System: This report focuses on identifying, developing, and implementing strategies to increase the electric system's resilience in the face of events that can cause large-area, long-duration outages: blackouts that extend over multiple service areas and last several days or longer.

U.S. Dept. of Energy. 2016. Climate Change and the Electricity Sector: Guide for Climate Change Resilience Planning: This report provides basic assistance to electric utilities and other stakeholders in assessing vulnerabilities to climate change and extreme weather, and in identifying an appropriate portfolio of resilience solutions.

Electric Power Research Institute (EPRI). 2016. Electric Power System Resiliency: This report describes innovative technologies, strategies, tools, and systems that the electricity sector is

developing and applying to address resiliency. The report explores three elements of resiliency: damage prevention, system recovery, and survivability.

Argonne National Laboratory. 2016. Front-Line Resilience Perspectives: The Electric Grid: This report summarizes how states and local utilities approach all-hazards resilience in planning, construction, operations, and maintenance of the electric system, as well as challenges faced when addressing all-hazards resilience.

U.S. Dept. of Energy. 2014. United States Fuels Resiliency Volume III: U.S. Fuels Supply Infrastructure Vulnerabilities and Resilience: This study evaluates the ability of the nation's oil and natural gas transportation, storage, and distribution infrastructure to respond to and recover from natural disasters and intentional acts, system chokepoints and interdependencies, and other supply interruptions.

U.S. Dept. of Energy. 2010. Hardening and Resiliency: U.S. Energy Industry Response to Recent Hurricane Seasons: This report examines the storm hardening and resilience measures that refiners, petroleum product pipeline operators, and electric utilities in the Gulf Coast area took in response to the 2005 and 2008 hurricane seasons. It focuses on the segments of the energy industry that contribute most to the delivery of gasoline and diesel to the Southeast U.S.

Specific Measure Resources

Advanced Distribution Management Systems

- NREL: Advanced Distribution Management Systems
- U.S. DOE: Insights into Advanced Distribution Management Systems

Battery Storage

- NREL: Valuing the Resilience Provided by Solar and Battery Energy Storage Systems
- NREL: Battery Storage for Resilience
- NREL: Renewable Energy Integration and Optimization Tool (ReOpt)
- SolarResilient: Sizing tool for solar PV and battery storage systems
- DOE: Solar-Plus-Storage 101

Demand Response Programs

- EIA: Demand-Side Management Programs Save Energy and Reduce Peak Demand
- FERC: Demand Response

Dry Cooling

- U.S. Energy Information Administration - EIA - Independent Statistics and Analysis
- DOE ARPA-E: Advanced Research in Dry (ARID) cooling program

Environmental Management

- EPA: What is Green Infrastructure?
- EPA: Green Infrastructure - Manage Flood Risk

- NOAA: Green Infrastructure Options to Reduce Flooding

Microgrids

- LBNL: Distributed Energy Resources Customer Adoption Model (DER-CAM)
- NREL: Voices of Experience Microgrids for Resiliency
- DOE: Microgrid Portfolio of Activities
- Sandia National Laboratories: Microgrid Design Toolkit

Advanced Metering Infrastructure

- DOE: Smart Grid Investments Improve Grid reliability, Resilience and Storm Responses
- DOE: Advanced Metering Infrastructure and Customer Systems Report
- NREL: Government Program Briefing: Smart Metering

Supply Chain Resilience Planning

- DOE: America's Strategy to Secure the Supply Chain for a Robust Clean Energy Transition
- DHS: Supply Chain Resilience Guide

Undergrounding Power Lines

- DOE: Resilient Power Grids: Strategically Undergrounding Powerlines
- FEMA: Reduce Wildfire Risk Case Study

Use of Drones for Asset Inspections

- Oak Ridge National Laboratory: An Early Survey of Best Practices for the Use of Small Unmanned Aerial Systems by the Electric Utility Industry

Vegetation Management

- U.S. EPA: Benefits of Integrated Vegetation Management (IVM) on Rights-of-Way
- FERC: Tree Trimming and Vegetation Management

APPENDIX F: Federal and State Resiliency Policies and Programs

This section provides information on energy sector-specific federal and state policies and programs aimed at promoting demand for reduction, energy storage, smart grids, and other resilience measures. This list is not all-inclusive and may need to be amended to integrate new or revised policies and programs.

Federal Policies

Federal Power Act - 16 U.S.C. §791 et seq. (1920)

This statute was originally developed as the Federal Water Power Act, and the Act authorized the then Federal Power Commission (now Federal Energy Regulatory Commission) to issue licenses to non-federal projects that affected navigable waters, occupied federal lands, affected the interests of interstate commerce, or used water or water power from government-operated dams. Congress amended the statute in 1935 to charge the agency with the responsibility to oversee all interstate transmission and sale rates of electric power and hydropower.

Energy Standards and Goals for Federal Government:

The federal Energy Policy Act of 2005 (EPAct 2005) established several goals and standards to reduce energy use in existing and new federal buildings. Executive Order 13423, signed in January 2007, expanded on those goals and standards and was later reaffirmed by congress with the Energy Independence and Security Act of 2007 (EISA 2007). EISA 2007 extended an existing federal energy reduction goal to 30% by fiscal year 2015; directed federal agencies to purchase Energy Star and Federal Energy Management Program (FEMP)-designated products; and required new federal buildings to be built 30% below American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) standards or the International Energy Conservation Code (IECC)[17].

Several Executive Orders, signed under previous administrations created certain requirements aimed at increasing the sustainability of all federal agencies. An Executive Order signed in March 2015 (13693) revoked the prior Executive Orders, and an Executive Order signed in May 2018 (13834) revoked that Executive Order. The May 2018 Executive Order references the statutory requirements and directs Federal agencies to manage their buildings, vehicles, and overall operations to optimize energy and environmental performance, reduce waste, and cut costs.

Interconnection Standards for Small Generators:

Through its Orders 792 and 792-A, the Federal Energy Regulatory Commission (FERC) adopted new "small generator" interconnection standards for distributed energy resources up to 20 megawatts (MW) in capacity in November 2013 and September 2014, respectively. These standards made revisions to those promulgated by FERC in May

[17] PUBL140.PS (congress.gov)

2005 through its Order 2006. The FERC's standards apply only to facilities subject to the jurisdiction of the commission; these facilities mostly include those that interconnect at the transmission level.

Given that purely intra-state distribution grids are generally considered to not be in "interstate commerce", the FERC's standards generally do not apply to distribution-level interconnection, which is regulated by state public utilities commissions. However, FERC's standard tends to serve as a guidepost for a number of state-level standards.

Natural Gas Act - 15 U.S.C. §717 et seq. (1938):

This statute gave the Federal Power Commission (now FERC) the authority to set 'just and reasonable rates' for the sale or transmission of natural gas in interstate commerce. The statute gave the agency the authority to grant certificates allowing construction and operation of facilities used in interstate gas transmission, to authorize the provision of services, and to allow pipeline companies to charge customers for some of the expenses incurred in pipeline construction and operation. The statute also required the agency to approve abandonment of any pipeline facility or services.

Clean Air Act - 42 U.S.C. §7401 et seq. (1970):

This statute authorizes the EPA to establish national air quality standards to protect public health and public welfare and allows the EPA to regulate air emissions from stationary and mobile sources. Specifically, Section 112 regulates emissions of hazardous air pollutants and establishes emission standards that require the maximum degree of reduction in emissions of hazardous air pollutants (Maximum Achievable Control Technology standards).

National Environmental Policy Act - 42 U.S.C. §4332 et seq. (1969):

This statute requires federal agencies to incorporate environmental considerations in the planning and decision-making process of the agency. As a result of this statute, all federal agencies are required to prepare detailed statements that assess the environmental impact of, and alternatives to, any major federal measures that significantly affect the environment.

Coastal Zone Management Act - 16 U.S.C. §1451 et seq. (1972):

This statute is administered by the National Oceanic and Atmospheric Administration, and the statute provides for the management of the nation's coastal resources, including the Great Lakes. The statutory goal is to "preserve, protect, develop, and where possible, to restore or enhance the resources of the nation's coastal zone."

Federal Energy Regulatory Commission - 42 U.S.C. §7171 et seq. (1977):

The Department of Energy Reorganization Act of 1977 created and defined the FERC, which regulates the interstate transmission of electricity, natural gas, and oil. FERC also reviews proposals to build liquefied natural gas terminals and interstate natural gas pipelines as well as licensing of hydropower projects.

Nuclear Regulatory Commission - 42 U.S.C. §5801 et seq. (1974):

The Energy Reorganization Act of 1974 established the NRC that is responsible for formulating policies and regulations governing nuclear reactors and materials safety, issuing orders to licensees, and adjudicating legal matters. As part of this regulatory process, the NRC has four regional offices that conduct inspection, enforcement, and emergency response programs for licensees within their region.

National Energy Conservation Policy Act – 42 U.S.C. §8251 et seq. (1978):

Originally, this Act directed the DOE to set minimum energy performance standards to replace the standards set by the Energy Policy and Conservation Act in 1975. An amendment to this Act changed the standards from voluntary to mandatory, and these standards preempted state standards. Under this Act, DOE issues notices and rules related to federal energy management including new federal, commercial, and residential buildings; federal procurement of energy efficient products; and federal fleet management.

Energy Independence and Security Act of 2007 addressed key energy issues including clean, renewable fuels; energy efficiency of products, buildings, and vehicles; and vehicle-fuel economy.

Energy Policy Act of 2005 addressed key energy issues including energy efficiency; renewable energy; oil and gas; coal; tribal energy; nuclear matters and security; vehicles and motor fuels, including ethanol; hydrogen; electricity; energy tax incentives; hydropower and geothermal energy.

Energy Policy Act of 1992 addressed key issues including clean and renewable energy incentives; EE; and alternative-fuel vehicles.

Natural Gas Policy Act of 1978 addressed key issues including 1) setting maximum prices for wellhead sale of natural gas and 2) approving the transportation of natural gas by an interstate pipeline on behalf of intrastate pipelines and local distribution companies.

Public Utility Regulatory Policies Act of 1978 addressed key issues including conservation of electric energy, wholesale distribution of electric energy, and reliability of electric service.

Federal Tax Credits/Financial Incentives

NAME	POLICY / INVENTIVE TYPE	SUMMARY	MORE INFORMATION
Business Energy Investment Tax Credit (ITC)	Corporate Tax Credit	The federal Business Energy Investment Tax Credit (ITC) has been amended several times, most recently in December 2015. The table in the link shows the value of the investment tax credit for each technology by year. The expiration date for solar technologies and wind is based on when construction begins. For all other technologies, the expiration date is based on when the system is placed in service (fully installed and being used for its intended purpose).	https://programs.dsireusa.org/system/program/detail/658
Federal Renewable Electricity Production Tax Credit (PTC)	Corporate Tax Credit	The federal renewable electricity production tax credit (PTC) is an inflation-adjusted per-kilowatt-hour (kWh) tax credit for electricity generated by qualified energy resources and sold by the taxpayer to an unrelated person during the taxable year. The duration of the credit is 10 years after the date the facility is placed in service.	https://programs.dsireusa.org/system/program/detail/734
Energy Efficient Commercial Buildings Tax Deduction	Corporate Tax Credit	A tax deduction of $1.80 per square foot is available to owners of new or existing buildings who install: (1) interior lighting; (2) building envelope; or (3) heating, cooling, ventilation, or hot water systems that reduce the building's total energy and power cost by 50% or more in comparison to a building meeting minimum	https://www.energy.gov/eere/buildings/179d-commercial-buildings-energy-efficiency-tax-deduction

NAME	POLICY / INVENTIVE TYPE	SUMMARY	MORE INFORMATION
		requirements set by ASHRAE Standard 90.1-2007. Energy savings must be calculated using qualified computer software approved by the IRS. Deductions of $0.60 per square foot are available to owners of buildings in which individual lighting, building envelope, or heating and cooling systems meet target levels that would reasonably contribute to an overall building savings of 50% if additional systems were installed.	
Renewable Electricity Production Tax Credit (PTC)	Corporate Tax Credit	The tax credit amount is $0.015 per kWh in 1993 dollars for some technologies and half of that amount for others. The amount is adjusted for inflation by multiplying the tax credit amount by the inflation adjustment factor for the calendar year in which the sale occurs, rounded to the nearest 0.1 cents. The Internal Revenue Service (IRS) publishes the inflation adjustment factor no later than April 1 each year in the Federal Register. For 2015, the inflation adjustment factor used by the IRS is 1.5336. Applying the inflation adjustment factor for the 2014 calendar year, as published in the IRS Notice 2015-20, the production tax credit amount is as follows: $0.023/kWh for wind, closed-loop biomass, and geothermal energy resources; $0.012/kWh for open loop biomass, landfill gas, municipal solid waste, qualified	https://programs.dsireusa.org/system/program/detail/734

NAME	POLICY / INVENTIVE TYPE	SUMMARY	MORE INFORMATION
		hydroelectric, and marine and hydrokinetic energy resources.	
Federal Energy Policy Act of 2005	Corporate Tax Deduction	The federal Energy Policy Act of 2005 established a tax deduction for energy-efficient commercial buildings applicable to qualifying systems and buildings placed in service from January 1, 2006, through December 31, 2007. This deduction was subsequently extended several times and is now permanent.	https://www.energy.gov/articles/energy-policy-act-2005
United States Department of Agriculture (USDA) High Energy Cost Grant	Grant Program	The USDA offers an ongoing grant program for the improvement of energy generation, transmission, and distribution facilities in rural communities.	http://www.rd.usda.gov/programs-services/high-energy-cost-grants

Federal Programs

DEPARTMENT OF ENERGY – GRID RESILIENCE AND INNOVATION PARTNERSHIP PROGRAM	
Funding	
Program Funding	$5 billion
Applicant Funding	$1 billion per year annually 2022 - 2026
Match Required	At least 50% from applicants
Schedule	
Notice of Funding	Fall 2024 (Anticipated)
Submission Due	Spring 2025 (Anticipated)
Required Coordination	None
Eligibility	
Applicant	Eligible applicants defined by the statute include electric grid operators, electricity generators, electricity storage operators, transmission owners or operators, distribution providers, fuel suppliers, and other relevant entities, as determined by the Secretary.
Project	To coordinate and collaborate with electric sector owners and operators—(A) to demonstrate innovative approaches to transmission, storage, and distribution infrastructure to harden and enhance resilience and reliability; and (B) to demonstrate new approaches to enhance regional grid resilience, implemented through States by public and rural electric cooperative entities on a cost-shared basis.
More Information	https://www.energy.gov/gdo/grid-innovation-program

DEPARTMENT OF ENERGY – GRID RESILIENCE UTILITY AND INDUSTRY GRANTS (GRIP TOPIC AREA 1)	
Funding	
Program Funding	$2.5 billion
Applicant Funding	$500 Million per year FY 22 - 26
Match Required	Funding is capped at the amount the eligible entity has spent in the previous three years on hardening efforts. There is a 100% cost match for this program.
Schedule	
Notice of Funding	Fall 2024 (Anticipated)
Submission Due	Spring 2025 (Anticipated)
Required Coordination	None
Eligibility	
Applicant	Eligible applicants are: electric grid operators, electricity storage operators, electricity generators, transmission owners or operators, distribution providers and fuel suppliers.
Project	Grid Resilience Utility and Industry Grants support activities that will modernize the electric grid to reduce impacts from extreme weather and natural disasters. This grant program will fund comprehensive transformational transmission and distribution technology solutions that will mitigate weather hazards across a region or within a community including wildfires, floods, hurricanes, extreme heat, extreme cold, and extreme weather events that can cause a disruption to the power system
More Information	https://www.energy.gov/gdo/grid-resilience-utility-and-industry-grants

DEPARTMENT OF ENERGY – SMART GRID GRANTS (DOE GRIP TOPIC AREA 2)	
Funding	
Program Funding	$3 billion
Applicant Funding	$600 million/year for Fiscal Years 2022-2026
Match Required	Recipients must provide a cost-share of at least 50% of the grant.
Schedule	
Notice of Funding	Fall 2024 (Anticipated)
Submission Due	Spring 2025 (Anticipated)
Required Coordination	None
Eligibility	
Applicant	Eligible applicants are: For-profit entities, Non-profit entities, State and local governmental entities, Tribal nations, and Institutions of higher education
Project	The Smart Grid Grants (40107) are designed to increase the flexibility, efficiency, and reliability of the electric power system, with particular focus on: increasing capacity of the transmission system, preventing faults that may lead to wildfires or other system disturbances, integrating renewable energy at the transmission and distribution levels, and facilitating the integration of increasing electrified vehicles, buildings, and other grid-edge devices.
More Information	https://www.energy.gov/gdo/smart-grid-grants

DEPARTMENT OF ENERGY – GRID INNOVATION PROGRAM (DOE GRIP TOPIC AREA 3)	
Funding	
Program Funding	$5 billion
Applicant Funding	$1 billion/year for Fiscal Years 2022-2026
Match Required	Recipients must provide a cost-share of at least 50% of the grant.
Schedule	
Notice of Funding	Fall 2024 (Anticipated)
Submission Due	Spring 2025 (Anticipated)
Required Coordination	None; however, DOE encourages eligible entities to collaborate with electric sector owners and operators to deploy projects.
Eligibility	
Applicant	Eligible applicants are: States (individual or combined), Tribes and Territories, Local governments, and public utility commissions
Project	The Grid Innovation Program supports projects that use innovative approaches to transmission, storage, and distribution infrastructure to enhance grid resilience and reliability. Projects selected under this program will include interregional transmission projects, investments that accelerate interconnection of clean energy generation, and utilization of distribution grid assets to provide backup power and reduce transmission requirements. Innovative approaches can range from use of advanced technologies to innovative partnerships to the deployment of projects identified by innovative planning processes.
More Information	https://www.energy.gov/gdo/grid-innovation-program

DEPARTMENT OF ENERGY – CARBON DIOXIDE TRANSPORTATION INFRASTRUCTURE – DEPARTMENT OF ENERGY	
Funding	
Program Funding	$2.1 billion
Applicant Funding	$2.1 billion will be appropriated to DOE in annual increments between 2022 - 2026
Match Required	At least 20% from applicants
Eligibility	
Applicant	Commercial, Industrial, Local Government, Nonprofit, Schools, State Government, Agricultural, Institutional
Project	An eligible project must be a large-capacity common carrier CO2 transportation infrastructure project over $100 million in project costs that transports CO2 captured from anthropogenic sources and/or ambient air by pipeline, shipping, rail, or other methods for storage and/or use.
More Information	CARBON DIOXIDE TRANSPORTATION INFRASTRUCTURE | Department of Energy

DEPARTMENT OF ENERGY LOAN GUARANTEE PROGRAMS	
Funding	
Program Funding	$40 Billion
Applicant Funding:	$5 Billion for Energy Infrastructure Reinvestment through September 30, 2026 $3 Billion for Advanced Tech Vehicle Manufacturing through September 30, 2028 $75 Million for Tribal Energy Projects through September 30, 2028
Match Required	None - Eligible for all Title 17 Innovative Clean Energy technology categories
Schedule	
Notice of Funding	N/A
Submission Due	N/A
Required Coordination	Authority to issue Loan Guarantees under the old Section 1703 Program
Eligibility	
Applicant	Commercial, Industrial, Local Government, Nonprofit, Schools, State Government, Agricultural, Institutional
Project	Projects that retool, repower, repurpose, or replace energy infrastructure that has ceased operations, or enable operating energy infrastructure to avoid, reduce, utilize, or sequester air pollutants or anthropogenic emissions of greenhouse gases. Projects that support the manufacture of eligible light-duty vehicles and qualifying components under the Advanced Technology Vehicles Manufacturing Loan Program (ATVM).
More Information	https://www.energy.gov/lpo/loan-programs-office

DEPARTMENT OF ENERGY PREVENTING OUTAGES AND ENHANCING THE RESILIENCE OF THE ELECTRIC GRID	
Funding	
Program Funding	$5B
Applicant Funding	*To be determined*
Match Required	*To be determined*
Schedule	
Notice of Funding	November 2024 (Anticipated)
Submission Due	March 2025 (Anticipated)
Required Coordination	State Coordination
Eligibility	
Applicant	Electric Grid Operators, Electricity Storage Operators, Electricity Generators, Transmission Owners and Operators, Distribution Providers, Fuel Suppliers, States, Tribes
Project	Formula program for eligible entities, States, and Tribes to prevent outages and enhance the resilience of the electric grid. To carry out activities that are supplemental to existing hardening efforts and reduce the risk of power lines causing a wildfire; or reduce the likelihood and consequences of disruptive events.
More Information	https://www.energy.gov/gdo/preventing-outages-and-enhancing-resilience-electric-grid-grants

DEPARTMENT OF ENERGY PROGRAM UPGRADING OUR ELECTRIC GRID AND ENSURING RELIABILITY AND RESILIENCY	
Funding	
Program Funding	$5B
Applicant Funding	*To be determined*
Match Required	20% - 50%
Schedule	
Notice of Funding	Fall 2023 (Anticipated)
Submission Due	Summer 2024 (Anticipated)
Required Coordination	State Coordination
Eligibility	
Applicant	State, combination of 2 or more States; Native American Tribes; units of local government, and/or public utility commissions.
Project	To provide Federal financial assistance to demonstrate innovative approaches to transmission, storage, and distribution infrastructure to harden and enhance resilience and reliability; and to demonstrate new approaches to enhance regional grid resilience.
More Information	https://www.energy.gov/bil/program-upgrading-our-electric-grid-and-ensuring-reliability-and-resiliency

DEPARTMENT OF ENERGY– INFLATION REDUCTION ACT (IRA): TRANSMISSION FACILITY SITING	
Funding	
Program Funding	$760M
Applicant Funding	*To be determined*
Match Required	50%
Schedule	
Notice of Funding	*To be determined*
Submission Due	*To be determined*
Required Coordination	*To be determined*
Eligibility	
Applicant	Siting authorities, or other state, local, or tribal governmental entities, for economic development activities in communities that may be affected by the construction and operation of these transmission projects.
Project	Award grants to siting authorities and local governments related to a covered transmission project, which is one that is a high-voltage interstate or offshore electricity transmission line that is expected to be constructed or operated. This includes a minimum of 275 kVs of either alternating current or direct-current electric energy, or offshore and a minimum of 200 kV.
More Information	Transmission Siting and Economic Development Grants Program | Department of Energy https://www.energy.gov/sites/default/files/2023-01/IRA%2050152%20Transmission%20Siting%20and%20Economic%20Development%20Grants%20RFI.pdf

DEPARTMENT OF ENERGY – ENERGY EFFICIENCY AND CONSERVATION BLOCK GRANT PROGRAM	
Funding	
Program Funding	$550B
Applicant Funding	$110M
Match Required	*To be determined*
Schedule	
Notice of Funding	July 2024 (Anticipated)
Submission Due	October 2024 (Local Governments) May 2025 (Tribes)
Required Coordination	*To be determined*
Eligibility	
Applicant	States, local governments, and tribes. Cities must have a population of at least 35,000 to apply directly to DOE.
Project	Development and implementation of an energy efficiency and conservation strategy; conducting residential and commercial building energy audits; establishing financial incentive programs for energy efficiency; provide grants for retrofits; conservation of energy in transportation, including development of bike/ped infrastructure and traffic signal improvements.
More Information	https://www.energy.gov/scep/energy-efficiency-and-conservation-block-grant-program

DEPARTMENT OF ENERGY – ENERGY TRANSITIONS INITIATIVE PARTNERSHIP PROJECT (ETIPP) COMMUNITY TECHNICAL ASSISTANCE	
Funding	
Program Funding	Does not provide any funding.
Applicant Funding	$1 billion per year annually 2022 - 2026
Match Required	At least 50% from applicants
Schedule	
Notice of Funding	Fall 2024 (Anticipated)
Submission Due	Spring 2025 (Anticipated)
Required Coordination	None
Eligibility	
Applicant	Must be a remote community and go through a competitive selection process.
Project	The experts that are partnered with the community design and execute a 12-to-18-month technical assistance project that helps to achieve the community's energy resilience goals.
More Information	https://www.energy.gov/eere/about-energy-transitions-initiative-partnership-project

DEPARTMENT OF ENERGY – ENERGY STORAGE DEMONSTRATION AND PILOT GRANT PROGRAM	
Funding	
Program Funding	$355M
Applicant Funding	Available until expended
Match Required	None determined
Schedule	
Notice of Funding	*To be determined*
Submission Due	Spring 2024 (Anticipated)
Required Coordination	*To be determined*
Eligibility	
Applicant	Technology developers and industry, state, local, and tribal governments, community organizations, national laboratories, universities, and utilities
Project	Funding will go toward three energy storage projects that: Improve energy security and emergency response, improve distribution and transmission system reliability and operations, supply energy during peak demand periods, reduce peak loads of end-users, improve advanced power conversion systems, provide ancillary services for grid stability, integrate renewable energy production, increase microgrid feasibility, support stored energy for natural gas systems and other industrial processes besides electricity, integrate electric vehicle charging, improve energy efficiency.
More Information	https://www.energy.gov/oced/energy-storage-demonstration-and-pilot-grant-program

DEPARTMENT OF ENERGY – ENERGY IMPROVEMENTS IN RURAL OR REMOTE AREAS (ERA)	
Funding	
Program Funding	$1B
Applicant Funding	$200M annual from 2022 through 2026 until expended.
Match Required	None
Schedule	
Notice of Funding	*To be determined*
Submission Due	Deadline for $50M grant funding issued May 2023: October 2023 Deadline for $300M funding issued March 2023: August 2023
Required Coordination	Grant terms and conditions; federal requirements under 2 CFR Part 200 and 910.
Eligibility	
Applicant	Higher education institutes, non-profit and for-profit organizations, state, local, and tribal governments, and incorporated or unincorporated consortia. Funding should be used in communities with 10,000 people or fewer.
Project	Projects that seek to improve the reliability, resilience, and affordability of energy systems. This includes: siting and upgrading transmission and distribution lines, reducing greenhouse gas emissions by energy generation in rural areas, modernizing or providing electricity generation, microgrid development, and energy efficiency improvements.
More Information	https://www.energy.gov/oced/energy-improvements-rural-or-remote-areas-0

FEDERAL EMERGENCY MANAGEMENT AGENCY BUILDING RESILIENT INFRASTRUCTURE AND COMMUNITIES	
Funding	
Program Funding	$2.295B
Applicant Funding	N/A, program is for technical assistance, not monetary
Match Required	N/A
Schedule	
Notice of Funding	To be determined
Submission Due	To be determined
Required Coordination	Upon selection, communities will work with FEMA to develop technical assistance plans.
Eligibility	
Applicant	Cities, towns/townships, parishes, boroughs, counties, special district governments, and federally recognized tribal governments. Groups of at least two communities that fit these descriptions are also eligible.
Project	Assistance must be for climate resilience planning and can include: community engagement, partnership development, grant writing, environmental review, and budget development examples. Communities must at least be noted in Executive Order 14008, have a CDC Social Vulnerability Index of at least 0.6, qualify as an economically disadvantaged rural community, show a compelling need, or not have received BRIC, HMGP, FMA, or PDM funding in the last five years.
More Information	https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities/direct-technical-assistance

FEDERAL EMERGENCY MANAGEMENT AGENCY FLOOD MITIGATION ASSISTANCE	
Funding	
Program Funding	$400 million
Applicant Funding	The updated values for use of pre-calculated benefits to determine cost effectiveness of elevations and acquisitions in the SFHA are $323,000 per structure for acquisitions and $205,000 per structure for Elevations (and Mitigation Reconstruction). FEMA has determined that the acquisition of a structure designated as Repetitive Loss or Severe Repetitive Loss, regardless of location within or outside of the Special Flood Hazard Area, with total project costs less than or equal to $323,000 is considered cost-effective. As such, FEMA has expanded the use of pre-calculated benefits to include acquisition projects of RL and SRL properties outside the Special Flood Hazard Area with a project cost less than or equal to the existing calculated threshold of $323,000.
Match Required	Generally, federal cost share funding is available for up to 75% of the eligible activity costs. However, based on Flood Mitigation Assistance funding allocated from the BIL, FEMA may contribute up to 90% federal cost share for eligible costs for a property that has National Flood Insurance Program insurance and is located within a census tract with a Centers for Disease Control and Prevention (CDC) Social Vulnerability Index (SVI) not less than 0.5001.
Schedule	
Notice of Funding	October 2024 (Anticipated)
Submission Due	January 2025 (Anticipated)
Required Coordination	N/A
Eligibility	
Applicant	States, local communities, federally recognized tribes and territories.
Project	Individual Flood Mitigation Projects are one of three program priorities for the Fiscal Year 2022 grant application cycle. These projects mitigate the risk of flooding to individual National Flood Insurance Program (NFIP) insured buildings. Out of $800 million in total funding for Fiscal Year 2022, FEMA will select at least $400 million for the federal cost share funding of Individual Flood Mitigation Projects.
More Information	https://www.fema.gov/grants/mitigation/floods

FEDERAL EMERGENCY MANAGEMENT AGENCY HAZARD MITIGATION GRANT PROGRAM	
Funding	
Program Funding	A Presidential major disaster declaration makes HMGP funds available.
Applicant Funding	Funding is based on the estimated total or aggregate cost of disaster assistance: Up to 15% of the first $2 billion Up to 10% for amounts between $2 billion and $10 billion Up to 7.5% for amounts between $10 billion and $35.333 billion States with enhanced mitigation plans: up to 20%, not to exceed $35.333 billion.
Match Required	Generally, the cost share is 75% federal and 25% non-federal funding. The 25% can come from the state or local government, an individual, construction labor, Increased Cost of Compliance (ICC) funds from a flood insurance policy, or Small Business Administration loans. Check with your respective community, state, or tribe to determine your specific cost-share requirements.
Schedule	
Notice of Funding	N/A
Submission Due	N/A
Required Coordination	Following a hazard event, states, local governments, federally recognized tribes and territories are required to perform a joint preliminary disaster assessment of the impacted area with FEMA. This helps determine if a major disaster declaration is warranted and the amount and type of federal assistance needed. The PDA also helps to identify potential mitigation opportunities for FEMA funding.
Eligibility	
Applicant	All state, local, tribal, and territorial governments must develop and adopt hazard mitigation plans to receive funding for their hazard mitigation projects.

Project	FEMA's Hazard Mitigation Grant Program provides funding to state, local, tribal and territorial governments so they can develop hazard mitigation plans and rebuild in a way that reduces, or mitigates, future disaster losses in their communities. When requested by an authorized representative, this grant funding is available after a presidentially declared disaster.
More Information	https://www.fema.gov/grants/mitigation/hazard-mitigation#reduce-risk

FEDERAL EMERGENCY MANAGEMENT AGENCY SAFEGUARDING TOMORROW REVOLVING LOAN PROGRAM	
Funding	
Program Funding	$500 million over five years
Applicant Funding	FEMA is making $50 million available to eligible entities to establish revolving loan funds. FEMA has considered the administrative burden on entities and anticipates making available no less than $5.1 million per capitalization grant application selected for funding with this first funding opportunity.
Match Required	Capitalization grant recipients must deposit an amount that is at least 10% of the amount of the grant into the loan fund, as a condition of receiving funding. On or before the date on which the capitalization grant is received, entities must contribute to the entity loan fund an amount equal to at least 10% of the capitalization grant. If an entity contributes less than 10%, FEMA will reduce the amount of the capitalization grant to whatever amount is 10 times that of what the entity contributes.
Schedule	
Notice of Funding	February 2025 (Anticipated)
Submission Due	April 2025 (Anticipated)
Required Coordination	N/A
Eligibility	
Applicant	States Federally recognized tribes that received a major disaster declaration pursuant to Section 401 of the Stafford Act Puerto Rico, the U.S. Virgin Islands, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, and the District of Columbia
Project	The Safeguarding Tomorrow through Ongoing Risk Mitigation (STORM) Act became law on Jan. 1, 2021 and authorizes FEMA to provide capitalization grants to states, eligible federally recognized tribes, territories and the District of Columbia to establish revolving loan funds that provide hazard mitigation assistance for local governments to reduce risks from natural hazards and disasters. The Act amends the Robert T. Stafford Disaster Relief and Emergency Assistance Act.

	These low interest loans will allow jurisdictions to reduce vulnerability to natural disasters, foster greater community resilience and reduce disaster suffering.
More Information	https://www.fema.gov/grants/mitigation/storm-rlf

FEDERAL EMERGENCY MANAGEMENT AGENCY HOMELAND SECURITY GRANT PROGRAM	
Funding	
Program Funding	$1.12B State Homeland Security Program: $415 million Urban Area Security Initiative: $615 million Operation Stonegarden: $90 million
Applicant Funding	State Administrative Agencies (SAAs) are required to pass-through at least 80% of SHSP and UASI funding to local or tribal units of government.
Match Required	None
Schedule	
Notice of Funding	May 2025 (Anticipated)
Submission Due	June 2025 (Anticipated)
Required Coordination	Local governments must apply through their state
Eligibility	
Applicant	The State Administrative Agency is the only entity eligible to submit HSGP applications to FEMA, including those applications submitted on behalf of UASI and OPSG applicants. All 56 states and territories, which includes any state of the United States, the District of Columbia, the Commonwealth of Puerto Rico, the U.S. Virgin Islands, Guam, American Samoa, and the Commonwealth of the Northern Mariana Islands, are eligible to apply for SHSP funds.

Project	In FY22, there are three components of the HSGP: State Homeland Security Program to support state and local governments to build, sustain, and deliver capabilities necessary to prevent, prepare for, protect against, and respond to acts of terrorism; Urban Area Security Initiative for pre identified high-threat, high density urban areas; and Operation Stonegarden for border protection.
More Information	https://www.fema.gov/grants/preparedness/homeland-security

DEPARTMENT OF HOMELAND SECURITY STATE AND LOCAL CYBERSECURITY GRANT PROGRAM

Funding

Program Funding	National program appropriations through FY25 FY2022: $200,000,000 FY2023: $400,000,000 FY2024: $300,000,000 FY2025: $100,000,000
Applicant Funding	Allocations for states and territories include a base funding level as defined for each entity: 1% for each state, the District of Columbia, and Puerto Rico; and 0.25% for American Samoa, the Commonwealth of the Northern Mariana Islands, Guam, and the U.S. Virgin Islands. State allocations include additional funds based on a combination of state population and rural population totals. 80% of total state allocations must support local entities, while 25% of the total state allocations must support rural entities; these amounts may overlap.
Match Required	Eligible entities applying as a single entity must meet a 10% non-federal cost-share requirement for the FY 2022 SLCGP. The recipient contribution can be cash (hard match) or third-party in-kind (soft match). Eligible applicants shall agree to make available non-federal funds to carry out an SLCGP award in an amount not less than 10% of the total project cost. In other words, the federal share applied toward the SLCGP budget at the project/activity level shall not exceed 90% of the total budget as submitted in the application and approved in the award. If the total project ends up costing more, the recipient is responsible for any additional costs. If the total project ends up costing less, the recipient may owe FEMA an amount required to ensure that the federal cost share is not in excess of 90%.

Schedule

Notice of Funding	September 2024 (Anticipated)
Submission Due	November 202 (Anticipated)
Required Coordination	States must pass down at least 80 percent of the funds they receive to local governments within their jurisdiction. 25 percent of funds must go to projects in rural areas.
Eligibility	
Applicant	All 56 states and territories, including any state of the United States, the District of Columbia Puerto Rico, American Samoa, and the Commonwealth of the Northern Mariana Islands, Guam, and the U.S. Virgin Islands, are eligible to apply for SLCGP funds. The designated State Administrative Agency (SAA) for each state and territory is the only entity eligible to apply for SLCGP funding.
Project	The goal of the State and Local Cybersecurity Grant Program (SLCGP) is to help states, local governments, rural areas, and territories address cybersecurity risks and cybersecurity threats to information systems. The program enables DHS to make targeted cybersecurity investments in state, local and territorial government agencies, thus improving the security of critical infrastructure and resilience of the services that state, local, and territorial governments provide to their communities.
More Information	https://www.fema.gov/fact-sheet/fiscal-year-2022-state-and-local-cybersecurity-grant-program-fact-sheet

U.S. DEPARTMENT OF AGRICULTURE HIGH ENERGY COST GRANT	
Funding	
Program Funding	$10 Million
Applicant Funding:	$100,000 - $3,000,000
Match Required	None
Schedule	
Notice of Funding	May 2024 (Anticipated)

Submission Due	July 2024 (Anticipated)
Required Coordination	N/A
Eligibility	
Applicant	Commercial, Industrial, Local Government, Nonprofit, Residential, Schools, State Government, Tribal Government, Institutional
Project	Electric generation, transmission, and distribution facilities; Natural gas or petroleum storage or distribution facilities Renewable energy facilities used for on-grid or off-grid electric power generation, water or space heating, or process heating and power; Backup up or emergency power generation or energy storage equipment; and Weatherization of residential and community property, or other energy efficiency or conservation programs.
More Information	https://www.rd.usda.gov/programs-services/electric-programs/high-energy-cost-grants

ENVIRONMENTAL PROTECTION AGENCY METHANE EMISSIONS REDUCTION PROGRAM	
Funding	
Program Funding	$850M
Applicant Funding	*To be determined*
Match Required	None
Schedule	
Notice of Funding	*To be determined*
Submission Due	*To be determined*

Required Coordination	*To be determined*
Eligibility	
Applicant	Eligible recipients for these funds include but are not limited to air pollution control agencies, other public or nonprofit private agencies, institutions, organizations, and individuals.
Project	Financial assistance is available for the following project types: • Reducing methane and other greenhouse gas emissions from petroleum and natural gas systems • Mitigating legacy air pollution from petroleum and natural gas systems • Improving climate resiliency of communities and petroleum and natural gas systems • Improving and deploying industrial equipment and processes that reduce methane and other greenhouse gas emissions and waste • Supporting innovation in reducing methane and other greenhouse gas emissions and waste from petroleum and natural gas • Shutting in and plugging wells on non-Federal lands permanently • Mitigating health effects of methane and other gas emissions • Supporting environmental restoration
More Information	https://www.epa.gov/inflation-reduction-act/methane-emissions-reduction-program

State Policies

§ 45.2-1710. Development of the Virginia Energy Plan

The Division, in collaboration with various stakeholders, is tasked with preparing a comprehensive Virginia Energy Plan to achieve a net-zero carbon energy economy across all sectors by 2045. The Plan includes projections of energy consumption, analyses of electricity generation, transmission, and distribution resources, siting requirements, fuel diversity, energy efficiency, regional initiatives, and the impact of energy development on disadvantaged communities. It also considers regulations for reducing carbon dioxide emissions, inventories of greenhouse gas emissions, data on electric vehicles, and the infrastructure needed for the 2045 net-zero carbon target in the transportation sector. The Plan uses state geographic information systems to assess the impact of recommendations on natural resources and assigns numerical scores to parcels of real property based on their suitability for wind or solar energy facilities. The Division analyzes the suitability of parcels recommended for wind or solar energy facilities and assigns them a numerical score. The Plan is updated every four years, with interim updates provided in the third year of each Governor's administration. The updates specify progress towards each proposed action of the Plan and reassess energy conservation goals based on progress to date and lessons learned. The Plan also includes a section on energy policy positions relevant to potential regulations for reducing carbon dioxide emissions from fossil fuel-fired electric generating units. Code of Virginia Article 4

Virginia Clean Economy Act

The VCEA, passed in 2020, transformed the Commonwealth's energy policy by introducing binding energy efficiency and renewable standards, emission reduction standards, and retirement deadlines for fossil-fired power plants. This initiated Virginia's transition towards a zero-carbon electric grid. The VCEA expanded the use of distributed generation and third-party owned renewables, increasing competition and customer choice. It also set ambitious targets for energy storage and offshore wind. The VCEA is central to decarbonizing Virginia's electric grid, reducing emissions from power plants, and combating climate change. It is also crucial for economic recovery post-COVID-19, potentially creating over 13,000 jobs annually in advanced energy and attracting millions in new investment and tax revenue. The VCEA aims to transition Virginia to a 100% clean grid while ensuring affordable electricity and empowering consumers. It proposes several ways to strengthen the VCEA, including accelerating clean energy transition, ensuring affordable electricity, and empowering consumers. These proposals involve ramping up the Renewable Portfolio Standard (RPS), bolstering energy storage, tightening emissions regulations, extending the Energy Efficiency Resource Standard (EERS), raising the share of third-party owned renewables, supporting full Percentage of Income Payment Program (PIPP) implementation, expanding the distributed generation carve-out, increasing Power Purchase Agreement (PPA) access, and encouraging behind-the-meter storage. Virginia Clean Economy Act

VA. Code § 56-592 Fuel Mix and Emissions Disclosure

Virginia's 1999 electric industry restructuring law requires the state's electricity providers to disclose -- "to the extent feasible" -- fuel mix and emissions data regarding electric generation. Legislation in 2007 and 2008 related to Electric Utility Regulation amended the restructuring laws, but still require emissions and fuel mix disclosure. Information must be provided to

customers and to the Virginia State Corporation Commission (SCC) at least once annually. If any portion of this information is unavailable, the electricity provider must file a report with the SCC explaining why that information is not available. The House Bill enacted in March 2016 requires the Commission to post the information of electric competitive service providers that offer renewable energy on the Commission website. Each utility will also provide information about purchase options of renewable energy offered by the utility on its website. 56-592 Virginia Law

§ 56-594. Interconnection Standards for Net Metering

These rules apply to residential customers with generation facilities up to 20 kW and non-residential systems up to 1,000 kW. Utilities that have enrolled 1% of their peak load for the previous year are not required to allow additional customers to net meter. Customer-generators with systems that meet major national safety and equipment standards are not required to install additional safety equipment. However, a utility's net metering tariff may require the installation of a manual, external disconnect switch. Customer-generators must notify and receive approval from the EDC and the energy service provider prior to installation. The application for interconnection is automatically approved if the utility does not respond within 30 days for residential customers and 60 days for nonresidential customers. In May 2009, Virginia's State Corporation Commission (SCC) adopted interconnection procedures for systems that are not net-metered. These rules apply to all electric utilities operating in Virginia. The interconnection procedures set three tiers of review for interconnection requests for all eligible technologies and systems up to 20 MW. Fees for interconnection requests increase with each Level. The process for each level differs; Level 1 requests require an evaluation and no additional studies. Level 2 requests require an initial review and possibly a supplemental review and/or modifications. Level 3 requests may include a scoping meeting, a feasibility study, system impact study, and facilities study. Regardless of the size or tier in which the facility is evaluated, it is the utility's discretion whether or not an external disconnect switch is required. Depending on the size of the small generator facility, insurance requirements differ. The SCC revised the interconnection rules for non-net metered systems in 2018, adopting several changes .56-594 Virginia Law

§ 56-577 Mandatory Utility Green Power Option

Virginia passed legislation (S.B. 1416) in April 2007 that includes a provision that electricity customers in Virginia have the option to purchase 100% renewable energy from their utility. If their utility does not offer a program that meets the 100% renewable energy requirement, its customers will be permitted to purchase green power from any licensed retail supplier. 56-577 Virginia Law

Virginia Renewable Portfolio Standard

In April 2020, Virginia's legislature passed H.B. 1526, which requires, among other things, the development of renewable portfolio standards for electric utilities and suppliers. Virginia's Renewable Portfolio Standard (RPS) requires Phase II Utilities to generate 100% of their power from renewable sources by 2045. The RPS requires Phase I Utilities to generate 100% of their power from renewable sources by 2050.

State Tax Credits/Financial Incentives

NAME	POLICY/ INCENTIVE TYPE	SUMMARY	MORE INFORMATION
Energy Efficient Buildings	Tax Exemption	This statute allows any county, city, or town to exempt or partially exempt energy efficient buildings from local property taxes. Eligible buildings are those that: Exceed the energy efficiency standards prescribed in the Virginia Uniform Statewide Building Code by 30 percent; Meets or exceeds performance standards of the Green Globes Green Building Rating System of the Green Building Initiative; Meets or exceeds performance standards of the Leadership in Energy and Environmental Design (LEED) Green Building Rating System of the U.S. Green Building Council; Meets or exceeds performance standards or guidelines under the EarthCraft House Program; or is an Energy Star qualified home	https://www.deq.virginia.gov/our-programs/pollution-prevention/virginia-information-source-for-energy/programs-and-financial-incentives
Energy Efficient Home	Tax Credit	This legislation significantly expands the 25C tax credit, now called the Energy Efficient Home Improvement Credit, and extends it for 10 years. Homeowners can receive a tax credit equal to 30 percent of the cost of all eligible energy efficient home improvements made during the year. The annual amount homeowners can claim for heat pumps, heat pump water heaters or biomass stoves is capped at $2,000. Upgrade costs eligible for the credit can include equipment, installation and labor costs. Homeowners can also claim up to $1,200 for other energy-efficient improvements including up to: $150 for a home energy audit, $250 for a new exterior door ($500 total for all exterior doors), $600 for new exterior windows and skylights, $1,200 for insulation and $600 for an upgraded electrical panel.	https://energy.virginia.gov/energy-efficiency/Available-Tax-Credits.shtml

Solar Energy Equipment	Tax Exemption	This statute allows any county, city, or town to exempt or partially exempt solar energy equipment from local property taxes. Eligible technologies include passive solar space heat, active solar water heat, active solar space heat, solar thermal electricity, and photovoltaics. Certified solar energy items are defined as any "property, including real and personal property, equipment, facilities and devices that use solar energy that would otherwise require a conventional source of energy.	https://www.deq.virginia.gov/our-programs/pollution-prevention/virginia-information-source-for-energy/programs-and-financial-incentives
Wood, Alternative Energy, or Cogeneration	Tax Exemption	This statute allows any county, city, or town to exempt or partially exempt generating equipment that is used to convert from oil or natural gas to wood, wood waste, or any alternative energy source for manufacturing, or any cogeneration equipment, from local property taxes.	https://www.deq.virginia.gov/our-programs/pollution-prevention/virginia-information-source-for-energy/programs-and-financial-incentives
Net Metering	Financial Incentive	Net metering is a billing mechanism that credits consumers who generate their own electricity. These consumers are billed for their net energy use. This is a financial incentive but does not fall under a grant or tax incentive. Virginia's current net metering law covers residential systems up to 10 kW and commercial systems up to 500 kW. Eligible technologies include solar, wind and hydropower systems intended primarily to offset part or all of a customer's requirements for electricity. Enrollment is open on a first-come, first-serve basis until the rated generating capacity owned and operated by customer-generators in the state reaches one percent of each EDC's peak load for the previous year.	https://www.deq.virginia.gov/our-programs/pollution-prevention/virginia-information-source-for-energy/programs-and-financial-incentives

State Programs

WEATHERIZATION ASSISTANCE PROGRAM (WAP)	
Eligibility	
Applicant	Low-income households with high utility bills.
Project	The Weatherization Assistance Program (WAP) reduces household energy use through the installation of cost-effective energy savings measures, which also improve resident health and safety. Common measures including sealing air leaks, adding insulation, and repairing heating and cooling systems.
More Information	https://www.dhcd.virginia.gov/wx

SMALL BUSINESS & NON-PROFIT LOAN PROGRAM	
Eligibility	
Applicant	Small businesses
Project	Virginia Small Business Financing Authority provides financing for wind and solar projects to small businesses and nonprofits.
More Information	https://sbsd.virginia.gov/virginia-small-business-financing-authority/

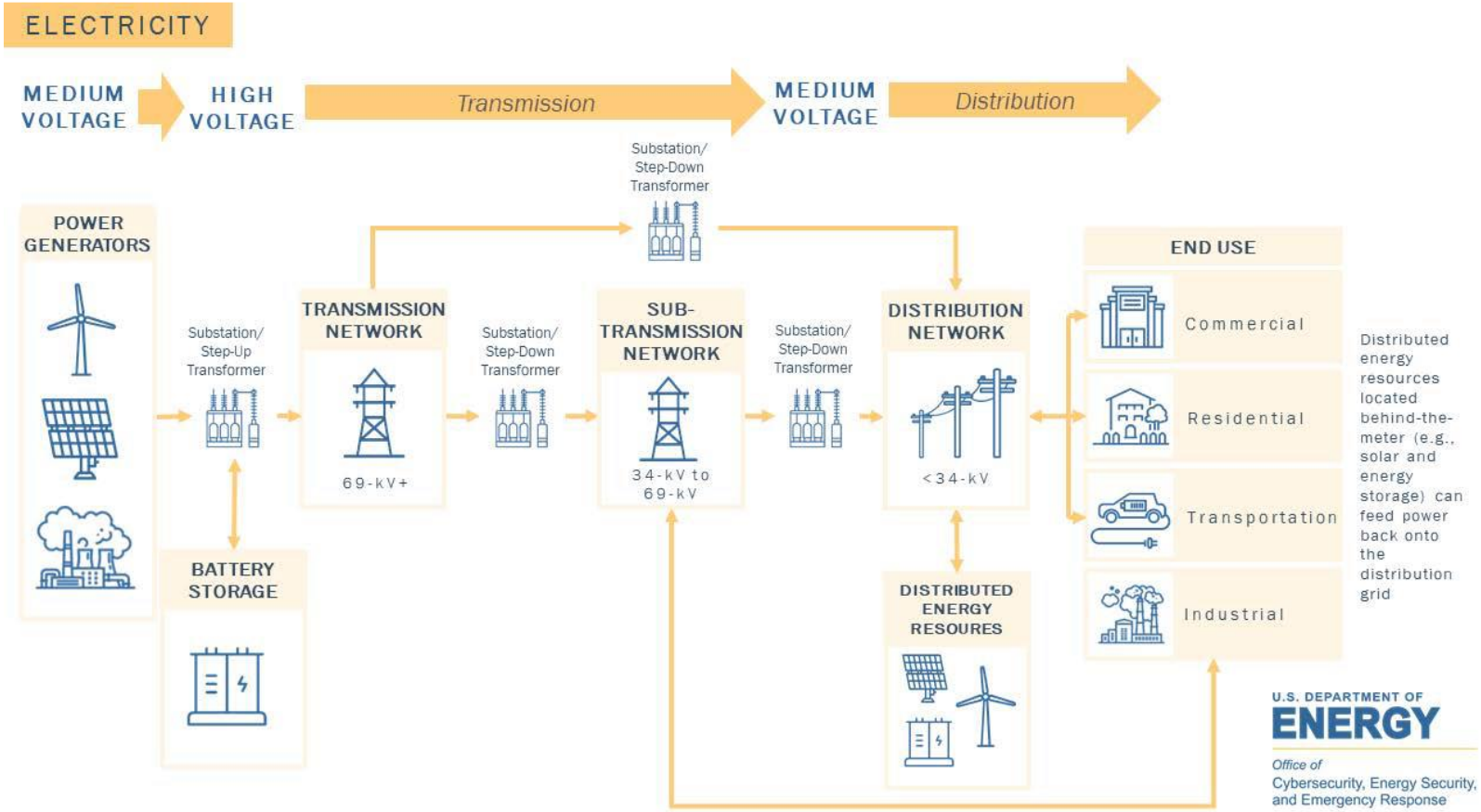
APPENDIX G: Acronyms

The table below provides a list of most acronyms included in this plan.

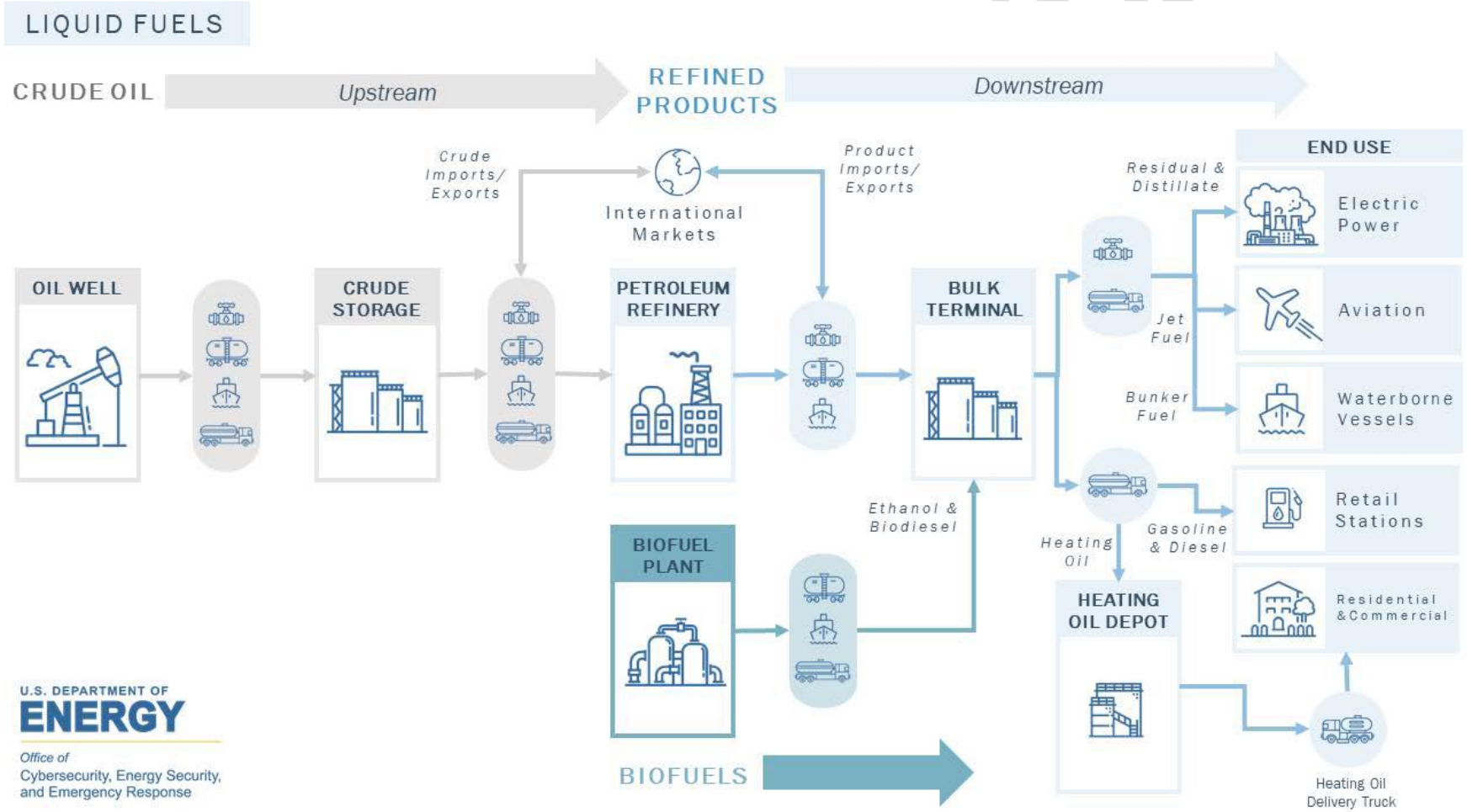
ACRONYM/ TERM	DESCRIPTION
AAR	After Action Review
ANL	Argonne National Laboratory
APPA	American Public Power Association
CESER	Office of Cybersecurity, Energy Security, and Emergency Response
CHP	Combined Heat and Power
COVEOP	Commonwealth of Virginia Emergency Operations Plan
DOE	U.S. Department of Energy
EEAC	State Energy Emergency Assurance Coordinators
EDC	Electric Distribution Company
EIA	Energy Information Administration
EOC	Emergency Operations Center
ESF	Emergency Support Function
ESP	Energy Security Plan
FEMA	Federal Emergency Management Agency
ICS	Industrial Control Systems
IOU	Investor-Owned Utility
IPP	Independent Power Producer
ISO	Independent System Operator
LDC	Local distribution company
kWh	Kilowatt-hour
MW	Megawatt
MWh	Megawatt-hour
NASEO	National Association of State Energy Officials
NERC	North American Electric Reliability Corporation
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
OASIS	Open Access Same Time Information System
OFO	Operational Flow Order
PADD	Petroleum Administration for Defense Districts
RFC	Reliability First Corporation
RFG	Reformulated Gasoline
RPS	Renewable Portfolio Standard
RPM	Reliability Pricing Model
RTO	Regional Transmission Operators
SCADA	Supervisory Control and Data Acquisition
SCC	State Corporation Commission
SEOC	State Emergency Operations Center
SERC	Southeastern Electric Reliability Corporation
SESP	State Energy Security Plan
SLTT	State, Local, Tribal, and Territorial
T&D	Transmission and Distribution
TRANSCO	Transcontinental Pipeline
USDA	U.S. Department of Agriculture
VCEA	Virginia Clean Economy Act
VDACS	Virginia Department of Agriculture and Consumer Services
VDEM	Virginia Department of Emergency Management
VEST	Virginia Emergency Support Team

APPENDIX H: Supply Chain Diagrams

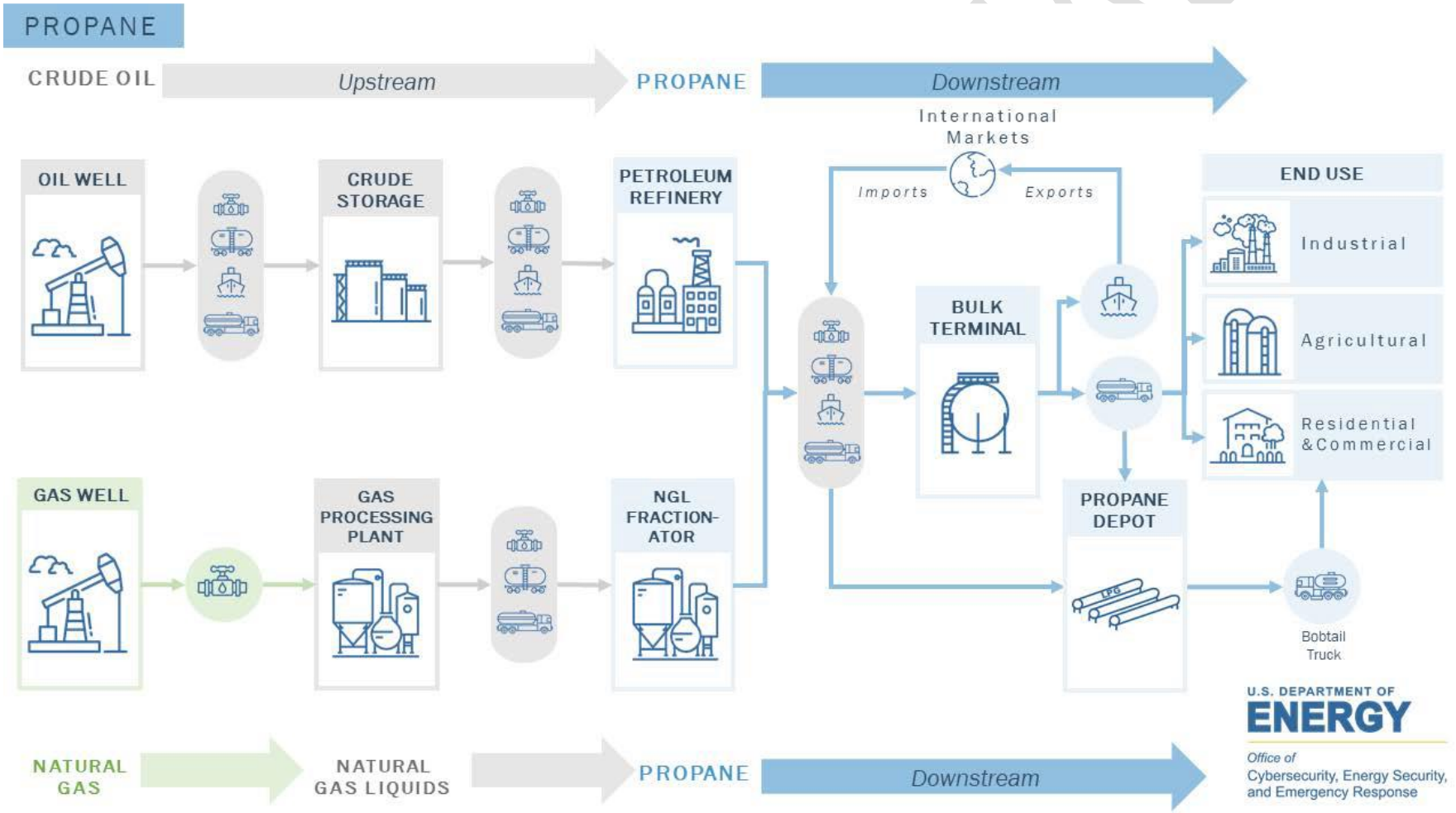
Most electricity is produced at large-scale power plants and transported to end users via transmission and distribution lines with substations stepping the voltage up or down. In recent years, however, electricity is increasingly generated at distribution-level generators and at consumer sites with behind-the-meter devices, in part due to growing small-scale renewable generation. In both utility-scale generation and distributed generation, energy storage may be connected to the electric grid, storing electricity when there is a supply surplus and later discharging it onto the grid as needed.



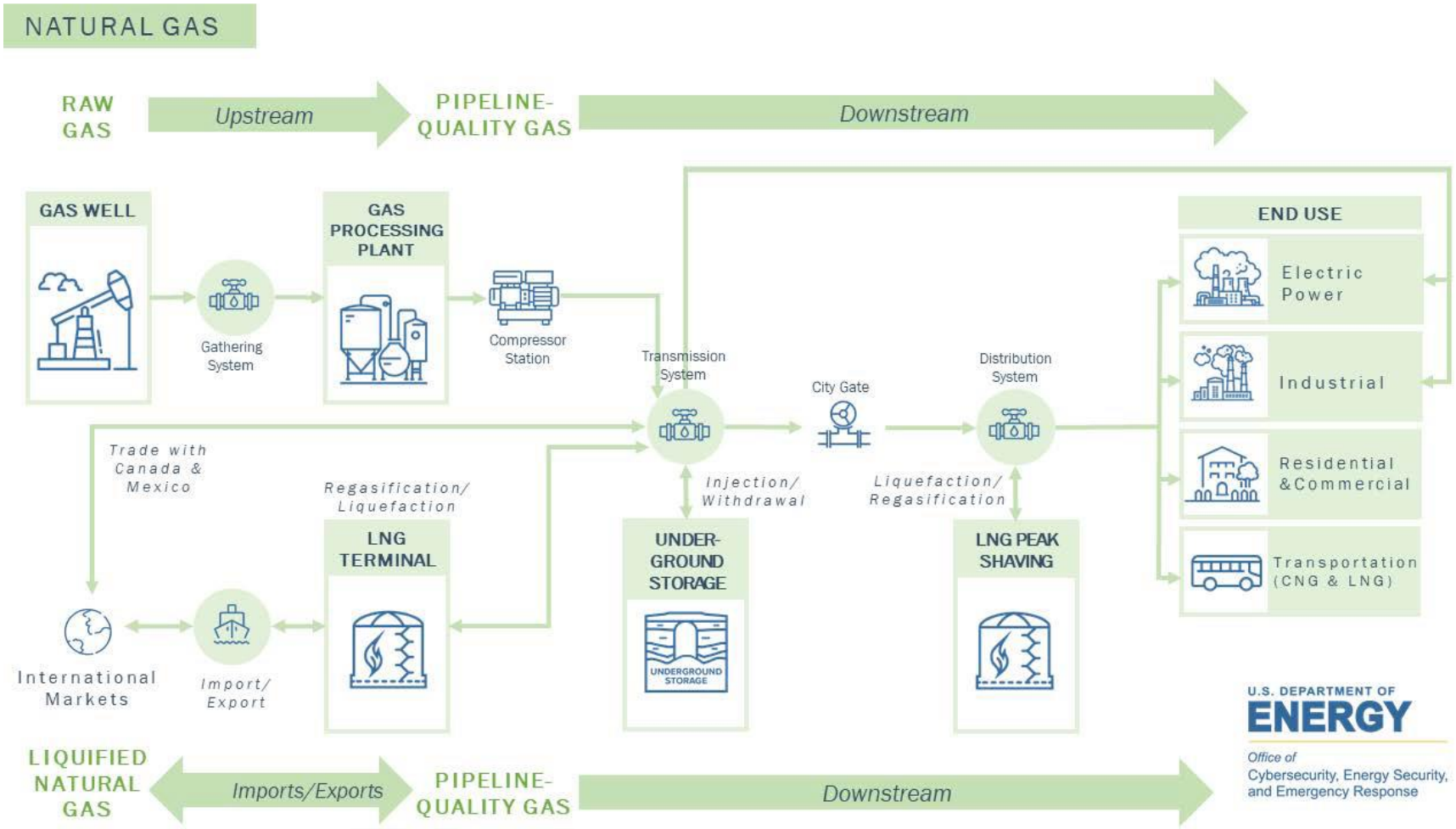
Petroleum products and propane are derived from crude oil. Crude oil is produced from underground reservoirs. Once transported to refineries, crude oil is refined into finished petroleum products, such as gasoline, diesel, jet fuel, residual fuel oil, and propane. Fuels are delivered to bulk terminals by pipeline, marine vessel, or ground transportation (rail or road) and stored in large tanks before being loaded onto distribution trucks (with appropriate blending of ethanol and additives for gasoline) for delivery to retail stations, heating oil distributor storage depots, and other end users.



Most U.S. propane is produced from natural gas liquids, or NGLs, which are liquid components recovered during natural gas processing. NGLs are separated into purity products, including propane, ethane, and butane, at fractionation facilities. After fractionation, propane is compressed and stored as a liquid and moved by pipeline, truck, rail, or barge to bulk propane terminals or directly to distributor storage depots. Propane is transported by smaller trucks to end users like residential and commercial customers.



Natural gas is produced either on its own or as associated gas in crude oil production. Natural gas is then separated from NGLs in natural gas processing plants. Gas is typically transported by transmission lines to city gate meters where gas then moves onto LDCs' distribution systems, which deliver gas to power plants and other end-use customers. Gas can be stored at various levels of the supply chain in underground storage caverns for use during high-demand times. It also can be converted into a liquid form, called liquified natural gas or LNG, which can be transported via marine vessels and either imported into the transmission system or its excess supply exported.


NATURAL GAS
RAW GAS
Upstream
PIPELINE-QUALITY GAS
Downstream
GAS WELL
Gathering System
GAS PROCESSING PLANT
Compressor Station
Transmission System
City Gate
Distribution System
END USE
Electric Power
Industrial
Residential &Commercial
Transportation (CNG & LNG)
Trade with Canada & Mexico
Regasification/ Liquefaction
Injection/ Withdrawal
Liquefaction/ Regasification
LNG TERMINAL
UNDER-GROUND STORAGE
LNG PEAK SHAVING
International Markets
Import/ Export
UNDERGROUND STORAGE
LIQUIFIED NATURAL GAS
Imports/Exports
PIPELINE-QUALITY GAS
Downstream
U.S. DEPARTMENT OF ENERGY
Office of Cybersecurity, Energy Security, and Emergency Response

Attachment 1 – Integrated Planning Team

ORGANIZATION	NAME
VDOT	Brich, Stephen
VDH - Drinking Water	Brown, Holly
SCC	Cizenski, Mike
Virginia Energy	Maiden, Vince
VDEM	Berry, Tom
Comcast	Conwell, John
VDEM	Knapp, Samantha
SCC	Dale, Matt
VDGS	DeGraaf, Brandon
VDCR	Ellis, Laura
SCC	Essah, David
Virginia Energy	Frazier Bestpitch, Brandi
VDCR	Freiberger, Kimberly
Verizon	Gibson, TeToya
VDEQ	Giese, John
VDOT	Gregg, Kevin
VDF	Harris, R
Verizon Wireless	Harrison, Elizabeth
VDEQ	Lohman, Beth
VDOT	Lott, Matt
VDACS	Maddux, Joel
SCC	Marshall, Scott
VDEM	Mayfield, Osjane’
Verizon Wireless	Mayo, Elizabeth
VDACS	Milton, Gary
VDF	Newman, Jim
VDEM	Oblinsky, Michelle
VDOT	Scrivani, John
VDOT	Pair, Doretha
VDEM	Sharpe, Jennifer
DSS	Sital, Sarabjit
VDF	Smith, LTC Philip
Comcast	Surdam, Brad
VSP	Totty, Jonathan
VDOT	Wade, Bryan
	Wallace, Joseph
VSP	Wilson, Marilyne

Attachment 2 – Plan Maintenance

Plan Maintenance and Updates

This plan is the result of the collaborative efforts between the agencies and partners listed in this document and active in the VEST. VDEM and Virginia Energy share responsibility for the maintenance of the Plan. VDEM will lead efforts to ensure the accuracy and utility of the Plan as an emergency management tool. The plan will be reviewed and updated as part of the periodic COVEOP review process. In addition to scheduled periodic reviews, additional review and revisions will be made whenever appropriate based upon the evolution of planning guidance and consideration of improvement plans, and lessons learned from real world incidents, drills, and exercises.

Virginia Energy will lead efforts to ensure that the Energy Sector Profiles and Energy Sector Risk Profiles are accurate and updated, and for submission of the Plan for the annual review as well as signature by the Governor as directed by DOE CESER.

Training and Exercises

The Plans should be validated and exercised in conjunction with the COVEOP. Training could include staff role and responsibility awareness, pre-determined site visit/walk-through, etc. Suggested exercises could include staff communications drills, site and/or organizational structure activation, simulated intake processing, etc., in the most appropriate exercise format for the objectives. Exercises should have a written after-action report and Improvement Plan (AAR/IP). After-Action Reports (AARs) are essential for identifying issues that impeded operations or innovative approaches introduced during the response and recovery that may improve management of future disruptive energy emergencies.

Attachment 3 – Record of Changes

CHANGE #	DATE	DESCRIPTION OF CHANGE	PAGE #	INITIALS
	9/1/2012	Original Publication	ALL	VDEM
	2022	This is a revision of the previous Energy Security Plan.	ALL	
	2023	Addressing DOE recommendations specific to the Commonwealth's 2022 submission of the ESP	ALL	Virginia Energy
	2024	Addressing DOE recommendations specific to the Commonwealth's 2023 submission of the ESP	ALL	Virginia Energy

[i] https://www.eia.gov/state/analysis.php?sid=VA
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[iii] https://services.pjm.com/annualreport2022/maintain-reliability/
[iv] https://www.pjm.com/-/media/training/nerc-certifications/markets-exam-materials/rpm/rpm-101-overview-of-reliability-pricing-model.ashx
[v] https://www.pjm.com/markets-and-operations/ancillary-services
[vi] https://pjm.com/markets-and-operations/demand-response
[vii] https://pjm.com/-/media/committees-groups/committees/mic/2022/20220511/item-04b---manual-11-revisions---redline.ashx
[viii] https://www.pjm.com/training
[ix] https://www.pjm.com/directory/manuals/m13/index.html#table-of-exhibits.html
[x] https://www.pjm-eis.com/program-information/virginia
[xi] https://www.globest.com/2024/03/18/u-s-power-grid-struggles-to-keep-up-with-data-center-growth/?slreturn=20240413124937
[xii] https://www.oag.state.va.us/media-center/news-releases/2743-june-5-2024-virginia-will-exit-california-electric-vehicle-mandate-at-end-of-year
[xiii] https://www.eia.gov/state/analysis.php?sid=VA
[xiv] U.S. Energy Information Administration - EIA - Independent Statistics and Analysis
[xv] https://www.eia.gov/state/analysis.php?sid=VA
[xvi] Virginia Prime Supplier Sales Volumes of Petroleum Products (eia.gov)
[xvii] fuel_jf.pdf (eia.gov)
[xviii] fuel_jf.pdf (eia.gov)
[xix] B25040: HOUSE HEATING FUEL - Census Bureau Tables
[xx] https://www.eia.gov/consumption/residential/data/2020/state/pdf/ce4.6.lp.st.pdf
[xxi] WCSC - U.S. Army Corps of Engineers
[xxii] https://www.eia.gov/state/analysis.php?sid=VA
[xxiii] https://energy.virginia.gov/energy-efficiency/documents/2022_Virginia_Energy_Plan.pdf
[xxiv] https://www.eia.gov/tools/faqs/faq.php?id=727&t=6#:~:text=Crude%20oil%20imports%20of%20about,countries%20and%204%20U.S.%20territories.
[xxv] *https://www.npr.org/2022/04/03/1090498777/how-releasing-federal-oil-reserves-affects-the-price-at-the-pump*
[xxvi] https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=WCSSTUS1&f=W
[xxvii] https://www.eia.gov/todayinenergy/detail.php?id=55079#:~:text=The%20Brent%2DWTI%20crude%20oil,crude%20oil%20from%20another%20source.
[xxviii] https://www.nytimes.com/2022/11/10/business/energy-environment/diesel-prices-inflation.html
[xxix] https://www.eia.gov/outlooks/steo/report/perspectives/2023/04-gasolineprice/article.php#:~:text=In%20both%20equations%2C%20increases%20in,than%20they%20affect%20fuel%20economy.
[xxx] Virginia Natural Gas Consumption by End Use (eia.gov)
[xxxi] rank_ng_capita.pdf (eia.gov)
[xxxii] https://data.census.gov/table/ACSDT1Y2022.B25040?q=HORNBACHER%20HOUSE%20MOVING%20INC&g=040XX00US51
[xxxiii] *Gas production is reported in annual reports to Virginia Energy and may differ from the production figures reported by the U.S. Energy Information Administration (EIA). The annual value of produced gas is calculated using the total production reported to Virginia Energy and the annual average Henry*

Hub (NYMEX) unit price reported by the U.S. Energy Information Administration (EIA). For 2021, the value was $3.89 per million Btu ($4.03 per thousand cubic feet, Mcf).

[xxxiv] From the U.S. Energy Information Administration, https://www.eia.gov/dnav/ng/TblDefs/ng_pri_sum_tbldef2.asp#:~:text=Definition,Commercial%20Price

[xxxv] https://energy.virginia.gov/energy-efficiency/documents/2022_Virginia_Energy_Plan.pdf

[xxxvi] https://www.eia.gov/dnav/ng/hist/n3045va2a.htm

[xxxvii] https://www.vaemergency.gov/wp-content/uploads/2023/03/cova-hazard-mitigation-plan.pdf

[xxxviii] https://www.12onyourside.com/2022/08/30/remembering-destruction-hurricane-gaston-18-years-later/

[xxxix] Sea Level Rise Technical Report: Download and FAQs (noaa.gov)

[xl] The Impact of Climate Change on Virginia's Coastal Areas (wm.edu)

[xli] https://cardinalnews.org/category/projects/southwest-virginia-flooding/

[xlii] Virginia | U.S. Drought Monitor (unl.edu)

[xliii] https://www.energy.gov/sites/default/files/2024-04/DOE%20CESER-Risk%20Assessment%20Essentials%20Guide%20for%20State%20Energy%20Security%20Plans.pdf

[xliv] SCC, Division of Utility and Pipeline Safety, Pipeline Safety, http://www.scc.virginia.gov/urs/pipe/index.aspx.

[xlv] TSA new cybersecurity directive for pipeline operators issued July 2023

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[xlvi] U.S. Department of Energy, Energy Security Plan Guidance https://www.energy.gov/sites/default/files/2023-01/DOE%20State%20Energy%20Security%20Plan%20Framework%20and%20Guidance%20FINAL.pdf

[xlvii] LEAD Tool | Department of Energy

[xlviii] History of Patawomecks | Patawomeck (patawomeckindiantribeofvirginia.org)

[xlix] https://vdemgis.maps.arcgis.com/home/webmap/viewer.html?layers=53664abca0e44d6da7b3da12dcddff66

[l] https://www.energy.gov/sites/default/files/2022-06/DOE_CESER_SESP_Drop-in_EEAC Program_FINAL_508.pdf

[li] https://emacweb.org/index.php/learn-about-emac/what-is-emac

[lii] https://law.lis.virginia.gov/compacts/emergency-management-assistance-compact/

[liii] https://www.americanpublicgasassociation-digital.com/pgar/2021_apga_member_directory/MobilePagedReplica.action?pm=2&folio=26#pg27

[liv] https://www.energy.gov/sites/default/files/2022-05/DOE_CESER_Energy%20Emergency%20Response%20Playbook%20for%20State%20and%20Territories%20FINAL_508_0.pdf
[lv] https://law.lis.virginia.gov/admincode/title20/agency5/chapter318/
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[lviii] https://www.hrpdcva.gov/DocumentCenter/View/3533/2022-Hampton-Roads-Hazard-Mitigation-Plan-PDF
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[lxi] https://planrva.org/wp-content/uploads/FINAL-2022-Richmond-Crater-Hazard-Mitigation-Plan-060523.pdf
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[lxiii] https://www.hrpdcva.gov/DocumentCenter/View/3533/2022-Hampton-Roads-Hazard-Mitigation-Plan-PDF
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[lxxiii]https://www.fairfaxcounty.gov/environment-energy-coordination/sites/environment-energy-coordination/files/assets/images/cecap%20report%20release/cecap%20draft_designed%20report_sept%202021_release_508.pdf
[lxxiv] https://planrva.org/wp-content/uploads/FINAL-2022-Richmond-Crater-Hazard-Mitigation-Plan-060523.pdf
[lxxv] https://planrva.org/wp-content/uploads/FINAL-2022-Richmond-Crater-Hazard-Mitigation-Plan-060523.pdf

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[lxxviii] https://www.vaemergency.gov/wp-content/uploads/2023/03/cova-hazard-mitigation-plan.pdf
[lxxix] https://planrva.org/wp-content/uploads/FINAL-2022-Richmond-Crater-Hazard-Mitigation-Plan-060523.pdf
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[lxxxv] https://law.lis.virginia.gov/admincodeexpand/title2/agency5/chapter425/