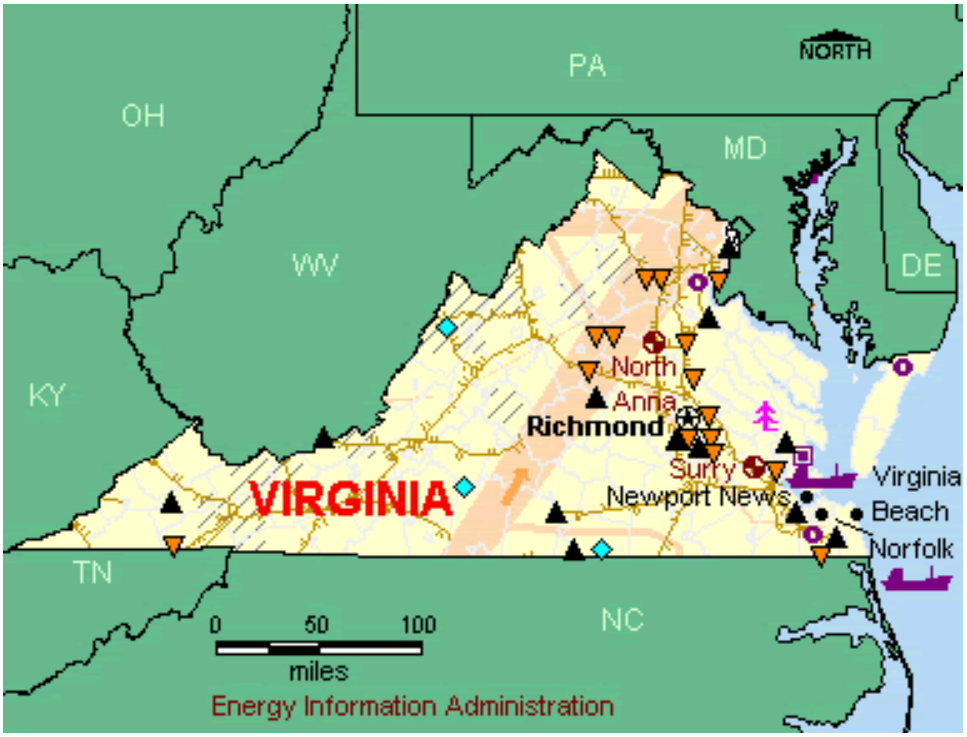
The Virginia Energy Plan

Commonwealth of Virginia

Governor Robert McDonnell



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VIRGINIA ENERGY PLAN – EXECUTIVE SUMMARY

The General Assembly established a state energy policy framework in Chapter 1 of Title 67 of the Code of Virginia and directed the Department of Mines, Minerals and Energy to draft the Virginia Energy Plan. The General Assembly further directed that the Plan be updated by July 1, 2010, and every four years thereafter.

The Code set energy policy and objectives for the Commonwealth. These broadly provide that Virginia should:

- Ensure availability of reliable energy supplies at reasonable costs;
- Establish sufficient infrastructure to support energy needs;
- Use resources efficiently and facilitate energy conservation;
- Facilitate development of Virginia's low cost resources, including clean coal and natural gas;
- Facilitate development of less polluting energy sources;
- Foster energy research and development; and
- Address environmental protection with energy facilities.

Virginia uses a diverse mix of energy resources.

- The transportation sector uses 31 percent of total energy use.
- The residential sector uses 24 percent.
- The commercial sector uses 23 percent.
- The industrial sector uses 22 percent.

Energy use by sector varies.

- Petroleum is the primary energy source for transportation, providing 97 percent of transportation energy.
- Residential energy is provided primarily by electricity (53 percent), natural gas (29 percent), and petroleum (14 percent).
- Commercial energy use comes primarily from electricity (65 percent) and natural gas (28 percent).
- Industrial energy comes from a diverse mix including petroleum (32 percent), coal (19 percent), natural gas (18 percent), biomass (16 percent), and electricity (15 percent).

This Plan assesses Virginia's energy situation through examining the state's primary energy resources: electricity, coal, nuclear, natural gas, renewables, and petroleum.

Electricity:

- Electricity is provided by three investor-owned utilities (84.2 percent of retail sales), 13 electric cooperatives (11.3 percent), and 16 municipal utilities (4.5 percent).
- Generation and transmission of electricity is managed through the PJM Interconnection, a regional transmission operator serving Virginia, Mid-Atlantic States through New Jersey, and portions of states to the West through Illinois.

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- Rates and terms of service for investor-owned utilities and cooperatives are set through cases heard by the State Corporation Commission.
- 2008 electricity use was provided 66 percent from in-state generation and 34 percent from electricity imports. Coal (44 percent), nuclear (38 percent), and natural gas (13 percent) fueled the majority of in-state generation in 2008.
- Virginia's electric rates have risen over time, with a higher percentage jump in 2009. Rates vary among Virginia's electric utilities. Average prices for electricity in 2009 were 10.61 cents/kilowatt hour (kWh) for residential consumers; 8.1 cents/kWh for commercial consumers; 6.87 cents/kWh for industrial users; and 8.42 cents/kWh for transportation consumers. Rates remain below the national average, at 90.5 percent of national rates in 2009.

Coal

- Virginia coal is used primarily for electric generation and industrial steam (steam coal), and coke for steel manufacturing (metallurgical coal). Virginia is a net exporter of coal.
- Coal prices have generally risen over time, with current steam coal prices averaging approximately $50/ton and metallurgical coal prices averaging about $120/ton.
- Coal mining is a significant economic driver of the Southwest Virginia economy, providing approximately 4,400 mining jobs and $1.7 billion in revenue from coal sales.

Nuclear

- Virginia is home to four nuclear units. Owned by Dominion, there are two units each at the North Anna and Surry Power Stations. These plants came on line between 1972 and 1980. Their operating licenses have been extended through 2032 and 2040. Dominion is considering constructing a third nuclear reactor at the North Anna Station.
- Virginia is a leader in nuclear technologies, with AREVA, B&W, and Northrop Grumman Newport News providing nuclear plant design, fuel services, nuclear plant maintenance, nuclear plant component manufacturing, and nuclear shipbuilding.
- Virginia is home to a commercially viable uranium deposit at Coles Hill in Pittsylvania County. There is a moratorium on mining due to questions whether the uranium can be safely mined in Virginia's environment. The Virginia Coal and Energy Commission is studying the safety and economic impact of possible uranium mining.

Natural Gas

- Natural gas is provided by ten investor-owned and three local government natural gas local distribution utilities. Large industrial and institutional consumers can also purchase their natural gas directly. Approximately 37 percent of Virginia's households and 90,000 commercial businesses use natural gas.
- Rates and terms of service for the investor-owned local distribution utilities are set through cases heard by the State Corporation Commission.
- Natural gas is delivered to Virginia through pipelines carrying natural gas produced in the Gulf of Mexico region, pipelines carrying natural gas produced in the Virginia and other Appalachian natural gas fields, and through the liquefied natural gas terminal in Cove Point, Maryland.

- Natural Gas prices have risen over time. In 2008, residential consumers paid on average $16.20/thousand cubic feet (MCF), commercial consumers paid $12.98/MCF, industrial consumers paid $1.49/MCF, and utility consumers paid $10.87/MCF.
- Virginia's natural gas companies produced 128.5 billion cubic feet of gas in 2008 from 6,428 wells, with approximately $0.5 billion in revenue from gas sales. Wells are located in Southwest Virginia. Approximately 80 percent of production comes from natural gas found in coal seams. There is potential to produce additional natural gas from Marcellus Shale formations and, subject to federal leasing, from offshore wells.

Renewables

- Renewable sources of energy provided approximately 2.8 percent of electricity generated in Virginia and approximately 6 percent of gasoline consumed in the state.
- The greatest potential for renewable energy production in Virginia comes from biomass, hydro power, and wind power. Solar power can provide distributed power to end users across the Commonwealth.
- Geothermal energy can provide heating and cooling through use of geothermal heat pumps. Virginia does not have high-temperature geothermal resources suitable for electric generation.

Petroleum

- Petroleum products are supplied to Virginia through pipelines carrying gasoline, diesel, aviation fuel, and other products produced in Gulf of Mexico area refineries; from the Western Refining refinery in Yorktown; and from water borne supplies delivered to coastal petroleum terminals.
- Western Refining has a production capacity of 70,000 barrels per day, slightly less than 15 percent of the state's consumption.
- Petroleum prices are largely set by national and international markets. Prices have been volatile over time. For example, gasoline prices have ranged from over $4.00 per gallon in September 2008, down to current prices of $2.70 per gallon.
- Virginia companies produce a nominal amount of petroleum from 75 stripper wells in Lee, Wise, and Russell Counties. There is potential to produce oil, subject to federal leasing, from offshore wells.

This plan sets out three goals and includes recommended actions.

1. Make Virginia the Energy Capital of the East Coast.
    - Grow both traditional and alternative energy production, jobs, and investment in Virginia.
    - Increase the use of conservation and efficiency in Virginia's homes and businesses and support the establishment and expansion of energy efficiency businesses.
2. Expand public education about Virginia's energy production and consumption, its effect on our economy, and how Virginians can use energy more efficiently.
3. Maximize the investment in clean energy research and development through the work of the Universities Clean Energy Development and Economic Stimulus Foundation.

SECTION 1 - GENERAL ENERGY INFORMATION

Quick Facts

- Energy (electricity, heating and cooling, transportation) is supplied to Virginians 44 percent from petroleum, 20 percent from coal, 18 percent from electricity generated outside Virginia, 13 percent from nuclear-based power generation, and 5 percent from hydro, biomass, and other renewable sources.
- Virginia's net energy balance is negative, having imported 55 percent of total energy used in 2008.
- Electricity generated in Virginia in 2008 came 44 percent from coal, 38 percent from nuclear, 13 percent from natural gas, 3 percent from renewables, and 2 percent from petroleum. Virginia's utilities imported 34 percent of the state's 2008 electricity consumption from generation facilities outside of Virginia.
- The Commonwealth is the 15th largest primary energy producer of the states, including coal, natural gas, hydro, biomass, and other renewables.
    - Virginia's mining companies produce nearly 10 percent of U.S. coal east of the Mississippi River from underground and surface mines in Southwest Virginia.
    - Virginia has nearly 6,500 natural gas wells that produce 43 percent of the natural gas the state consumes. Two Virginia coalbed methane fields and the Nora and Oakwood fields in Southwest Virginia are among the top 100 natural gas fields in the United States.
- Virginia is home to a robust energy infrastructure including:
    - 130 coal, nuclear, natural gas, hydro, oil, and biomass fueled electric power plants.
    - The southern end of the PJM Interconnection system with approximately 60,000 miles of transmission lines and approximately 6,000 substations, connected to an extensive network of local distribution lines reaching customers in almost every corner of Virginia.
    - Approximately 3,000 miles of natural gas transmission pipelines[1], approximately 3,200 miles of natural gas gathering pipelines[2], and approximately 20,000 miles of distribution pipelines.[3]
    - Two petroleum product pipelines moving gasoline, diesel, and other fuels from the Gulf of Mexico to Virginia; piers to receive water-borne petroleum products; and four major petroleum terminal hubs.
    - A petroleum refinery in Yorktown that can process 70,000 barrels per day of petroleum into gasoline, diesel fuel, and other products.[4]
- Virginia uses energy more efficiently than the nation, ranking 31st in energy use per unit of gross domestic product (GDP).
- Virginia has a voluntary goal to reduce electricity use by 2022 through conservation and efficiency, by an amount equal to 10 percent of 2006 electricity use.
- Virginia's utilities and coal and gas producers employ over 20,000 people, with an estimated $2 billion in payroll.

[1] PHMSA Pipeline Safety Program, http://primis.phmsa.dot.gov/comm/reports/safety/VA_detail1.html?nocache=9885#_OuterPanel_tab_1, June 22, 2010
[2] DMME, Division of Gas and Oil, June 23, 2010
[3] PHMSA Pipeline Safety Program, http://primis.phmsa.dot.gov/comm/reports/safety/VA_detail1.html?nocache=9885#_OuterPanel_tab_1, June 22, 2010.
[4] Western Refining, http://www.wnr.com/Refining.aspx, June 23, 2010

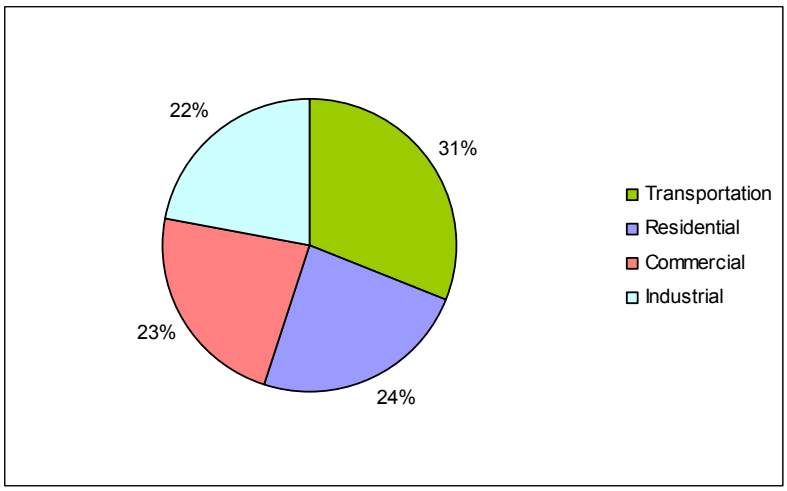
State Energy Policy

- Virginia's General Assembly set out the following broad policies and objectives in state law:[5]
- Ensure availability of reliable energy supplies at reasonable costs;
- Establish sufficient infrastructure to support energy needs;
- Use resources efficiently and facilitate energy conservation;
- Facilitate development of Virginia's low cost resources, including clean coal and natural gas;
- Facilitate development of less polluting energy sources;
- Foster energy research and development; and
- Address environmental protection with energy facilities.

Energy Consumption

- Virginians use electricity, natural gas, fuel oil, and other fuels to light, heat, cool, and operate their homes, stores, and factories; and gasoline and diesel fuel to move their cars, trucks, buses, airplanes, ships, and trains.
- This energy comes from multiple sources: 44 percent from petroleum, 20 percent from coal, 18 percent from electricity generated outside Virginia, 13 percent from nuclear-based power generation, and 5 percent from hydro, biomass, and other renewable sources.
- Energy is used in different ways and in differing quantities by residential, commercial, industrial, and transportation customers.
    - The transportation sector is the largest user of energy in Virginia. Residential, commercial, and industrial consumers use about equal amounts.
    - Compared to the average state, Virginia uses more energy for transportation and commercial use and less for industrial use.

Figure 1-1: Virginia Total Energy Consumption by Sector, 2007[6]

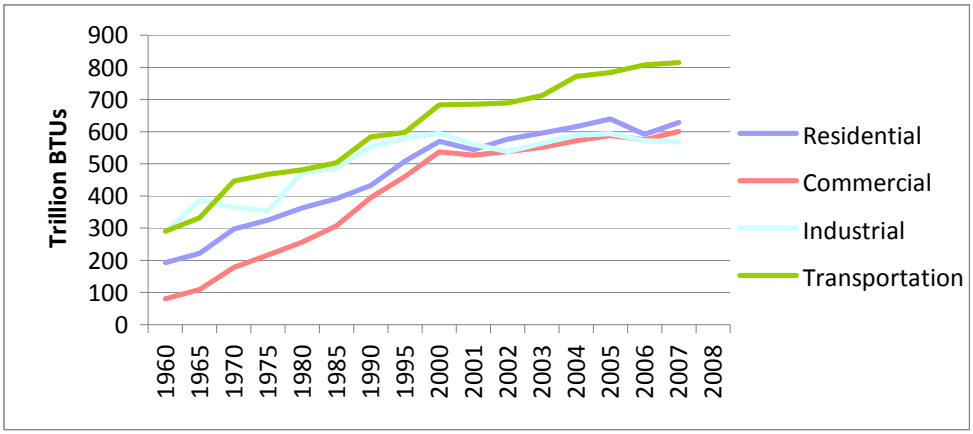


[5] Code of Virginia, Title 67, Sections 67-101 and 67-102, http://leg1.state.va.us/cgi-bin/legp504.exe?000+cod+TOC67000000001000000000000, June 29, 2010

[6] EIA, State Energy Consumption Estimates, http://www.eia.doe.gov/emeu/states/sep_use/notes/use_print2007.pdf

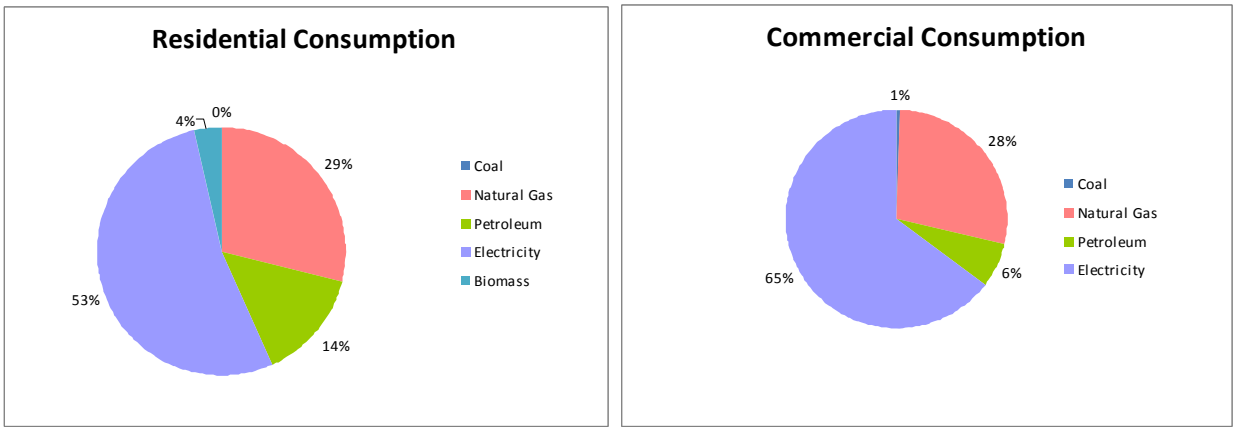
- Energy use for transportation has grown at the fastest rate. Energy use in the industrial sector has grown at the slowest rate. The residential and commercial sectors grew rapidly in the 1990s but slowed through the 2000s.

Figure 1-2: Virginia's Total Energy Consumption by Sector, 1960–2007[7]

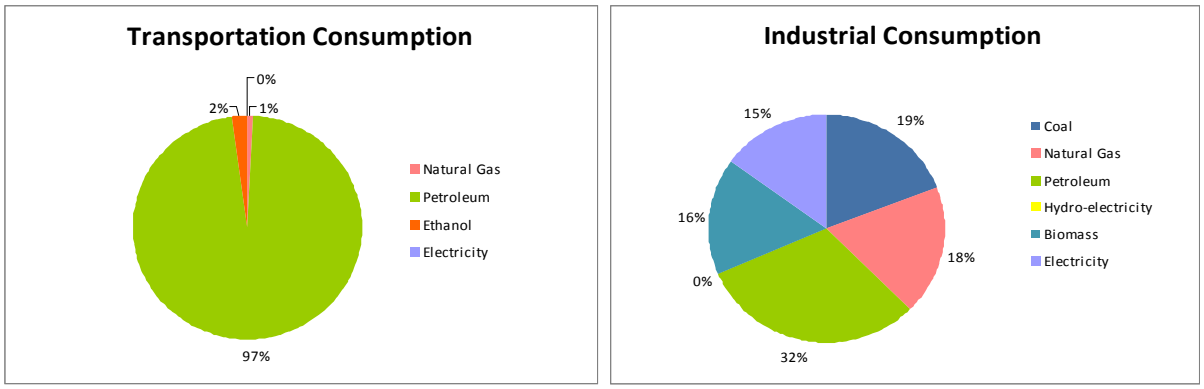


- Electricity delivers 65 percent of all energy to the commercial sector, 53 percent to the residential sector, 19 percent to the industrial sector, and less than 1 percent to the transportation sector. In contrast petroleum delivers 97 percent of energy used by the transportation sector and only 6 percent used by the commercial sector.

Figure 1-3: Virginia's Energy Consumption by Sector, 2007[8]

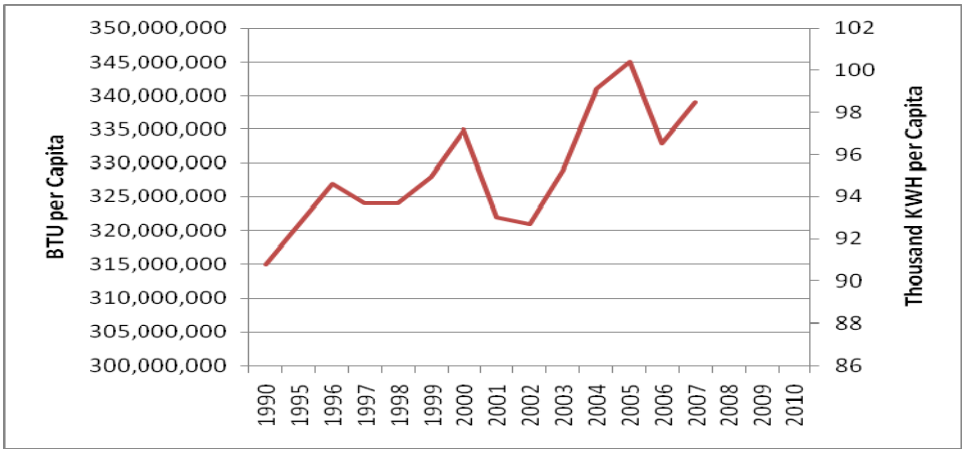


[7] EIA, State Energy Consumption Estimates, http://www.eia.doe.gov/emeu/states/sep_use/notes/use_print2007.pdf
[8] EIA, State Energy Consumption Estimates, http://www.eia.doe.gov/emeu/states/sep_use/notes/use_print2007.pdf



- Per capita energy use has increased over time, generally tracking economic activity. Energy use also has increased due to increases in energy used for transportation and as consumers use more energy-consuming devices in their homes and businesses.

Figure 1-4: Virginia's Per Capita Energy Use, 1990–2007[9]



- The average household in 2008 spent $6,599 for electricity, other household energy, and gasoline.

Figure 1-5: Average Household Energy Expenditures[10]

Energy Type	Annual Expenditures
Electricity	$990
Gasoline	$4,185
Other	$1,424
Total	$6,599

[9] EIA, State Energy Consumption Estimates, http://www.eia.doe.gov/emeu/states/sep_use/notes/use_print2007.pdf
[10] DEQ, http://www.deq.virginia.gov/export/sites/default/info/documents/climate/Virginia_Energy_Analysis_091008.pdf, June 20, 2010

Energy Balance – Imports and Exports

- Virginia has a net negative energy balance, importing 55 percent of the total amount of energy the state uses.[11] The Commonwealth is a net exporter of coal and a net importer of all other fuels.
- In 2007 Virginians spent $30.5 billion to purchase energy.[12] On a net basis, this included $13.7 billion on imported fuels and electricity.
- With expected growth in use, 2020 imports would cost $21.6 billion in today's prices.

Figure 1-8: Virginia's Net Energy Imports/(Exports), 2007[13] (Trillion Btus)

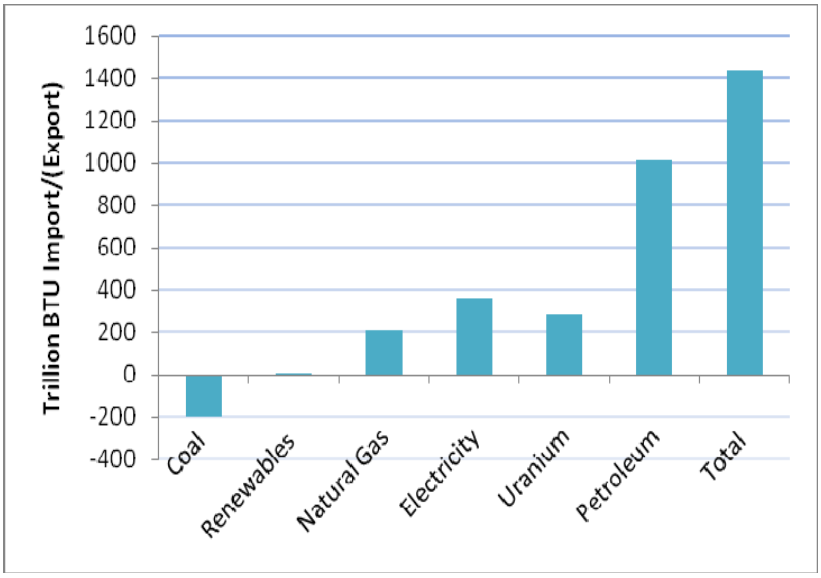
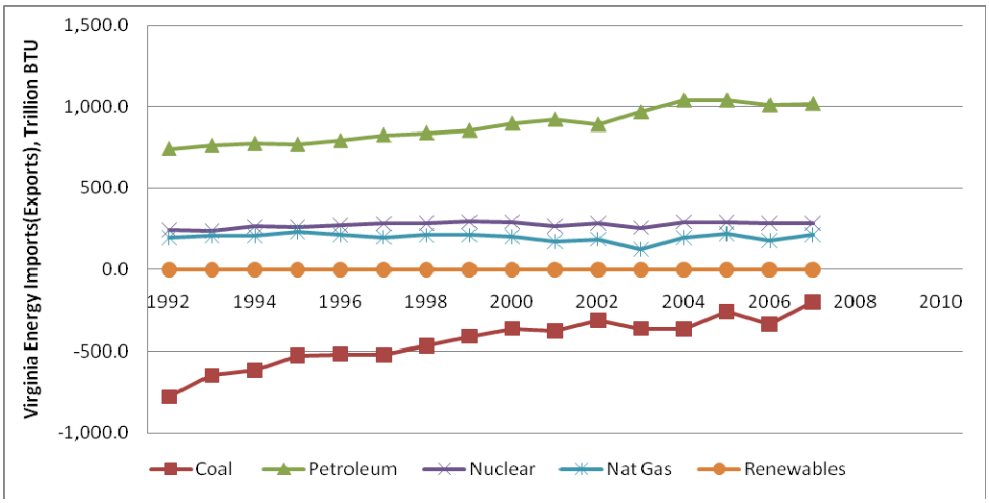


Table 1-1: Virginia's Net Energy Imports/(Exports), 2007[14] (Trillion Btus)

Fuel	Production	Consumption	Net Imp/(Exp)
Coal	656.3	457.9	(198.44)
Renewables	114.2	114.2	0.013
Natural Gas	116.5	332.7	216.161
Electricity	15.61	380.7	365.09
Uranium	0	286	286
Petroleum	0.1	1,016.60	1016.496
Total	1,173	2,611	1,438

Figure 1-9: Virginia's Net Energy Imports/(Exports) by Fuel, 1992–2007[15]

[11] Unless otherwise noted, Virginia energy production and consumption data used in this section comes from: EIA, State Energy Profiles, Virginia, http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=VA, May 26, 2010
[12] EIA, State Energy Data System Consumption, Price, and Expenditure Estimates, http://www.eia.doe.gov/emeu/states/_seds.html
[13] EIA, State Energy Profiles, Virginia, http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=VA
[14] EIA, State Energy Profiles, Virginia, http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=VA



- Reducing energy imports would allow the Commonwealth to expand its economy.
- For each 1 percent that Virginia reduces its energy imports, we would keep nearly $150 million in the state's economy.
    - Reducing imports of electricity by 1 percent by adding in-state generation would increase state gross domestic product by $20 million dollars and result in increased jobs in electric generating plants and businesses supporting the plants.
    - Increasing coal exports by 1 percent through increased production that would increase state gross domestic product by nearly $7 million, with the attendant jobs in coal mining and support service, railroad, and ports across the state.

Table 1-2: Impact of 1 Percent Change in Virginia's Energy Imports/Exports

CHANGE IN NET IMPORTS					
Fuel	2007 Net Imports (Billion Btus)	1% of Net Imports (Billion Btus)	Equivalent Amount	Units	Market Value ($Million)
Natural gas	190,399	1,904	1,851,420	MCF	$12.8
Electricity	109,472	1,095	320,750	MWh	$20.1
CHANGE IN NET EXPORTS					
Fuel	2007 Net Exports (Billion Btus)	1% of Net Exports (Billion Btus)	Equivalent Amount	Units	Market Value ($Million)
Coal	364,609	3,646	136,227	Tons	$6.8
Thermal conversion factors: 1 cubic foot natural gas = 1,028.4 Btus; 1 kWh electricity = 3,413 Btus; 1 lb coal = 12,867.4 Btus					

[15] EIA, State Energy Data System. Energy Consumption Estimates by Source, Virginia, http://www.eia.doe.gov/emeu/states/hf.jsp?incfile=sep_use/total/use_tot_va.html&mstate=VIRGINIA

Energy Consumption and Production Forecasts

- Future energy use depends on population growth, personal income and economic activity, use of transportation, development of new products, and implementation of energy efficiency and conservation practices.
- Virginia's energy consumption is expected to grow at its historic long-term rate of about 1.5 percent per year.
- Virginia will need to grow its energy supply by 14.6 percent (397.8 trillion Btus) to meet the growing energy demand through 2020.

Table 1-3: Energy Production and Consumption Forecasts for Virginia (Trillion Btus) [16]

Year	Consumption	Growth	Primary Production	Growth	Gap/Imports	Growth
1995	2144.3		1355.5		788.8	
1996	2207.8	2.9%	1415.7	4.3%	792.1	0.4%
1997	2213.1	0.2%	1425.1	0.7%	788	-0.5%
1998	2242.6	1.3%	1374.5	-3.7%	868.1	9.2%
1999	2296.5	2.3%	1346	-2.1%	950.5	8.7%
2000	2384.7	3.7%	1353.9	0.6%	1030.8	7.8%
2001	2317.5	-2.9%	1300.1	-4.1%	1017.4	-1.3%
2002	2341.8	1.0%	1235.7	-5.2%	1106.1	8.0%
2003	2422.7	3.3%	1339.7	7.8%	1083	-2.1%
2004	2547.3	4.9%	1311.8	-2.1%	1235.5	12.3%
2005	2605.2	2.2%	1221.8	-7.4%	1383.4	10.7%
2006	2546.3	-2.3%	1279.9	4.5%	1266.4	-9.2%
2007	2610.9	2.5%	1173.1	-9.1%	1437.8	11.9%
2008	2650.68	1.5%	1147.9	-2.2%	1502.78	4.3%
2009	2690.46	1.5%	1122.7	-2.2%	1567.76	4.1%
2010	2730.24	1.5%	1122	-0.1%	1608.24	2.5%
2011	2770.02	1.4%	1122	0.0%	1648.02	2.4%
2012	2809.8	1.4%	1122	0.0%	1687.8	2.4%
2013	2849.58	1.4%	1122	0.0%	1727.58	2.3%
2014	2889.36	1.4%	1122	0.0%	1767.36	2.3%
2015	2929.14	1.4%	1122	0.0%	1807.14	2.2%
2016	2968.92	1.3%	1122	0.0%	1846.92	2.2%
2017	3008.7	1.3%	1122	0.0%	1886.7	2.1%
2018	3048.48	1.3%	1122	0.0%	1926.48	2.1%
2019	3088.26	1.3%	1122	0.0%	1966.26	2.0%
2020	3128.04	1.3%	1122	0.0%	2006.04	2.0%

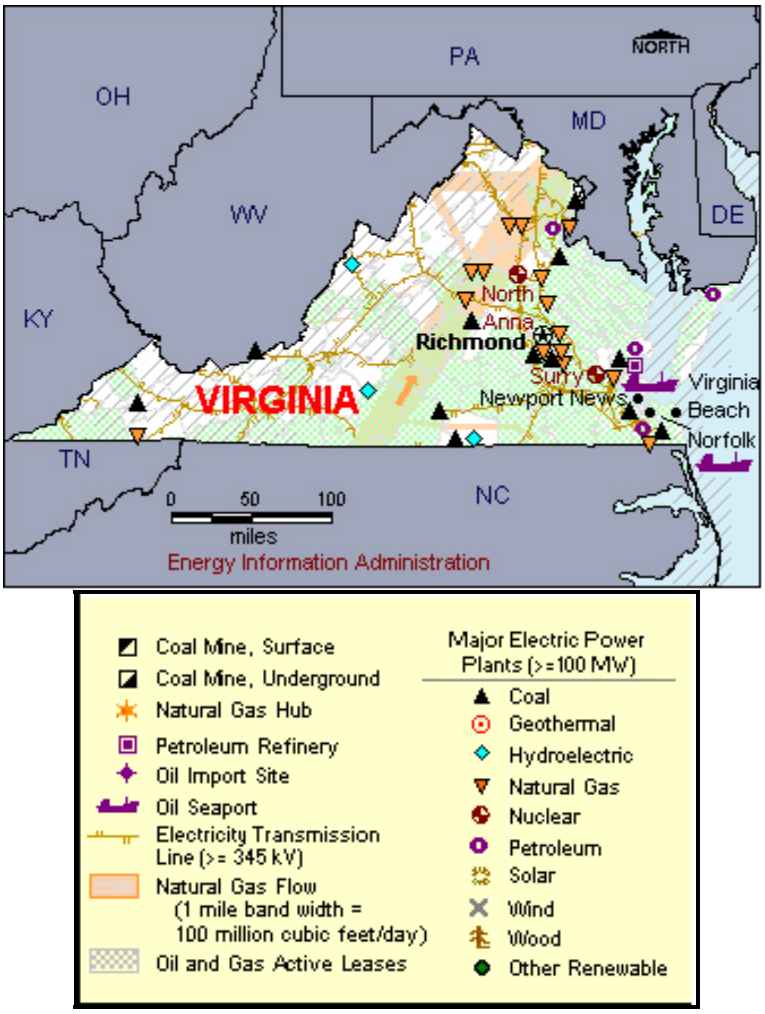
[16] EIA, State Energy Data System, Virginia, http://www.eia.doe.gov/emeu/states/state.html?q_state_a=va&q_state=VIRGINIA

Energy Infrastructure

A robust infrastructure is needed to deliver affordable, reliable energy supplies to energy users. Virginia's energy infrastructure (see Figure 4-1) includes facilities required for:

- Electricity generation, transmission, and distribution;
- Natural gas production, transmission, and storage;
- Petroleum production, refining, transportation, and distribution;
- Coal mining, transportation, and export;
- Propane production, transportation, and distribution; and
- Wood/biomass production and transportation.

Figure 1-10: Virginia's Energy Infrastructure[17]



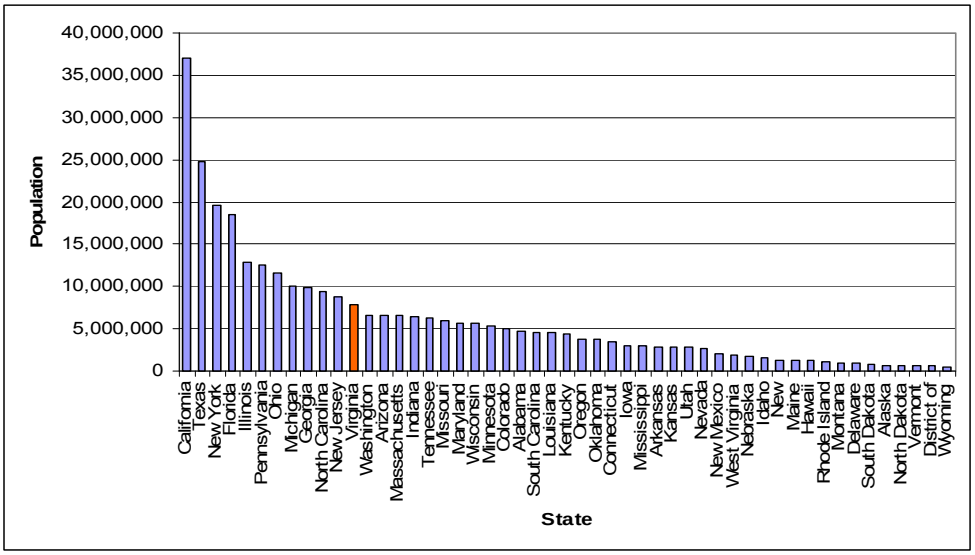
[17] EIA, State Energy Profile, Virginia, http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=VA

State Rankings

As shown in the following comparisons of states, the Commonwealth has an economy that ranks among the top tier of states, while using energy more efficiently than the majority of states.

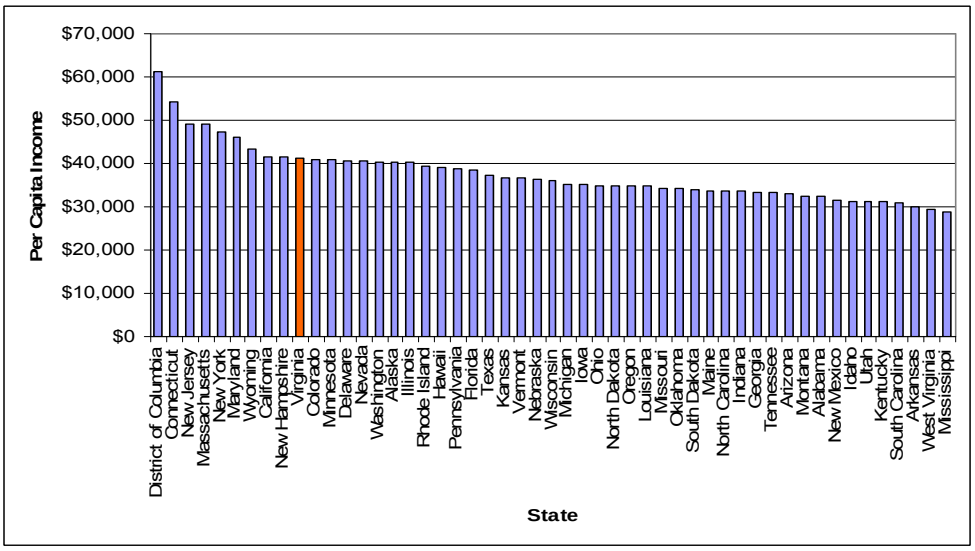
- In 2009, Virginia was home to 7.8 million people, the 12th largest of the states.[18]

Figure 1-11: State Rankings – Population, 2009



- In 2007, Virginia's per capita personal income was $41,347, the 9th highest of the states (not including the District of Columbia), 107 percent of the national median income.

Figure 1-12: State Rankings – Per Capita Income, 2007[19]

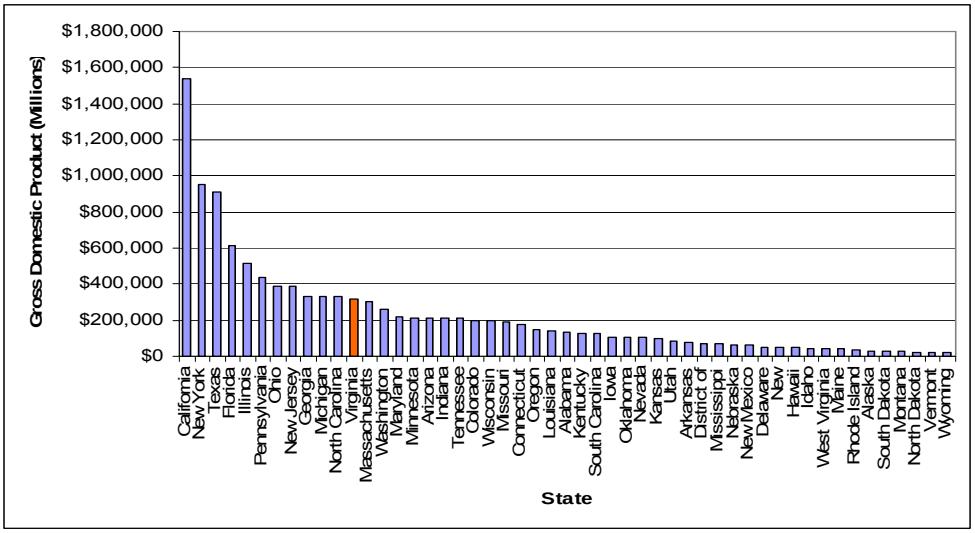


[18] U.S. Census Bureau, Annual Estimates of the Population for the United States, Regions, States, and Puerto Rico: April 1, 2000 to July 1, 2009, http://www.census.gov/popest/states/tables/NST-EST2009-01.xls, June 16, 2010

[19] Bureau of Economic Analysis, State Personal Income, 2007, http://www.bea.gov/newsreleases/regional/spi/2008/pdf/spi0308.pdf, June 16, 2010

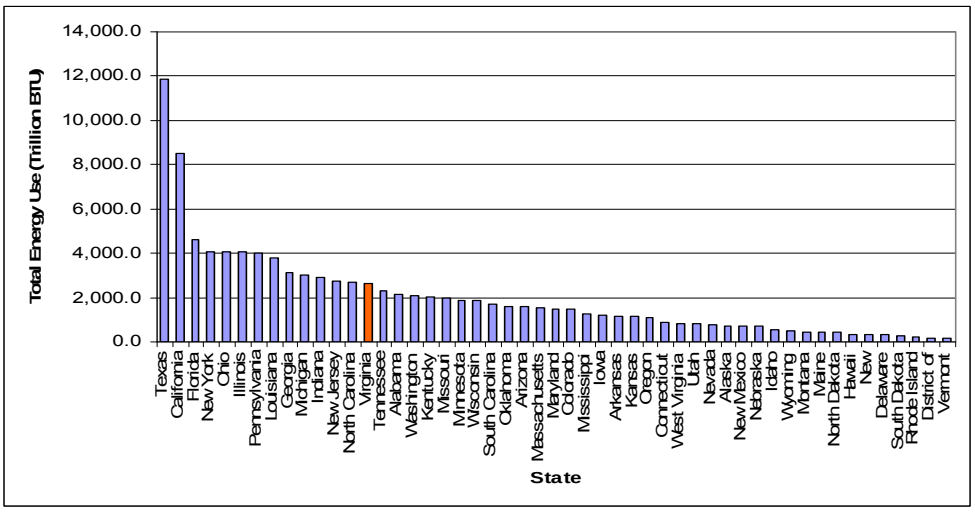
- In 2007, Virginia's gross domestic product (GDP) was $320 billion, 12th among the states, 143 percent of the average state GDP.

Figure 1-13: State Rankings – Gross Domestic Product, 2007[20]



- In 2007, Virginia ranked 14th in total energy consumption, using 2,611 trillion Btu's of energy, 131 percent of the average state's energy consumption.

Figure 1-14: State Rankings - Total Energy Consumption, 2007[21]



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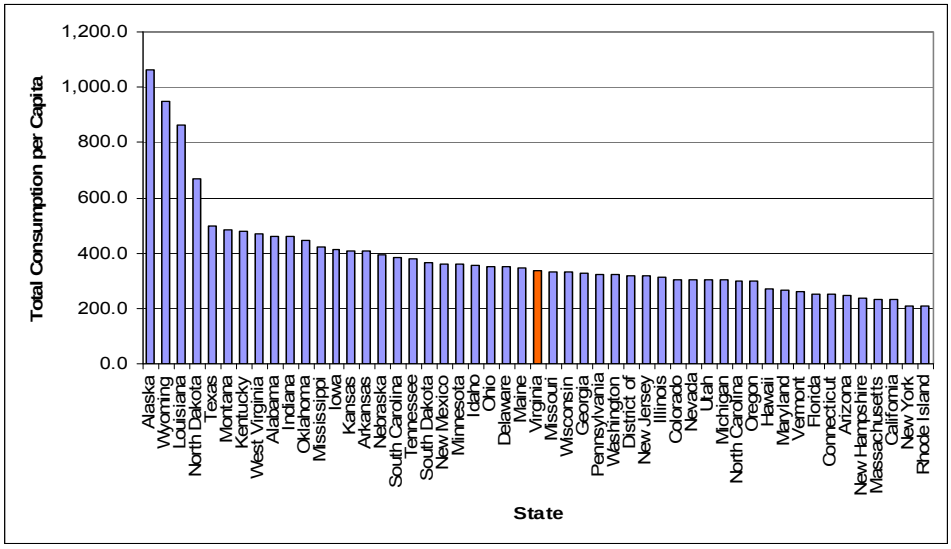
[20] http://www.bea.gov/scb/pdf/2009/06%20June/0609_gdp_state.pdf, June 16, 2010
[21] EIA, Total Energy Consumption by Sector, Ranked by State, 2007, http://www.eia.doe.gov/emeu/states/sep_sum/html/pdf/rank_use.pdf

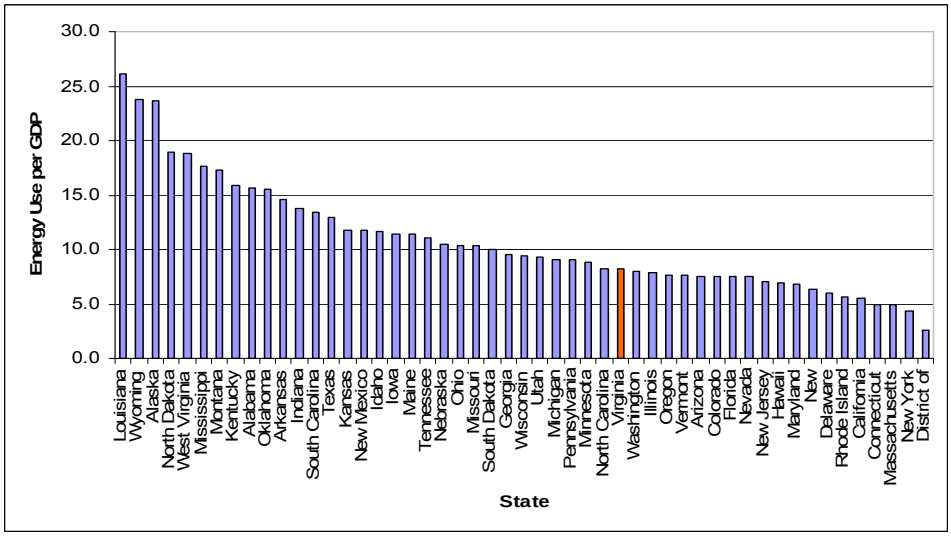
In 2007, Virginia ranked 26th in energy use per capita among the states, using 339 million Btu's per person, 100.7 percent of the national average.

Figure 1-15: State Rankings - Energy Use Per Capita, 2007[22]



- In 2007, Virginia ranked 31st (tied with North Carolina) in energy use per gross domestic product, using 8,200 Btus per dollar of GDP, 92 percent of the national amount of energy per GDP.

Figure 1-16: State Rankings - Energy Use Per Gross Domestic Product (GDP), 2007[23]



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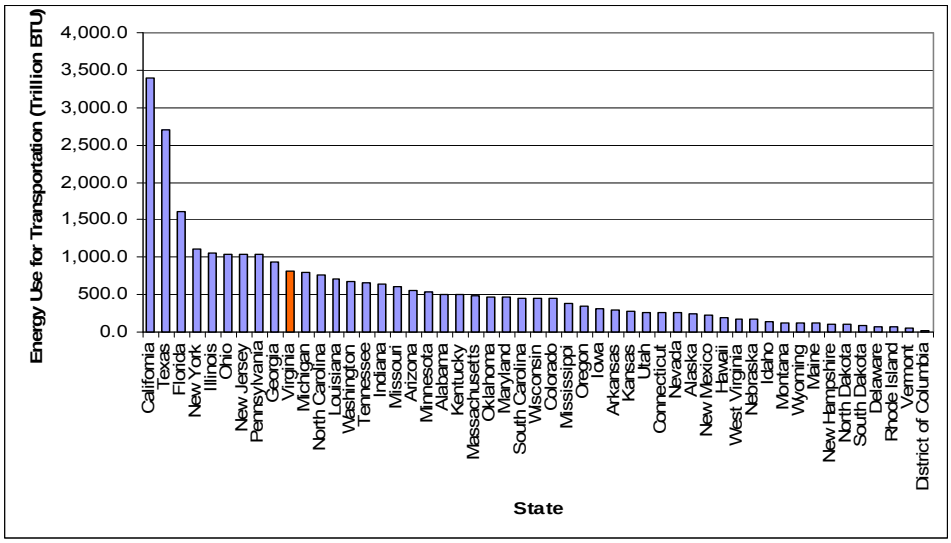
[22] http://www.eia.doe.gov/emeu/states/sep_sum/plain_html/rank_use_per_cap.html, June 16, 2010
[23] http://www.eia.doe.gov/emeu/states/_seds.html, Data: http://www.eia.doe.gov/emeu/states/sep_sum/html/pdf/rank_use_gdp.pdf, June 16, 2010

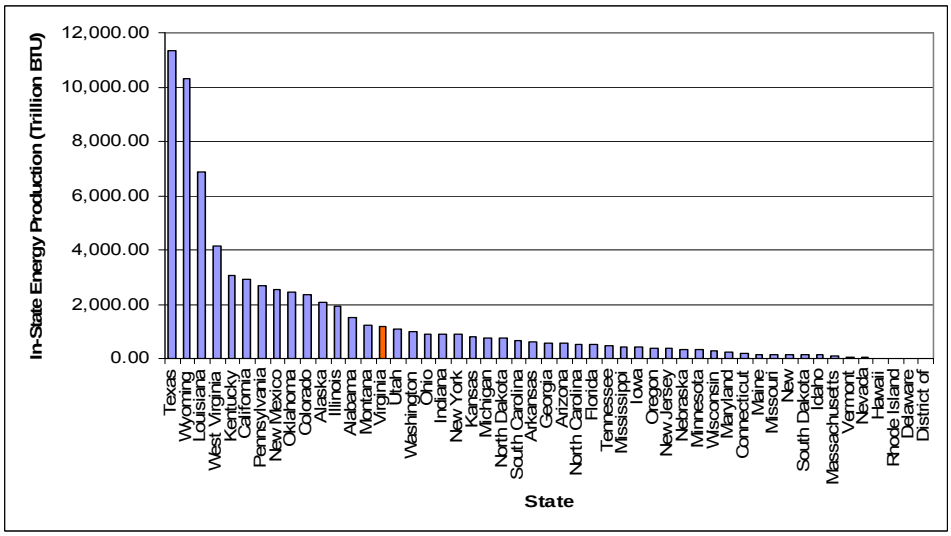
In 2007, Virginians used more energy for transportation than in any other sector, ranking 10th among the states in total energy used for transportation. Virginia ranks 28th in vehicle mile per capita, at 96 percent of the national average. Transportation energy use has risen at a greater rate than energy use in other sectors.

Figure 1-17: State Rankings – Energy Use for Transportation, 2007[24]



- In 2007, Virginia produced more energy than most states, ranking 15th among the states.

Figure 1-18: State Rankings – In-State Energy Production[25]



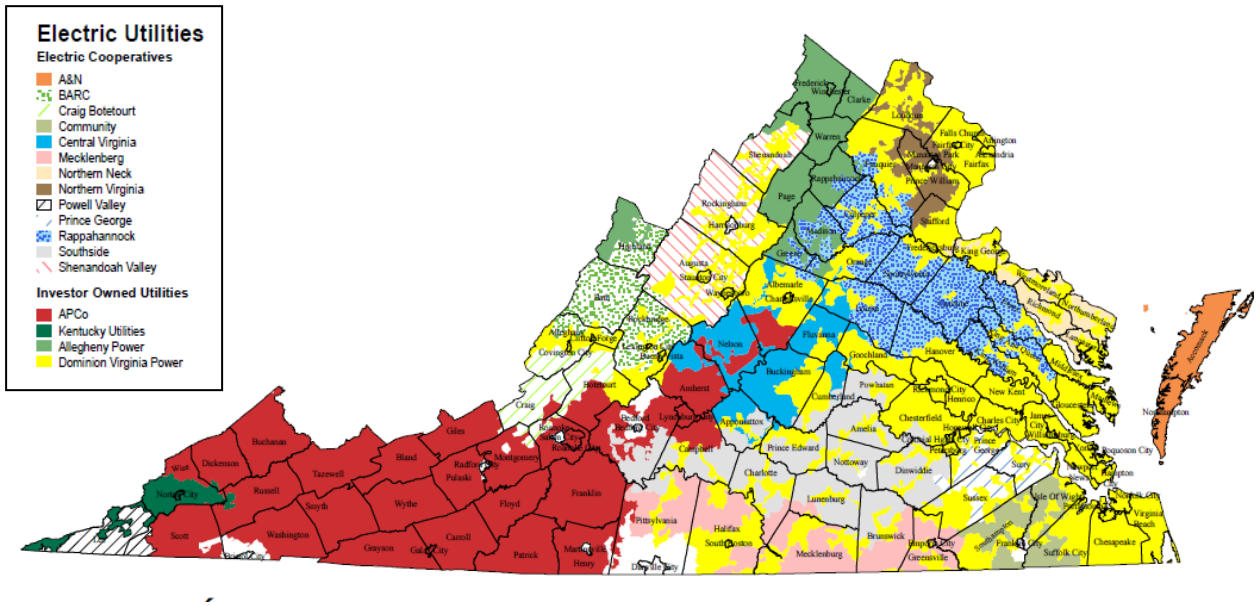
[24] http://www.eia.doe.gov/emeu/states/sep_sum/html/pdf/rank_use.pdf, June 16, 2010
[25] http://tonto.eia.doe.gov/state/state_energy_rankings.cfm?keyid=89&orderid=1, June 16, 2010

SECTION 2 - ELECTRICITY

Virginia's Electric Providers

- Electricity is provided to retail electric customers by:
  - Three investor-owned utilities providing 84.2 percent of retail sales;
  - Thirteen electric cooperatives providing 11.3 percent of retail sales; and
  - Eight municipal utilities providing 4.5 percent of retail sales.
- Investor-owned electric utilities include:
  - Dominion Virginia Power;
  - Appalachian Power (American Electric Power); and
  - Old Dominion Power (Kentucky Utilities).
- The 16 municipal electric utilities, serving customers located in their localities, include:
  - The Cities of Bedford, Bristol, Danville, Franklin, Harrisonburg, Manassas, Martinsville, Radford, and Salem;
  - The Towns of Blackstone, Culpeper, Elkton, Front Royal, Richlands, and Wakefield; and
  - Virginia Tech (serving the Town of Blacksburg).

Figure 2-1: Electric Utility Service Territories[26]



[26] SCC, http://www.scc.virginia.gov/pue/elec/map.aspx, June 24, 2010. Shows Allegheny Power service territory which was transferred in 2010 to Rappahannock and Shenandoah Valley Electric Cooperatives.

Electric Consumption

- Virginians consumed 110 million megawatt hours of electricity in 2008.
- Electricity use has grown by approximately 3 percent per year over the last 10 years, with about two thirds of the growth attributable to new customers and one third to growth in use per customer.
- Growth is not uniform across the state, most being in the Northern Virginia, Hampton Roads, and Richmond areas.

Table 2-1: Electricity Sales by Type of Utility[27]

Item	Full Service Providers			Other Provider	
	Investor-Owned	Public	Cooperative	Energy	Total
Number of Entities	3	16	13	1	35
Number of Retail Customers	2,816,469	161,822	599,435	1,157	3,578,883
Retail Sales (thousand MWh)	92,727	4,960	12,404	16	110,106
Percentage of Retail Sales	84.21	4.50	11.27	0.01	100.00
Revenue from Retail Sales (million $)	6,970	418	1,418	2	8,809
Percentage of Revenue	79.12	4.75	16.10	0.02	100.00
Average Retail Price (cents/kWh)	7.60	8.44	11.44	10.50	8.00

Table 2-2: Electricity Sales - Top Four Retailers of Electricity in Virginia[28]

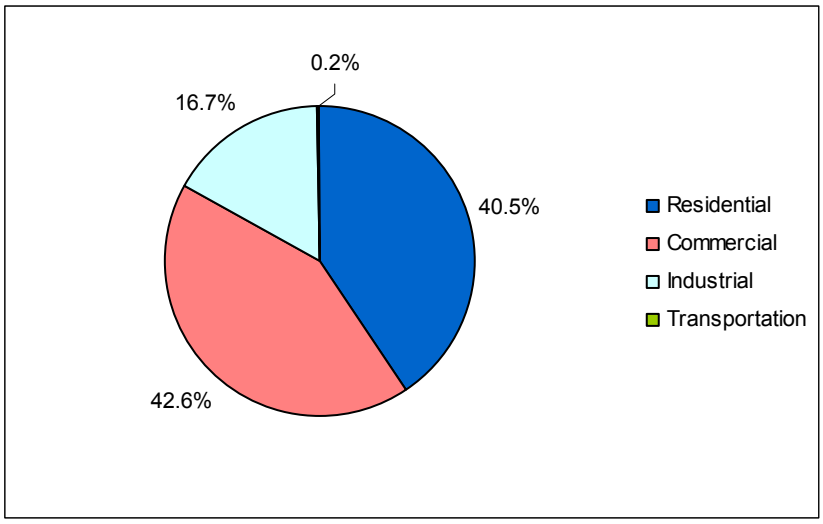
Entity	Type of Provider	All Sectors	Residential	Commercial	Industrial	Transportation
1. Dominion	Investor-Owned	74,453	28,082	38,113	8,064	194
2. Appalachian Power	Investor-Owned	16,350	6,638	4,161	5,551	0
3. Rappahannock Coop	Cooperative	4,055	2,077	505	1,473	0
4. NOVEC	Cooperative	3,230	1,888	905	438	0
Total, Top Four		99,656	39,363	44,066	16,033	194
Total State Sales		110,106	44,597	46,878	18,438	194
% Total State Sales		91	88	94	87	100
(Thousand megawatt hours)						

[27] Adapted from EIA, State Electricity Profile, Retail Electricity Sales Statistics, 2008 http://www.eia.doe.gov/cneaf/electricity/st_profiles/sept09va.xls, June 18, 2010. Data modified to show sales provided by cooperatives for customers formerly served by Allegheny Power.

[28] Adapted from EIA, State Electricity Profile, Top Five Retailers of Electricity, with End Use Sectors, 2008, http://www.eia.doe.gov/cneaf/electricity/st_profiles/sept03va.xls, June 18, 2010. Data modified to show sales provided by cooperatives for customers formerly served by Allegheny Power.

Virginia's utilities serve major military bases, one of the largest ports in the United States, and a large share of the computer infrastructure supporting the Internet and centralized computing. This results in a greater commercial load in Virginia than in many other states.

Figure 2-2: Percent of Retail Electric Sales by Customer Class, 2008[29]



Virginia's Electric Utility Regulatory Structure

- Virginia re-regulated electricity in 2007. Electricity is provided pursuant to a modified cost of service regulated monopoly system. Utilities serve exclusive territories and have an obligation to serve. Rates and terms of service for investor-owned utilities and electric cooperatives are subject to State Corporation Commission (SCC) review.[30]
    - Utilities are entitled to recover their reasonable and prudent operating expenses and earn up to a reasonable rate of return on the value of their capital investment in generating plants, transmission and distribution systems, and other facilities.
    - Calculation of a reasonable rate of return includes a comparison to the rates of return for peer electric utilities in the Southeastern United States.
    - Base rates are reviewed every two years.
    - Rates of return can be increased or decreased based on a utility's performance.
    - Additions to base rates are permitted through application of rate adjustment clauses which allow the recovery of costs for:
        - Fuel and purchased power (fuel adjustment clause);
        - Transmission, as approved by the Federal Energy Regulatory Commission;
        - Environmental and reliability improvements;
        - Energy efficiency programs;

[29] EIA, Virginia Electricity Profile, Table 8, Retail Sales, Revenue, and Average Retail Price by Sector, 1990 Through 2008. http://www.eia.doe.gov/cneaf/electricity/st_profiles/sept08va.xls, May 7, 2010

[30] Virginia Electric Utility Regulation Act, Chapter 23 of Title 56 of the Code of Virginia, http://leg1.state.va.us/cgi-bin/legp504.exe?000+cod+TOC56000000023000000000000, June 19, 2010

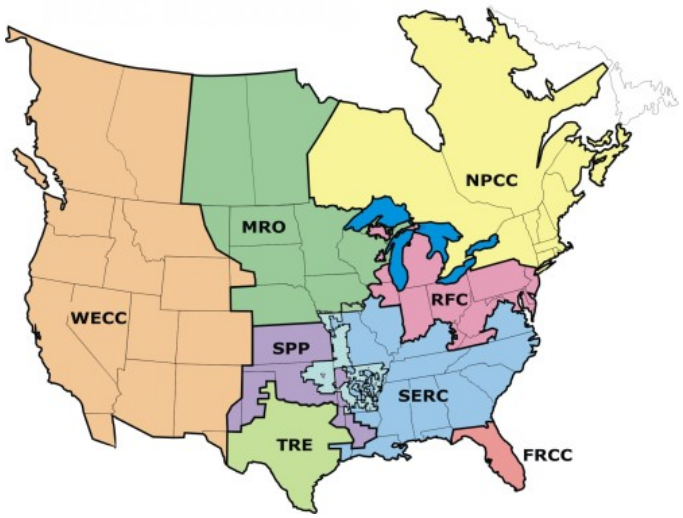
- Renewable energy needed to meet the state's renewable portfolio standard;
- Cost of new generating facilities; and
- A financial emergency.

- Electric cooperatives are authorized to increase or decrease rates by 5 percent in a three-year period (not including fuel factor adjustments) without SCC approval.
- Investor-owned electric utilities are also required to complete a 15-year Integrated Resource Plan (IRP) that sets out how the utilities will meet their customers' future demands for electricity and maintain adequate and reliable service. IRPs are to be updated every two years.[31]
- Electric utilities are required to be members of a regional transmission organization (RTO). The PJM Interconnection serves as the RTO for Virginia and areas to the north and west. PJM operates the largest centrally dispatched electric grid in the world by coordinating the movement of electricity in thirteen states.
- Rates and terms of service for municipal electric utilities are set by each City or Town Council.

Reliability Requirements

- Virginia's utilities must meet national standards established by the North American Electricity Reliability Council (NAERC) to ensure the reliability of electric service. Virginia is included in two regions of the North American Electricity Reliability Council.
  - The Southeastern Electric Reliability Council (SERC) that covers the Dominion region; and
  - The Reliability First Corporation (RFC, successor to the East Central Area Reliability Council) that covers the Appalachian Power region in Virginia.

Figure 2-3: North American Electric Reliability Council (NAERC) Regions[32]



[31] Electric Utility Integrated Resource Planning, Chapter 24 of Title 56 of the Code of Virginia, http://leg6.state.va.us/cgi-bin/legp604.exe?000+cod+TOC56000000024000000000000, June 24, 2010
[32] Solcomhouse, The US Power Grid, http://www.solcomhouse.com/uspowergrid.htm, June 19, 2010

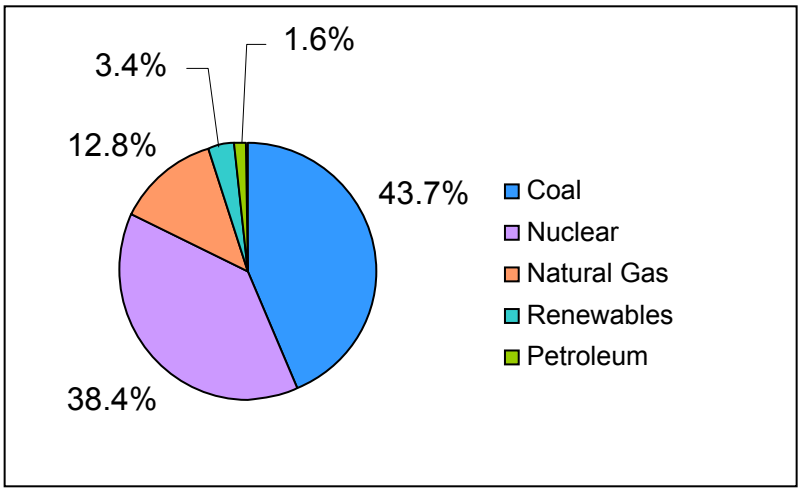
Electric Generation

- Virginia's utilities use a mix of utility-owned in-state generation, out-of-state generation, contractual purchases of electricity from in-state and out-of-state producers, and spot purchases of electricity from the PJM wholesale market to meet customer loads.
- Approximately one-third of Virginia's electric supply comes from power generated out of state. Most imports come from coal-fired plants located west and north of Virginia. A small amount of imports comes from renewable projects such as wind projects in West Virginia, Illinois, and Indiana.
- Electric generation is measured two ways, net generation and generation capacity.
  - Net generation is the amount of electricity generated over time. It is expressed in megawatt hours (MWh).
  - Generation capacity is the amount of electricity that can be generated at any one time. It is expressed in megawatts (MW).

Net Generation

- Virginia's electricity generation facilities produced 72,678,531 megawatt hours of electricity in 2008.
  - 59,780,402 megawatt hours (82 percent) were generated in plants operated by electric utilities; and
  - 12,898,129 megawatt hours (18 percent) were generated in plants operated by independent power producers and industrial combined heat and power facilities.
- Electricity is generated from diverse sources. Significant amounts of power come from coal, nuclear, and natural gas, with small amounts from renewable sources and petroleum.

Figure 2-4: In-State Net Generation by Fuel Type, 2008[33]



[33] EIA, State Electricity Profile, http://www.eia.doe.gov/cneaf/electricity/st_profiles/sept05va.xls, May 11, 2010

Generation Capacity

- Dominion, Appalachian Power, and ODEC own power plants in Virginia with a combined peak generation capacity of 18,828 megawatts.
- Municipal utilities have very little generation capacity, purchasing almost all power through long-term, wholesale power contracts.
- Virginia's merchant and industrial cogeneration plants produce power for the wholesale marketplace and internal industrial use. These have a generation capacity of 4,648 megawatts.
- The ten largest power plants in size make up 60 percent of the generation capacity in the state.

Figure 2-5: Virginia Electric Generating Capability (MW) by Fuel Type, 2008[34]

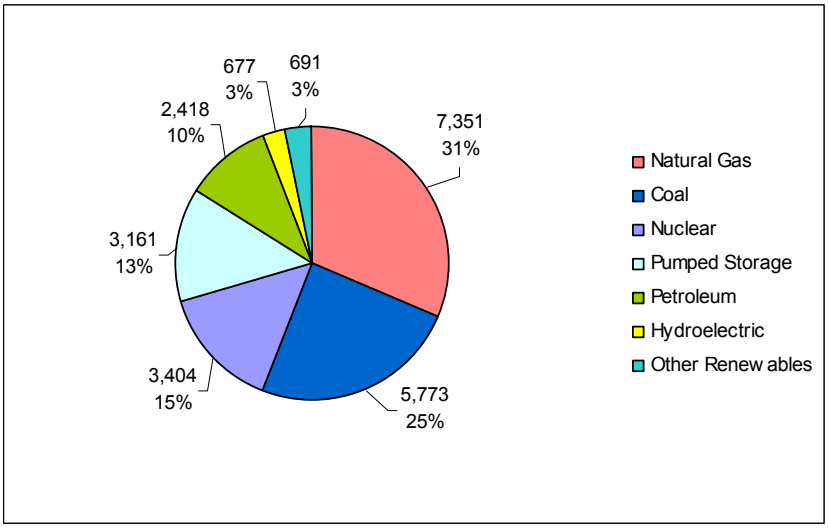


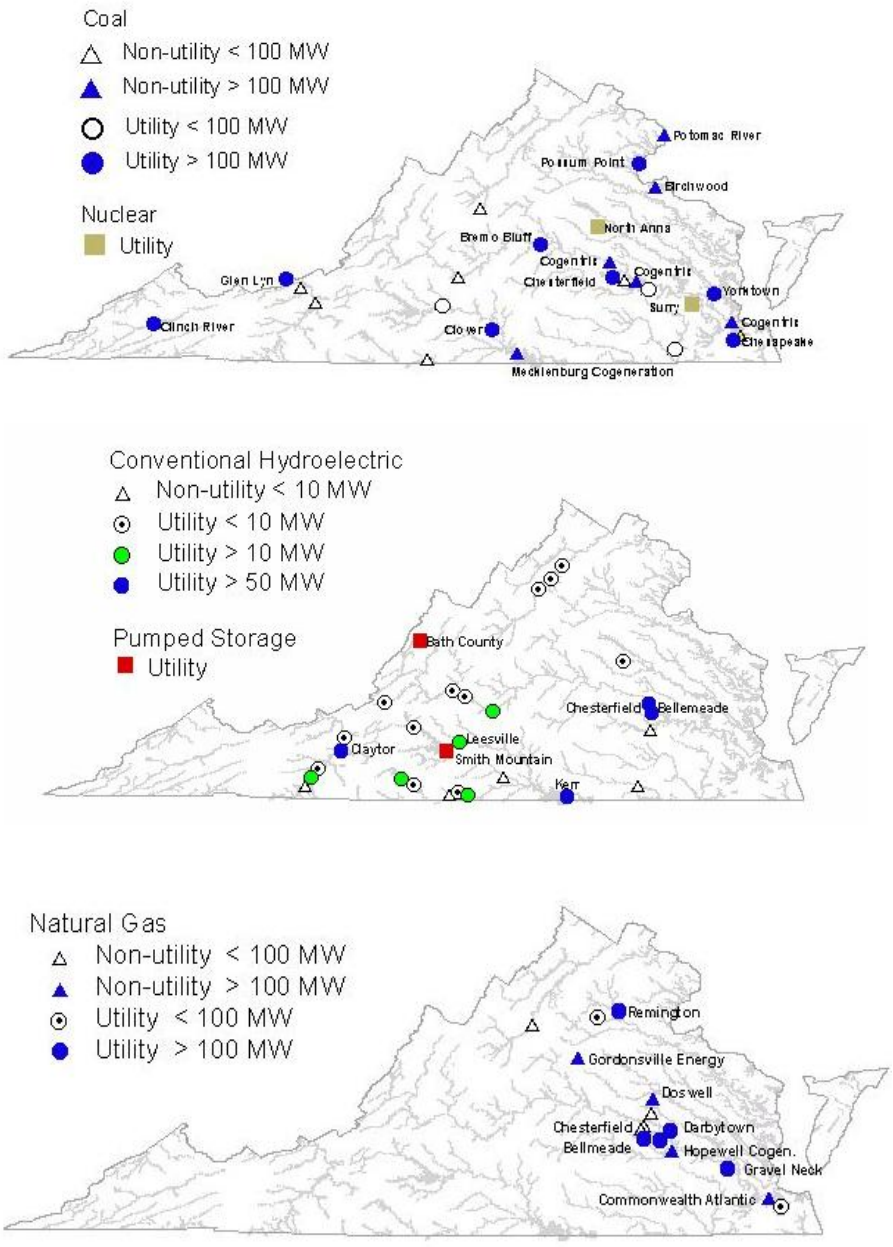
Table 2-3: Ten Largest Plants by Generation Capacity

Plant	Primary Energy Source or Technology	Operating Company	Net Summer Capacity (MW)
1. Bath County	Pumped Storage	Virginia Electric & Power Co	2,923
2. North Anna	Nuclear	Virginia Electric & Power Co	1,807
3. Possum Point	Gas	Virginia Electric & Power Co	1,733
4. Chesterfield	Coal	Virginia Electric & Power Co	1,632
5. Surry	Nuclear	Virginia Electric & Power Co	1,598
6. Yorktown	Coal	Virginia Electric & Power Co	1,141
7. Tenaska VA Gen Sta	Gas	Tenaska Virginia Partners LP	935
8. Clover	Coal	Virginia Electric & Power Co	865
9. Doswell Energy Center	Gas	Doswell Ltd Partnership	820
10. Chesapeake	Coal	Virginia Electric & Power Co	710
TOTAL			14,164

[34] EIA, State Electricity Profiles, http://www.eia.doe.gov/cneaf/electricity/st_profiles/sept04va.xls, May 11, 2010

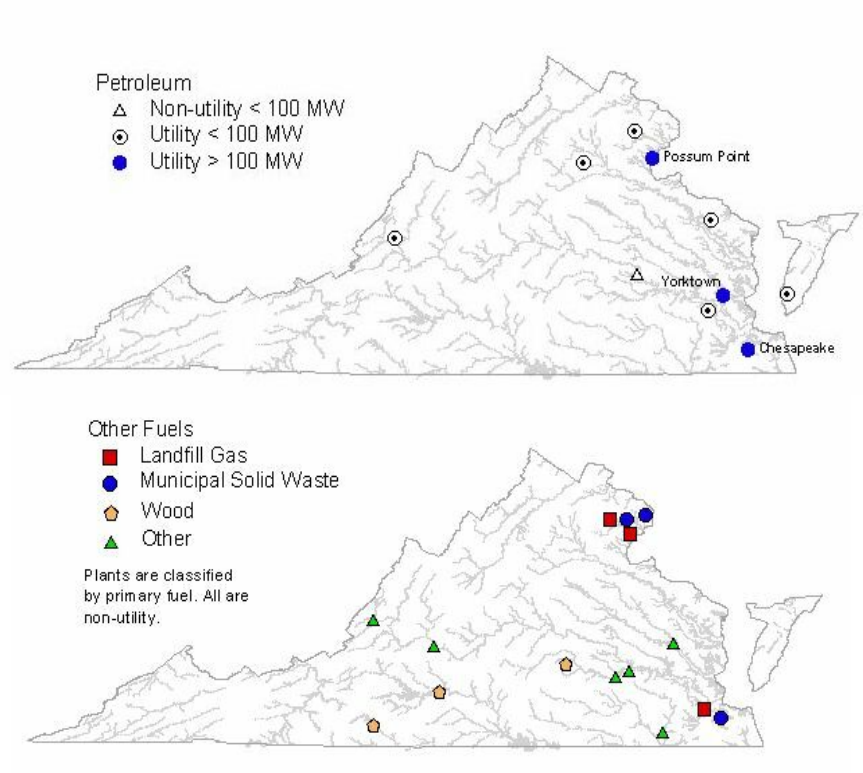
- Generation facilities are located across Virginia. Some are near population centers while others are located in remote areas requiring additional electric transmission to deliver the power to population centers.

Figure 2-6: Location of Electric Power Generation Plants by Primary Fuel Consumed[35]



[35] Virginia Energy Patterns and Trends. Location of Electric Power Generation Plants by Primary Fuel Consumed, http://www.energy.vt.edu/vept/electric/plantlocations.asp, June 19, 2010.

Note that the generation resources shown on these maps will be augmented by the new generation resources, including the coal/biomass Virginia City Hybrid Power Station in Wise County (to be online in 2012), and the natural-gas Warren County Power Station (to be online in 2015)



Renewable Portfolio Standard

- Virginia established a voluntary renewable portfolio standard (RPS) for investor-owned utilities to provide increasing amounts of electricity from renewable resources. Targets, measured against 2007 base load sales (total less sales attributable to nuclear generation), are:
  - 4 percent by 2010;
  - 7 percent by 2016;
  - 12 percent by 2022; and
  - 15 percent by 2025.
- A utility is eligible to earn an enhanced rate of return of up to 50 basis points if it meets the RPS targets and is not receiving a separate performance incentive for overall utility operations.
- Utility RPS plans and cost recovery are subject to SCC approval.

Table 2-4: Generation Needed to Meet RPS Targets (MWh)[36]

Utility	Base Line	2010 Target	2016 Target	2022 Target	2025 Target
Dominion	43,318,649	1,732,746	3,032,305	5,198,238	6,497,797
Appalachian	16,377,000	655,080	1,146,390	1,965,240	2,456,550

[36] Sourced from applications for approval of Renewable Portfolio Standards filed with the State Corporation Commission in case numbers PUE-2008-00003 (Appalachian Power) and PUE-2009-00082 (Dominion Power).

Generating Plant Loading Order

- PJM is the regional transmission organization (RTO) serving Virginia and areas to the north and west. PJM works with electric generators and utilities to operate the wholesale electric market and ensure reliable sources of electricity are available in the region.
- PJM selects which power plants are needed to meet electric loads based on plant availability and cost and capacity to deliver the electricity from the generating plant to load centers.
- Generation owners bid generation and demand side management capacity into the PJM marketplace. PJM selects the lowest cost resources first, and moves up the cost curve until the demand is satisfied.
- The cost bid for the last plant needed to meet demand sets the price for all electricity delivered during the bid period.
- This process results in the following mix of fuel types being used to supply power in the PJM system.

Table 2-8: PJM – Electric Generation by Fuel Type, CY 2009[37]

	GWh	Percent
Coal	349,818.2	50.5%
Nuclear	249,392.3	36.0%
Gas	67,218.9	9.7%
Natural Gas	65,848.2	9.5%
Landfill Gas	1,368.5	0.2%
Biomass Gas	2.2	0.0%
Hydroelectric	14,123.0	2.0%
Waste	5,664.7	0.8%
Solid Waste	4,147.0	0.6%
Miscellaneous	1,517.7	0.2%
Wind	5,489.7	0.8%
Oil	1,568.1	0.2%
Heavy Oil	1,383.7	0.2%
Light Oil	162.9	0.0%
Diesel	14.4	0.0%
Kerosene	7.1	0.0%
Jet Oil	0.0	0.0%
Solar	3.5	0.0%
Battery	0.3	0.0%
Total	693,278.7	100.0%

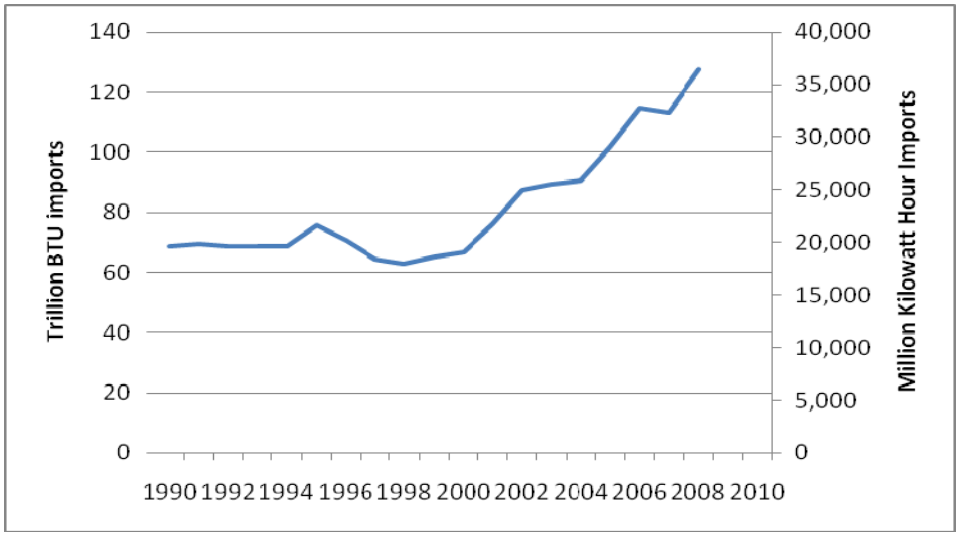
Electricity Imports

- Virginia utilities do not own in-state generation capacity sufficient to meet the state's peak load plus the reserve capacity required by federal regulation.
- It is sometimes less expensive to purchase electricity on the wholesale market than to generate the electricity at in-state, utility-owned facilities.

[37] PJM. 2009 Year in Review

- These factors resulted in Virginia importing 34 percent of electricity consumed in the state during 2008.
- As demand has grown faster than additions to generation, imports have increased by an average of 1.4 percent per year over the last 10 years.
- Virginia's imports come from:
    - Dominion's 1,632 megawatts Mount Storm electric generating station in West Virginia dedicated to serving Dominion's customers;
    - American Electric Power's generating plants dedicated to serving AEP customers;
    - Kentucky Utility's generating plants dedicated to serving KU customers; and
    - Generating plants not dedicated to serve only Virginia customers, primarily located in the PJM Interconnection area that runs from Virginia north to New Jersey and west to Illinois.

Figure 2-8: Virginia's Net Electricity Imports, 1990–2008[38]



Electric Rates

- Virginia's electric rates vary among the state's electric utilities[39], but on average have historically remained below the national average.

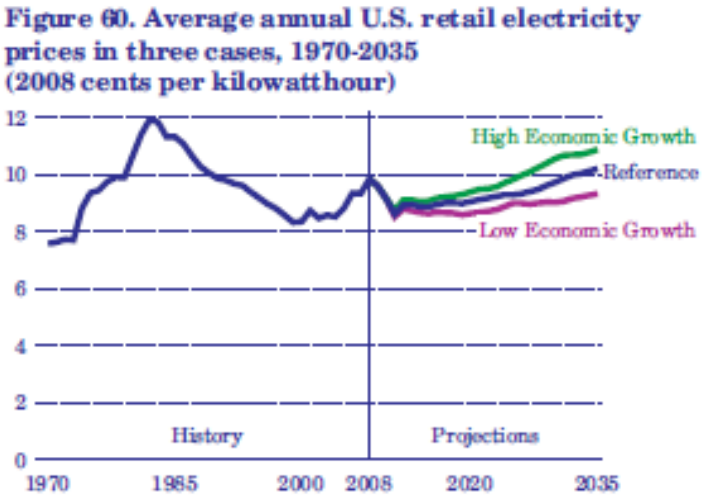
[38] EIA. State Electric Profiles, Virginia, http://www.eia.doe.gov/cneaf/electricity/st_profiles/virginia.html
[39] See http://dls.state.va.us/GROUPS/elecutil/12_14_09/rates.pdf for data on residential electric rates for individual Virginia electric utilities

Table 2-6: Average Retail Electric Rates by Customer Class (cents/kWh)[40]

Sector	1990	1995	2000	2005	2006	2007	2008	2009	YTD Thru Mar 2010
Residential	7.25	7.84	7.52	8.16	8.49	8.74	9.62	10.61	10.15
Commercial	6.06	6.07	5.65	6.05	6.21	6.38	7.32	8.10	7.78
Industrial	4.27	4.16	3.90	4.46	4.69	5.07	5.82	6.87	6.80
Transportation	5.31	5.21	5.05	6.81	6.81	6.73	7.80	8.42	7.82
All Sectors – VA	6.03	6.26	5.94	6.64	6.86	7.12	8.00	8.95	8.79
All Sectors – US	6.57	6.89	6.81	8.14	8.90	9.13	9.74	9.89	9.47
VA as % of US	91.78	90.86	87.22	81.57	77.08	77.98	82.14	90.5	92.82

- Future electric rates in Virginia will be affected by factors such as:
  - Utility operating costs;
  - Fuel costs;
  - Cost of capital;
  - Need for investments in new generation and transmission infrastructure;
  - Level of utility investments in energy efficiency and renewable portfolio standard projects; and
  - Rates of return for Virginia utilities.
- The federal Energy Information Administration (EIA) predicts that nationally, electric rates will fall through 2011 as fossil fuel costs and demand for electricity drops. Costs should then show a moderate increase through 2035 in response to rising fuel prices and the construction of new power plants.

Figure 2-7: EIA Electricity Price Forecast[41]



[40] EIA, State Electricity Profiles, http://www.eia.doe.gov/cneaf/electricity/st_profiles/sept08va.xls, June 24, 2010
[41] EIA, Annual Energy Outlook, 2010, Electricity Projections, http://www.eia.doe.gov/oiaf/aeo/pdf/trend_3.pdf, May 7, 2010

Factors Affecting Electric Generation Costs

- Electric generating costs vary based on the type and age of generating plants, the size of the plants, capital costs and the amount that has been depreciated, the cost of fuel and personnel, and other operational costs.
    - Older plants typically have lower costs. However, these plants may be more expensive if substantial environmental controls have to be added.
    - Larger plants generally offer an economy of scale due to spreading infrastructure and personnel costs over larger amounts of generation.
    - Fuel costs vary by fuel type. The relative cost of fuel also varies over time. Fuel costs are typically compared on a cost per million Btu input.
    - Differing types of electric generating plants require different amounts of manpower. Some plants, such as peaking natural gas plants, can operate with few, if any, workers present. Others, such as a biomass or coal plants, require larger numbers of workers to manage fuel, environmental controls, and ash.

Table 2-7: Average Wholesale Cost of Power by Power Plant Type (cents/kWh), 2008[42]

Plant Type	2008 Costs
Operation	
Nuclear	0.968
Coal, and Oil	0.365
Hydroelectric	0.578
Gas Turbine and Small Scale	0.298
Maintenance	
Nuclear	0.620
Coal and Oil	0.359
Hydroelectric	0.389
Gas Turbine and Small Scale	2.072
Fuel	
Nuclear	0.529
Coal and Oil	2.843
Hydroelectric	0
Gas Turbine and Small Scale	6.423
Total	
Nuclear	2.116
Coal and Oil	3.567
Hydroelectric	0.967
Gas Turbine and Small Scale	6.993

[42] EIA. Electric Power Annual. Average Power Plant Operating Expenses for Major U.S. Investor-Owned Electric Utilities, http://www.eia.doe.gov/cneaf/electricity/epa/epat8p2.html, June 19, 2010

Table 2-8: Average Delivered Cost of Fossil Fuel to Utility Power Plants ($/MMBtu), 2008[43]

Type of Fuel	Total All Sectors	Electric Power Sector	
		Electric Utilities	Independent Power Producers
Bituminous Coal	2.50	2.49	2.50
Petroleum	10.87	12.38	9.03
Natural Gas	9.02	9.15	8.94

Wholesale Electricity Pricing

- Wholesale electric prices in the PJM system are affected by the cost and availability of generation and the availability of transmission capacity to carry power from generating plants to load centers.
- Wholesale prices are higher in areas that do not have sufficient local generation or long-distance transmission capacity to meet peak electric loads as the demand in these areas must be met by local, more costly generating plants. This method of wholesale power pricing is called Locational Marginal Pricing (LMP).
- LMP in coastal areas with more congestion, such as Virginia, generally runs higher than in areas to the west, such as Illinois or Kentucky.
- Utilities in generation and transmission constrained areas must pass higher LMP along to their customers through higher retail rates.
- Wholesale electric costs in the PJM market vary over time as the demand for power grows or shrinks, as input costs such as for fuel change, and as new generation and transmission capacity is added to the region. For example, wholesale electric costs have dropped during 2009 and 2010 as demand and fuel costs have dropped.

[43] EIA. Cost and Quality of Fuels for Electric Plants 2007 - 2008 Edition, http://www.eia.doe.gov/cneaf/electricity/cq/cq_sum.html, June 19, 2010

Table 2-9: Wholesale Electric Prices (LMP) by State ($/MWh), 2008-2009[44]

	2008	2009	Difference	Difference as Percent of 2008
Delaware	$76.26	$40.80	($35.47)	(46.5%)
Illinois	$49.38	$29.05	($20.33)	(41.2%)
Indiana	$53.01	$33.08	($19.93)	(37.6%)
Kentucky	$53.80	$33.48	($20.32)	(37.8%)
Maryland	$79.75	$41.66	($38.09)	(47.8%)
Michigan	$54.07	$34.09	($19.98)	(36.9%)
New Jersey	$79.27	$41.08	($38.19)	(48.2%)
North Carolina	$71.69	$38.92	($32.77)	(45.7%)
Ohio	$52.64	$33.25	($19.39)	(36.8%)
Pennsylvania	$68.98	$38.47	($30.50)	(44.2%)
Tennessee	$54.36	$33.54	($20.82)	(38.3%)
Virginia	$73.20	$39.29	($33.91)	(46.3%)
West Virginia	$55.02	$34.60	($20.42)	(37.1%)
District of Columbia	$80.57	$42.98	($37.59)	(46.7%)

Table 2-10: Wholesale Electric (LMP) Prices in PJM ($/MWh), 1998-2009[45]

	Real-Time LMP			Year-to-Year Change		
	Average	Median	Standard Deviation	Average	Median	Standard Deviation
1998	$21.72	$16.60	$31.45	NA	NA	NA
1999	$28.32	$17.88	$72.42	30.4%	7.7%	130.3%
2000	$28.14	$19.11	$25.69	(0.6%)	6.9%	(64.5%)
2001	$32.38	$22.98	$45.03	15.1%	20.3%	75.3%
2002	$28.30	$21.08	$22.41	(12.6%)	(8.3%)	(50.2%)
2003	$38.28	$30.79	$24.71	35.2%	46.1%	10.3%
2004	$42.40	$38.30	$21.12	10.8%	24.4%	(14.5%)
2005	$58.08	$47.18	$35.91	37.0%	23.2%	70.0%
2006	$49.27	$41.45	$32.71	(15.2%)	(12.1%)	(8.9%)
2007	$57.58	$49.92	$34.60	16.9%	20.4%	5.8%
2008	$66.40	$55.53	$38.62	15.3%	11.2%	11.6%
2009	$37.08	$32.71	$17.12	(44.1%)	(41.1%)	(55.7%)

[44] Monitoring Analytics, LLC. 2009 State of the Market Report for PJM, Table 2-57, Page 66
[45] Monitoring Analytics, LLC. 2009 State of the Market Report for PJM, Table 2-55, Page 65

Cost of New Generation

- Electric generators consider a variety of factors when deciding to build a new generating plant. These factors can be evaluated to calculate a levelized cost of power.
- Factors include:
  - Fuel costs and their expected change over time;
  - Risk associated with being able to successfully permit and construct each type of plant;
  - Time needed to construct the plant;
  - Expected life of the plant;
  - Cost of capital;
  - Capacity factor of the plant; and
  - Other.

Table 2-11. Estimated Levelized Cost of New Generation Resources, 2016[46]

Plant Type	Capacity Factor (%)	U.S. Average Levelized Costs (2008 $/megawatthour) for Plants Entering Service in 2016				
		Levelized Capital Cost	Fixed O&M	Variable O&M (including fuel)	Transmission Investment	Total System Levelized Cost
Conventional Coal	85	69.2	3.8	23.9	3.6	100.4
Advanced Coal	85	81.2	5.3	20.4	3.6	110.5
Advanced Coal with CCS	85	92.6	6.3	26.4	3.9	129.3
Natural Gas-fired						
Conventional Combined Cycle	87	22.9	1.7	54.9	3.6	83.1
Advanced Combined Cycle	87	22.4	1.6	51.7	3.6	79.3
Advanced CC with CCS	87	43.8	2.7	63.0	3.8	113.3
Conventional Combustion Turbine	30	41.1	4.7	82.9	10.8	139.5
Advanced Combustion Turbine	30	38.5	4.1	70.0	10.8	123.5
Advanced Nuclear	90	94.9	11.7	9.4	3.0	119.0
Wind	34.4	130.5	10.4	0.0	8.4	149.3
Wind – Offshore	39.3	159.9	23.8	0.0	7.4	191.1
Solar PV	21.7	376.8	6.4	0.0	13.0	396.1
Solar Thermal	31.2	224.4	21.8	0.0	10.4	256.6
Geothermal	90	88.0	22.9	0.0	4.8	115.7
Biomass	83	73.3	9.1	24.9	3.8	111.0
Hydro	51.4	103.7	3.5	7.1	5.7	119.9

[46] DOE EIA. 2010 Annual Energy Outlook. 2016 Estimated Levelized Cost of New Generation Resources, http://www.eia.doe.gov/oiaf/aeo/pdf/2016levelized_costs_aeo2010.pdf, June 19, 2010

Future Electric Demand

- PJM forecasts of summer peak demand and consumption predict:
  - Demand in Dominion's control area will grow on average 2.5 percent per year over the next 10 years. Consumption is forecast to grow by 2.4 percent per year.
  - Demand in Appalachian Power's control area will grow by 1.3 percent per year. Consumption is forecast to grow by 1.2 percent per year.
- Based on these growth rates, Virginia will need to add over 14,000 megawatts of capacity by 2020 to maintain the same level of electricity imports as in 2008.
- These growth forecasts may increase in the future as the state and national economy recovers, and as the electric market changes due to electric cars, added computing capacity, and other factors.

Table 2-12: Forecast of Peak Electric Demand in Virginia (MW)[47]

Year	Base-Case Forecast -- Peak Electric Demand	Annual Growth in Peak Demand	Cumulative Growth in Peak Demand	Capacity Needed to Maintain 2008 Import Ratio (29.4%)	Capacity Needed to Maintain 2008 Import Ratio	Cumulative Capacity Needed to Maintain 2008 Import Ratio
2008	117,804	0	0	72,697	0	0
2009	119,571	1,767	1,767	73,769	1,040	1,090
2010	121,365	1,794	3,561	74,876	1,107	2,197
2011	123,185	1,820	5,381	75,999	1,123	3,320
2012	125,033	1,848	7,229	77.139	1,140	4,460
2013	126,908	1,875	9,104	78,296	1,157	5,617
2014	128,812	1,904	11,008	79,470	1,174	6,791
2015	130,744	1,961	12,940	80,662	1,192	7,983
2016	132,705	1,961	14,901	81,872	1,210	9,193
2017	134,696	1,991	16,892	83,100	1,228	10.421
2018	136,716	2,020	18,912	84,347	1,247	11,668
2019	138,767	1,991	20,963	85,612	1,265	12,993
2020	140,849	2,082	23,045	86,896	1,284	14,217

Integrated Resource Plans

- Electric utilities in Virginia are required to complete an Integrated Resource Plan (IRP) to address how they will meet this growing demand over a 15-year time frame.
- Dominion's preferred IRP includes adding 7,900 megawatts of generation capacity, nearly 950 megawatts from demand side management programs, and market purchases.[48]
  - Projected new generation capacity would come from the Virginia City coal-biomass hybrid plant under construction and new plants including six natural gas combined cycle, four natural gas combustion turbine, the third North Anna nuclear, two biomass, and four wind facilities.

[47] Calculated based on EIA Electricity Profile Supply and Disposition historical data
[48] Virginia Electric and Power Company Integrated Resource Plan filed with the Virginia SCC on September 15, 2009

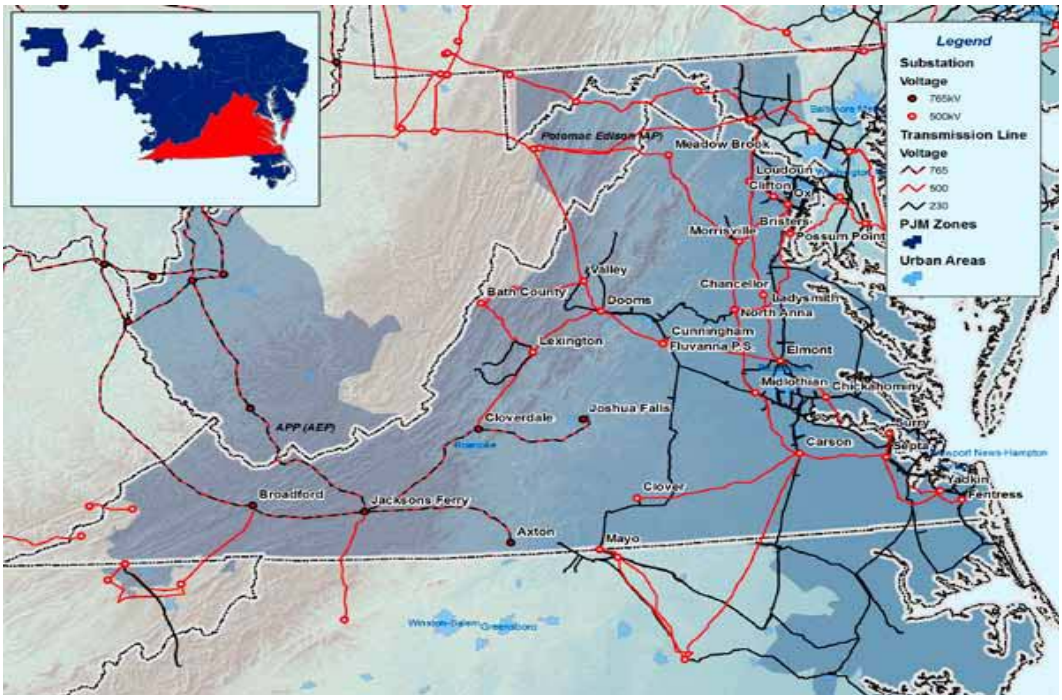
- Appalachian Power's IRP (East Zone) includes adding 4,168 megawatts of generation capacity and 1,346 megawatts from demand side management. This will be offset by planned unit retirements and retrofits lowering capacity by 5,093 megawatts for a net capacity addition of 422 megawatts.[49]
    - Projected new generation capacity would come from completion of the Dresden plant under construction in Ohio; capacity uprates at the Cook nuclear plant in Michigan; and construction of four new fossil fuel plants, biomass co-firing and two new biomass plants, and purchases or additions of wind and solar capacity.
- The Old Dominion Electric Cooperative (which provides wholesale power to its member retail electric cooperatives) is proposing constructing a new coal-fired power plant near Cyprus Creek in Surry County. The Cyprus Creek Power Station would have a capacity between 750 and 1,500 megawatts, and be completed at the earliest by 2018.

Transmission and Distribution of Electricity

- Electricity is delivered to end users through a network of high-voltage transmission and local distribution lines.[50]
    - Electric power is transmitted in Virginia through 230, 500, and 765-kV transmission lines constructed, owned, and operated by Dominion, Appalachian Power, Delmarva Power, and Allegheny Power.
    - Transmission lines are typically located above ground. The cost of burying high-voltage transmission lines underground is many times the cost of placing the lines overhead. Underground lines also present higher maintenance challenges and costs.
    - Electricity is distributed from the transmission network to end users through a network of smaller, lower-voltage lines and facilities.
    - Distribution lines are typically located above ground. Distribution lines can also be placed underground, typically in new development where the incremental cost of burying the lines is lower.
- Electric cooperatives and municipal electric departments do not own any transmission lines.
- Management of and additions to the regional transmission grid are directed by the PJM Interconnection to ensure reliability of the system.

[49] Appalachian Power Company's Integrated Resource Plan filed with the Virginia SCC on September 1, 2009
[50] PJM 2009 RTEP Report – Section 12.12, Virginia, http://www.pjm.com/documents/reports/~/media/documents/reports/2009-rtep/2009-section12-12-va.ashx, June 18, 2010

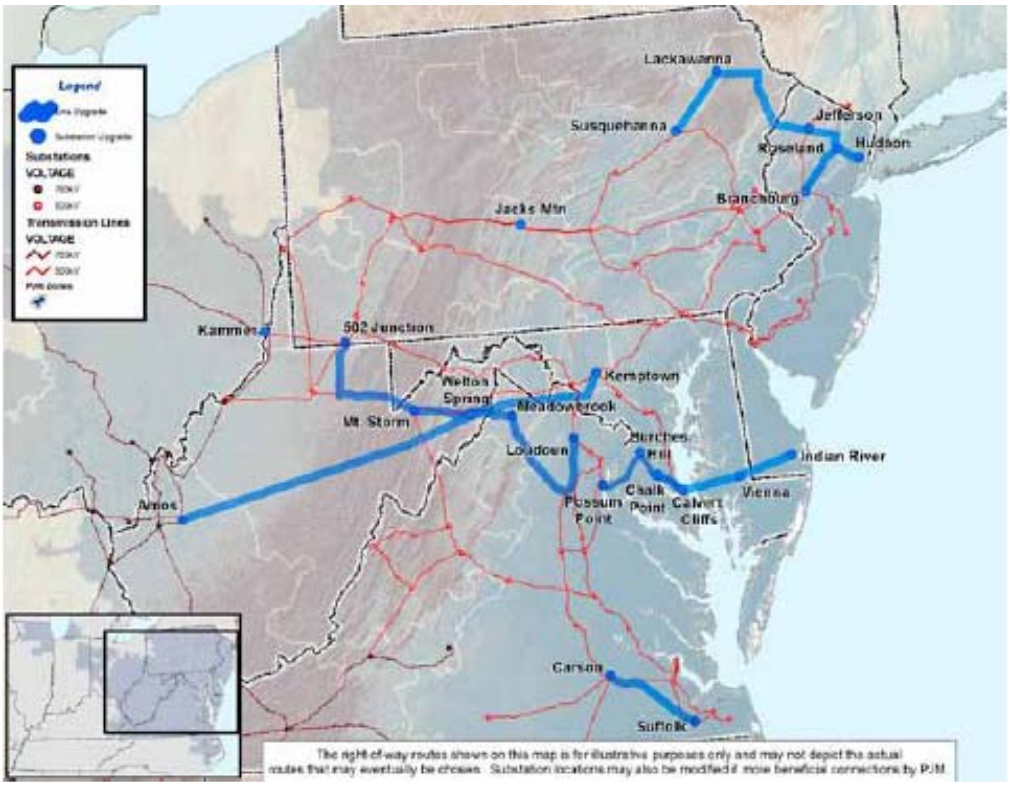
Figure 2-9. Virginia's Electric Transmission System[51]



- PJM creates a Regional Transmission Expansion Plan (RTEP) to identify the need for new transmission resources. The 2009 RTEP includes four high-voltage lines affecting Virginia.
  - Allegheny and Dominion's 500 kV Trans Allegheny Interstate Line (TrAIL) from the 502 Junction in western Pennsylvania to Loudoun County;
  - Dominion's 500 kV Carson to Suffolk line;
  - Allegheny and Appalachian Power's 765 kV Potomac-Appalachian Transmission Highline (PATH) from Atmos, West Virginia, to Kempstown, Maryland; and
  - Pepco's 500 kV Mid-Atlantic Power Pathway (MAPP) from Possum Point in Virginia to Indian River, Maryland.
- The Virginia SCC must determine and certify the need for and location of proposed new electric transmission lines. The SCC has approved the TrAIL and Carson-Suffolk lines.
- PJM has delayed the schedules for the PATH and MAPP lines due to the 2009-10 drops in electric demand.

[51] PJM. PJM 2009 Regional Transmission Expansion Plan, Section 12.12, Virginia RTEP Overview, Map 12-53, Page 321

Figure 2-10: PJM 2009 RTEP Approved 765 and 500 kV Facilities[52]



- The Federal Energy Regulatory Commission (FERC) regulates electric transmission rates. The charges are passed through to Virginia ratepayers on a dollar-for-dollar basis.
- FERC has the authority under the National Interest Electric Transmission Corridor (NIETC) legislation to designate priority electric transmission corridors in transmission constrained areas.
    - Based on a U.S. Department of Energy study of transmission needs, FERC has designated two corridors in the Eastern United States with inadequate transmission, one crossing through Northern Virginia.
    - If the SCC fails to act on a petition to build a new line in a designated corridor, the applicant to the line could petition FERC to take over jurisdiction for the line.

Conservation and Efficiency

- Electric efficiency actions can be used to reduce future growth in electrical demand.
- Substantial cost-effective investments in energy efficiency remain unmade as there are factors that undercut market forces. These include:
    - Principal-agent barriers – the party responsible for the building improvements doesn't pay electric bills;

[52] PJM. PJM 2009 Regional Transmission Expansion Plan, Executive Summary, Map 1.2, Page 6

- Information barriers – consumers don't have sufficient trusted information in order to act;
- Transaction cost barriers – consumers cannot budget or borrow the up front investment needed for energy efficiency projects; and
- Externality cost barriers – benefits of energy efficiency, such as lower utility costs from reduced peak demand, accrue to other people than those making the investments.

- State government has taken a number of actions to overcome these market barriers, including:
  - Adoption by the General Assembly of voluntary goals to reduce electric use by 2022, through conservation and efficiency, by an amount equal to 10 percent of 2006 use;
  - An Energy Star appliance sales tax holiday over Columbus Day weekend in October;
  - An income tax exemption for sales tax paid on certain energy efficiency improvements;
  - $15 million in American Recovery and Reinvestment Act (ARRA) State Energy Program funding for energy efficiency rebates;
  - $7.4 million in ARRA funds for Energy Star appliance and equipment rebates;
  - $94 million in ARRA funds to expand the Weatherization Assistance Program, under which efficiency improvements are made to homes of families earning up to 60 percent of the state medium based on family size;
  - $200 million in energy efficiency improvements made to state government facilities;
  - Completion of carbon emission inventories and plans to lower carbon emissions. Energy efficiency actions are a primary strategy of these plans; and
  - Authorization for local governments to provide property tax and other incentives for:
    - Energy Star buildings (at least 20 percent more efficient than minimum building code requirements);
    - Buildings with green roofs and solar energy systems; and
    - Property Assessed Clean Energy (PACE) or Home Performance with Energy Star programs.

- Virginia's consumers also benefit from federal incentives and programs that encourage efficiency, such as:
  - Federal energy efficiency income tax credits;
  - Strengthened minimum equipment efficiency requirements; and
  - Expansion of the Energy Star program.
- Conservation and efficiency can offset a portion of future electric load growth. If Virginia's consumers can meet the state goal to reduce its electricity use by 10 percent, the forecasted peak electric generation capacity would be reduced by 3,285 megawatts.

Table 2-13: Electricity Generation Scenarios for Virginia (Demand/Generation Capacity)

Scenario	Year	In-State Electrical Demand (MW)	Energy Efficiency Goal Percent	Energy Efficiency Goal (MW)
Base Case	2008	38,052	0%	0
1	2020	49,756	0%	0
2	2020	46,471	9%	3,285
	Scenario Description			
Base Case	Base historical year – 2008 - Based on Energy Information Administration data			
1	No conservation and efficiency impacts, no new generation			
2	10% conservation and efficiency impacts, no new generation			
Energy Efficiency goal based on 10% reduction from 2006 base year by 2022 as provided in Chapter 888 (HB 3068), 2007 Virginia Acts of Assembly. 2006 base consumption was 118,365,000 MWh, with an approximate 36,500 MW peak demand. (2006 data source - State Electricity Profiles 2006, 11/21/07). http://tonto.eia.doe.gov/ftproot/electricity/stateprofiles/06st_profiles/062906.pdf.				

Adequacy of Electric Infrastructure Siting Requirements

- Permitting for new electric facilities is a complex and lengthy process.
- Multiple federal, state, and local permits are required to address issues such as need for the project, cost, and impact on ratepayers; environmental impacts; safety; and local land use impacts.
- The permits establish performance requirements in multiple environmental and public safety areas.
- These processes provide for multiple opportunities for public comment, in writing and orally.
- For example, an applicant for a proposed fossil-fuel power plant must apply for permits or approvals from:
    - The Department of Environmental Quality (DEQ) for air, water, and waste discharges, including:
        - Air permits to address use of Best Available Control Technology to maintain compliance with the National Ambient Air Quality Standards (NAAQS) and Maximum Achievable Control Technology for hazardous air pollutants;
        - Water permits to address withdrawals from and discharges to surface and groundwater;
        - Wetland permits (issued jointly with the U.S. Army Corps of Engineers and Virginia Marine Resource Commission) to address construction affecting wetlands; and
        - Waste permits to address management of solid wastes, typically bottom and fly ash from combustion.
    - The Department of Conservation and Recreation for erosion and sediment control and stormwater management;

    - The Departments of Game and Inland Species and Agriculture and Consumer Services for threatened or endangered plant, animal, or insect species;
    - The Department of Historic Resources for state and federally-protected historic or other natural or cultural resources;
    - The Department of Transportation for access to public highways;
    - The SCC which must issue a Certificate of Public Convenience and Necessity showing the need for the project, that the power plant is in the public interest, and that it would not have an excessive rate impact;
    - Multiple federal agencies for environmental controls, such as:
        - The Environmental Protection Agency (EPA);
        - The Army Corps of Engineers;
        - The U.S. Fish and Wildlife Service; and
        - The U.S. Forest Service.
- Virginia has taken a number of actions to facilitate permitting of new electric infrastructure.
    - Applicants for new electric generation or transmission projects, or natural gas transmission lines or storage facilities, may use a pre-application planning and review process with agencies within the Secretary of Natural Resources to provide a plan that will provide for an efficient and coordinated review of the proposed energy facility. The plan includes:
        - A list of the permits or other approvals likely to be required based on the information available;
        - A specific plan and preliminary schedule for the different reviews;
        - A plan for coordinating those reviews and the related public comment process; and
        - Designation of points of contact, either within each agency or for the Commonwealth as a whole, to facilitate this coordination.
    - The DEQ is drafting permits by rule for renewable energy projects of 100 megawatts or less in size (such as land-base wind projects) and of 20 megawatts or less if the project results in air emissions (such as biomass projects) to provide a streamlined permitting process for smaller renewable projects.
    - The SCC, in considering its Certificate of Public Convenience and Necessity for electric generating plants and associated facilities, cannot impose additional conditions with respect to environmental protection, building codes, transportation plans, and public safety when a separate permit is granted by a federal, state, or local government entity.
- A long permitting process makes it more difficult to finance the large capital investments required for generating facilities.
- To help reduce the financial risk, Virginia provides, subject to SCC approval:
    - An increased rate of return for utility investments in new, clean-technology generating plants; and

    - Construction work in progress cost recovery to reduce the regulatory lag in recovering capital investments in new plants.
- EPA has taken steps under the Clean Air Act to regulate carbon emissions as a regulated emission. This will require a change in how utilities permit new fossil-fueled generation plants.
- Virginia lacks a process to permit carbon capture and storage that might be part of a new generation project. Items to be addressed before widespread carbon sequestration is possible include:
    - Testing technology and permanence of sequestration in unminable coal seams;
    - Addressing the rights and liabilities of owners of lands used for sequestration; and
    - The potential of saline aquifers in Central and Eastern Virginia to serve as underground carbon sinks.

Future Direction

- To meet the projected growth in electric demand and the need to replace aging generation capacity, we must :
    - Construct new, large centralized generation facilities and smaller-scale independent power projects;
    - Expand distributed generation;
    - Construct new transmission facilities; and
    - Expand conservation and efficiency actions.
- EPA's decision to regulate carbon dioxide as a pollutant, or federal carbon legislation that would supersede EPA regulation requiring more stringent emission standards, may make older fossil fuel facilities more expensive to operate. In response, utilities may retire such units and increase reliance on more expensive power purchased on the wholesale market.
- The threat of cap and trade regulation creates substantial uncertainty that may discourage investment in new fossil-fueled generation.
- The greatest potential for renewable electric generation and new jobs comes from onshore and offshore wind, waste or biomass-to-energy facilities, and solar. However, renewable projects are typically smaller and are unable to substitute for new base-load generation.
- Hydropower is limited due, to the few locations in Virginia without a major environmental impact.
- The unknown rate of penetration of electric vehicles into the marketplace may require additional generation capacity expansions.
- Smart meters have been subject to complaints by some regarding their accuracy. There may need to be a longer history of use before public acceptance improves and the savings from voltage control attributable to smart meter use has been proven.

SECTION 3 - COAL

Coal Markets – Electric Generation

- In 2008, Virginia's electric generators produced 47 percent of the electricity generated in Virginia from coal.
  - Twenty-five percent of the coal used to generate this electricity came from Virginia coal mines.
  - Substantial tonnage also came from Kentucky (38 percent) and West Virginia (16 percent).
  - The sources of coal fluctuate as the cost and availability of coal from Virginia and competing states change.

Table 3-1: Coal Used in Virginia Power Plants (Thousand Short Tons), 1995-2008[53]

Year	Coal Use at VA Power Plants	Virginia Coal Delivered to VA Power Plants	Percent from Virginia Mines
1995	14,454	4,423	30.6
1996	14,479	6,024	41.6
1997	15,346	6,197	40.4
1998	16,818	6,868	40.8
1999	12,932	7,078	54.7
2000	12,584	7,299	58.0
2001	19,647	5,402	27.5
2002	21,632	6,150	28.4
2003	21,118	5,942	28.1
2004	15,750	5,153	32.7
2005	18,314	6,501	35.5
2006	15,442	8,963	58.0
2007	20,212	9,201	45.5
2008[54]	15,511	3,883	25.0

[53] EIA, http://www.eia.doe.gov/cneaf/electricity/cq/cq_sum_backissues.html, June 29, 2010
[54] EIA, http://www.eia.doe.gov/cneaf/electricity/cq/cqaxlfile15_a.xls, June 29, 2010

Table 3-2: Source of Coal to Virginia Power Plants, 2007-2008

Destination Origin	Quantity (thousand tons)	Average Quality				Average Delivered Cost	
		Heat Value (Btu per pound)	Sulfur (percent by weight)	Sulfur (pounds per MMBtu)	Ash (percent by weight	(Cents per million Btu)	(Dollars per ton)
2007							
Virginia	**14,746**	**12,531**	**0.94**	**0.75**	**9.93**	**249**	**62.34**
Colorado	12	12,379	0.5	0.4	9	289	71.43
Kentucky	2,609	12,721	0.96	0.75	9.47	251	63.33
Ohio	316	11,680	0.54	0.46	7.97	257	59.95
Virginia	9,201	12,636	1.02	0.81	10.51	234	59
West Virginia	1,327	12,665	0.81	0.64	10.33	244	59.76
Imported	1,281	11,458	0.51	0.44	6.82	264	60.57
2008							
Virginia	**15,511**	**12,492**	**0.92**	**0.74**	**10.01**	**277**	**69.18**
Alabama	11	12,675	0.64	0.5	8.6	--	--
Colorado	226	12,193	0.56	0.46	9.6	264	64.26
Kentucky	5,913	12,697	1.06	0.84	9.42	269	68.25
Virginia	3,883	12,591	0.98	0.78	11.92	248	62.32
West Virginia	2,406	12,638	0.83	0.65	10.41	282	70.21
Imported	1,643	11,368	0.47	0.42	7.06	272	61.77
Unclassified	1,431	12,469	0.93	0.74	10.1	--	--

- Virginia coal operators also sell coal to electric utilities in states from Florida to New Hampshire and west to Indiana. Most steam sales are made to utility customers in Virginia, Georgia, North Carolina, and West Virginia

Table 3-3: Destination States for Virginia Coal (Thousand Short Tons)

Census Division and Destination State	2007	2006	2005	2004	2003	2002	2001	2000	1995	1990
Total	20212	19387	18314	15750	21118	21632	19647	19582	14454	17366
Virginia	9201	8963	6501	5153	5942	6150	5402	7299	4423	3488
Georgia	5674	5240	5288	5122	6453	5563	7075	5798	1987	3339
Tennessee	2202	2240	3016	2882	4236	4896	2700	1880	658	1223
North Carolina	1227	1494	1978	1867	1713	363	1505	702	3282	4345
West Virginia	816	-	198	50	12	29	18	17	-	-
Delaware	396	385	352	21	40	22	-	41	23	227
Mississippi	282	326	374	-	-	31	139	-	-	-
Florida	135	186	75	19	95	20	38	476	703	969
New Hampshire	102	361	144	157	70	328	-	-	19	-
Connecticut	47	-	-	-	68	-	-	-	-	-
New Jersey	43	-	-	-	1137	539	-	319	689	963
Maryland	39	17	58	33	60	206	-	7	394	21
Pennsylvania	39	9	10	21	19	-	-	-	-	-
Michigan	5	9	-	-	27	-	96	-	76	113
South Carolina	4	110	41	31	253	896	982	1078	1096	993
New York	-	46	142	-	-	-	-	-	-	-
Ohio	-	-	109	143	429	896	454	514	89	-
Indiana	-	-	18	251	529	1172	1065	707	1014	56
Kentucky	-	-	8	-	-	-	-	-	-	60
Massachusetts	-	-	-	-	25	-	-	-	-	1510
Wisconsin	-	-	-	-	-	-	25	62	-	59
District of Columbia	-	-	-	-	-	-	-	10	-	-
Alabama	-	-	-	-	9	218	148	671	-	-
Data are for electric generating plants with a total steam electric and combined name plate capacity of 50 megawatts or more.										
In some cases coal shipments include coal mined in other States but processed and loaded in Virginia, as well as coal mined in and shipped from Virginia.										

Coal Markets – Other Uses

- In a typical year, 25-30 percent of Virginia coal is sold domestically for manufacturing steel or making industrial steam.
- A small amount is sold domestically for institutional, commercial, and residential heating.

Table 3-4: Markets for Coal Shipped From Virginia[55]

Domestic Shipments of Virginia Coal (thousand short tons)			
	2000	1995	1990
Electric Utilities	16,372	14,632	15,892
Coke Plants	3,385	6,511	8,263
Industrial Plants (Other than Coke)	4,738	2,912	3,948
Residential and Commercial	113	187	137
Unknown Consumer Class	101	40	623
Total	24,785	24,283	28,862
Note: Data set was discontinued after 2000.			

- Virginia coal operators also sell coal in the European and Asian markets for steel manufacturing or electric generation.
    - Overseas tonnage varies greatly from year to year, depending on the competitiveness of Virginia coal as compared to Australian, South African, Polish, and South American coal.

Coal Prices

- Coal is priced separately in the steam and metallurgical coal markets.[56] Steam coal is generally lower in cost.
- Coal prices fluctuate over a considerable range as the international and domestic coal markets fluctuate due to changes in economic activity and demand for electricity and steel.
    - Steam coal prices have ranged from just under $23.92 dollars per short ton in 1999 to $51.45 in 2008.[57]
    - Metallurgic coal costs have ranged from $45.25 in March 2001 to a high of $151.18 in September 2009.[58]

[55] Compiled from the EIA, Annual Coal Report, http://www.eia.doe.gov/cneaf/coal/page/acr/acr_sum.html
[56] Metallurgical coal is used for making steel and generally has a higher energy value, lower ash, and higher volatility than steam coal.
[57] EIA, Annual Energy Review, Coal, Coal Prices, 1949-208, http://www.eia.doe.gov/emeu/aer/txt/stb0708.xls, May 11, 2010
[58] EIA, Average Cost of Metallurgical Coal, Priced at Coke Plants, and at Export Docks, January 2001- Latest Available, http://www.eia.doe.gov/cneaf/coal/page/coalnews/metcoalpricepost.xls, May 11, 2010

Table 3-5: Steam Coal Prices – Average Delivered Price ($/ton)[59]

Year	Electric Utilities	Other Industrial Plants
2000	$24.28	$31.46
2001	$24.68	$32.26
2002	$24.24	$35.49
2003	$25.82	$34.70
2004	$27.36	$39.30
2005	$31.22	$47.63
2006	$34.26	$51.67
2007	$36.06	$54.42
2008	$41.32	$63.44

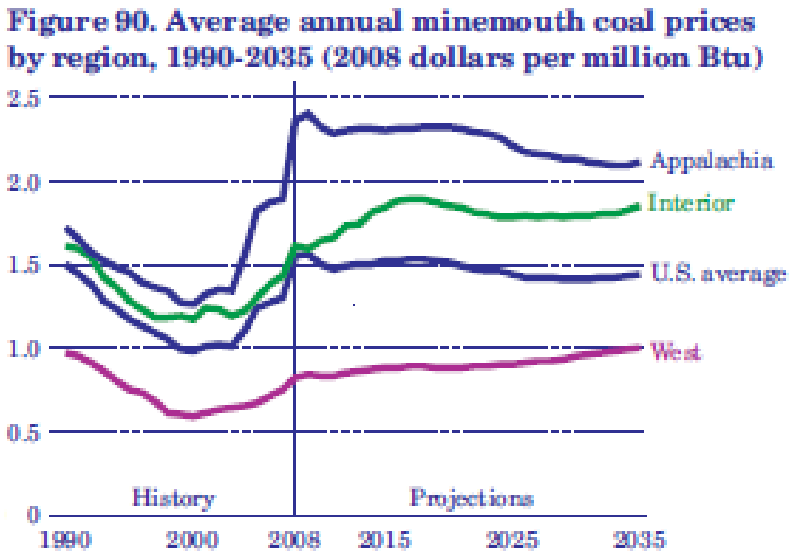
Table 3-6: Metallurgical Coal Prices – Average Delivered Price ($/ton)[60]

Year	Coke Plants and Export Docks
2001	$41.84
2002	$45.51
2003	$44.49
2004	$63.40
2005	$81.82
2006	$90.76
2007	$89.21
2008	$133.28
2009	$118.36

- The federal Energy Information Administration (EIA) estimates that average minemouth prices[61] for Appalachian steam coal, after peaking in 2009, will decline by 0.5 percent per year through 2035. The decline will be a result of falling demand for the region's coal and a shift to lower cost production in the northern part of the Appalachian basin.
- Metallurgical coal prices are projected to remain volatile based on international demand for steel.

[59] EIA, Annual Coal Reports, 2001-2008, http://www.eia.doe.gov/cneaf/coal/page/acr/acr_sum.html, June 23, 2010
[60] EIA, Average Cost of Metallurgical Coal, Priced at Coke Plants and at Export Docks, January 2001- Latest Available, http://www.eia.doe.gov/cneaf/coal/page/coalnews/metcoalpricepost.xls, June 23, 2010
[61] Mine mouth price is the price paid by a purchaser at the mine, without added transportation costs.

Figure 3-1: EIA Coal Price Forecast.[62]

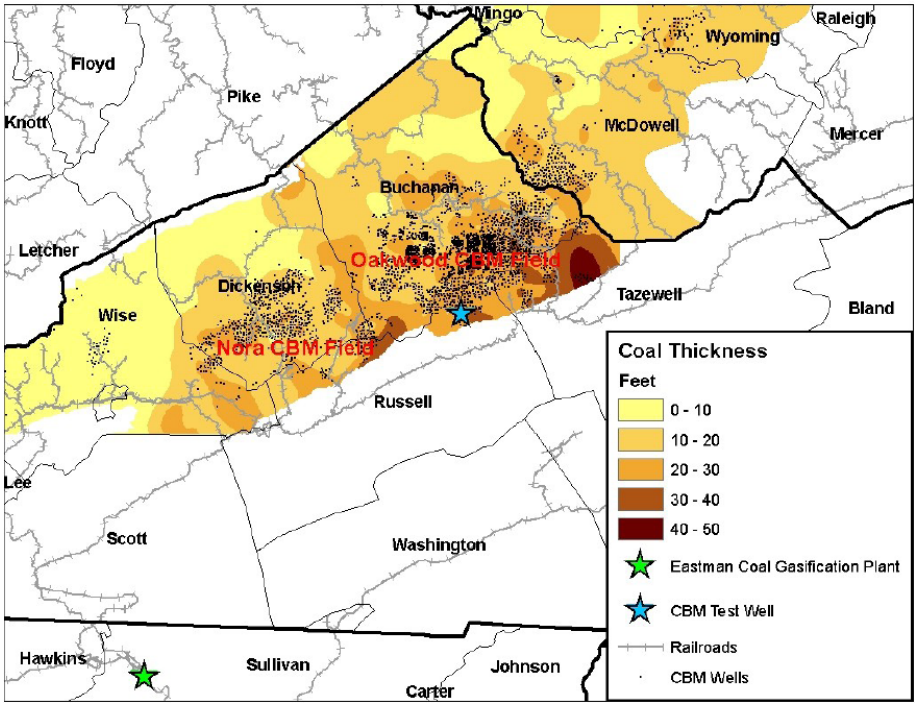


Future Use of Coal

- No source of electricity will be available within the next 10 years that can provide base-load power in the volume provided today by coal. Therefore, coal must continue to provide a large share of fuel for electric power generation over the term of this Plan.
- Use of Virginia coal should increase as the 585 megawatt Virginia City Power Station in Wise County comes on line. This increase may be offset as Dominion converts its 250 megawatt Bremo Power Station from coal to natural gas.
- Long-term use of coal in Virginia and elsewhere will be affected by the cost competitiveness of other fuel sources and whether federal legislation assigns new costs to coal use by capping or taxing carbon emissions.
- Increasing regulatory costs imposed by new federal administrative action will also increase the cost of coal, and therefore the cost of coal-fired electricity.
- Research and development of clean coal technologies is needed in anticipation of federal regulation of greenhouse gases.
    - Virginia has been testing carbon capture and storage as part of the Southeastern Carbon Sequestration Partnership (SECARB), including characterization of unminable coal seams for carbon sequestration and testing sequestration technology in Russell County.

[62] Annual Energy Outlook, Coal Forecasts, http://www.eia.doe.gov/oiaf/aeo/pdf/trend_5.pdf, May 11, 2010. The delivered price of coal ($/ton) = (Heating value of coal (Btu/lb) x Cost (¢/mmBtu)) / 50,000. Appalachian coal is equivalent to $26.00 per ton for every $1.00 per million Btus.

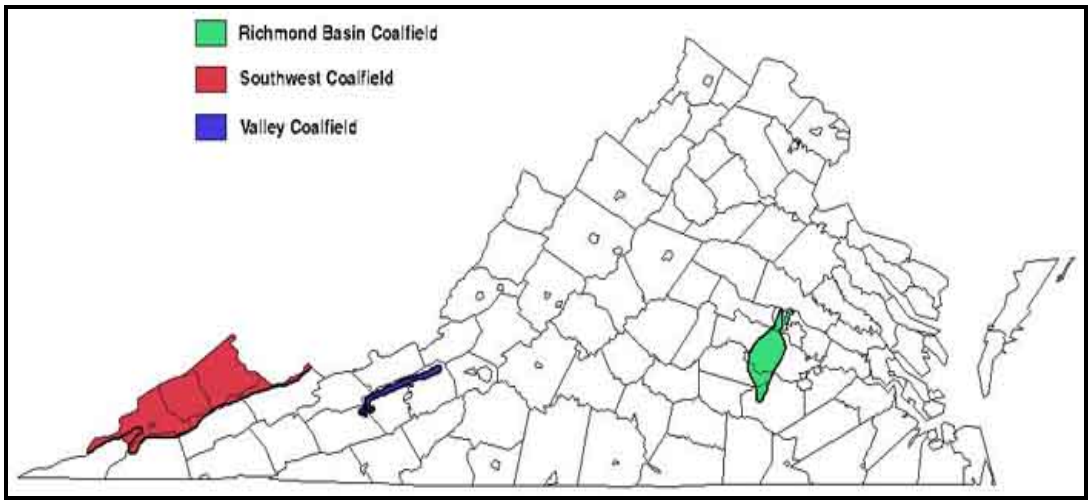
Figure 3-2: Location of Carbon Sequestration Test Well in Russell County, Virginia[63]



Coal Mining in Virginia

- Coal is mined in Virginia in the Southwest Virginia Coalfield.
- The last mining in the Valley Coalfield took place in the 1950s, and in the Richmond Coalfield in the 1920s.

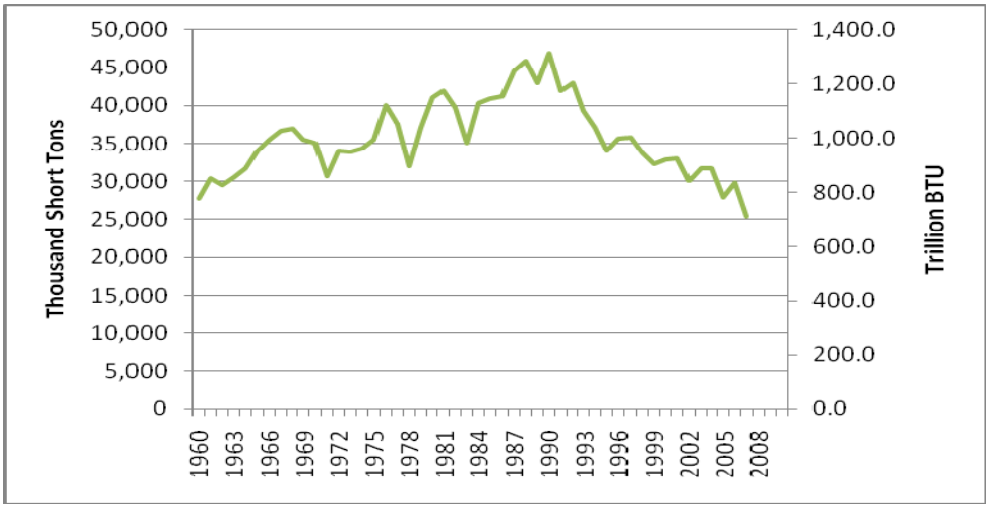
Figure 3-3: Virginia's Coalfields[64]



[63] Southeast Carbon Sequestration Partnership, Central Appalachian Coal Seam Project Fact Sheet, http://www.energy.vt.edu/secarb/index.asp, June 23, 2010
[64] VEPT, Existing Coal Fields, www.energy.vt.edu/vept/coal/basins.asp

- Virginia mining companies produced 24.7 million tons of coal in 2008.
- Production decreased an average of 2.5 percent per year over the last 10 years.

Figure 3-4: Virginia Coal Production, 1960–2008[65]



- Virginia's coal industry directly employed 4,394 people in 2008, down from over 6,000 in 1996.

Table 3-7: Virginia Coal Mining Employment[66]

Year	Number of Mines	Number of Coal Miners
1996	325	6,089
1997	355	6,534
1998	352	5,802
1999	361	5,456
2000	341	4,926
2001	327	5,261
2002	323	4,956
2003	295	4,353
2004	292	4,501
2005	265	4,764
2006	269	4,782
2007	252	4,358
2008	261	4,394

[65] VEPT, Summary of Coal Production and Employment, http://www.energy.vt.edu/vept/coal/coal_prod_eia.asp
[66] VEPT, Production and Employment Data by Mine Size (Coal), www.energy.vt.edu/vept/coal/minesize.asp

- Some of these reductions are the result of mine technology increasing mine productivity, while other reductions are the result of drops in tonnage mined.
- Virginia produces the majority of its coal from underground mines.[67].
  - In 2008, 64 percent of coal mined in Virginia came from underground mines.
  - The percentage of surface mined coal has increased in recent years, from 16 percent in 1990, to 25 percent in 1998, and to 36 percent in 2008.
  - The percentage of coal mined from surface sites is expected to decrease over the next 10 years as the larger areas of surface reserves are mined out.
- There has been a trend towards consolidation of coal ownership.
  - Nationally, there are fewer small operators, with a higher percentage of mine production attributable to a few large operators.
  - The top five companies produce more than 50 percent of the coal mined in the United States 2008.

Table 3-8: Top 20 Coal Producers in the United States, 2008[68]

Rank	Controlling Company Name	Production (thousand short tons)	Percent of Total Production
1	Peabody Energy Corp	200,752	17.1
2	Rio Tinto Energy America	140,818	12.0
3	Arch Coal Inc	134,017	11.4
4	Foundation Coal Corp	69,366	5.9
5	CONSOL Energy Inc	63,806	5.4
6	Massey Energy Co	40,151	3.4
7	Patriot Coal Corp	33,317	2.8
8	NACCO Industries Inc	29,554	2.5
9	Westmoreland Coal Co	29,275	2.5
10	Peter Kiewit Sons Inc	28,198	2.4
11	Alliance Resource Operating Partners LP	26,395	2.3
12	Murray Energy Corp	26,059	2.2
13	Energy Future Holdings Corp	23,307	2.0
14	Alpha Natural Resources LLC	20,879	1.8
15	Intl Coal Group Inc (ICG)	18,340	1.6
16	BHP Billiton Ltd	15,952	1.4
17	Chevron Corp	10,976	0.9
18	PacifiCorp	10,884	0.9
19	James River Coal Co	10,583	0.9
20	Level 3 Communications	10,559	0.9

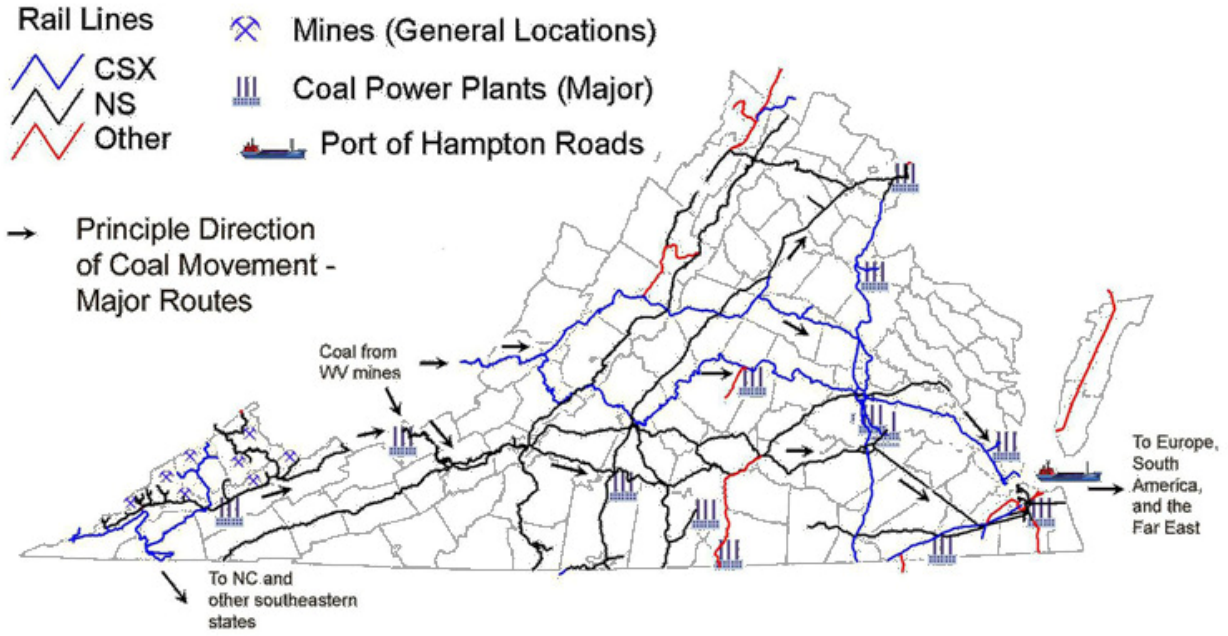
[67] EIA, Coal Production Reports, http://www.eia.doe.gov/fuelcoal.htm , May 10, 2010
[68] EIA, Major Coal Producers, http://www.eia.doe.gov/cneaf/coal/page/acr/table10.htm , May 10, 2010

- In Virginia, production is predominately (70 percent of mining operations) from small operations (36 employees on average) mining remnant or finite reserves using the room and pillar mining method.
- Coal mining companies pay severance taxes of 2 percent of the value of the coal extracted to the county where the mine is located, as well as personal property and other local taxes.
    - Minerals taxes account for over 40 percent of Buchanan County's local government revenue[69], with similar amounts supporting Dickenson and Wise Counties.

Infrastructure

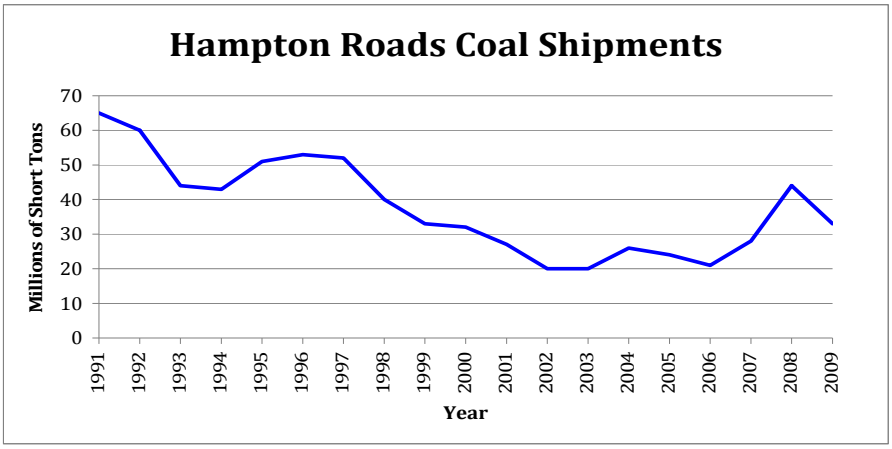
- Most Virginia coal is shipped from mines to preparation plants and rail load outs by truck, then to market and ports by rail.
- Coal transportation is a revenue center for Virginia's railroads, and thereby supports maintenance of Virginia's rail transportation infrastructure.
- Virginia coal is exported from terminals in the Port of Hampton Roads.
    - The port serves as an export point for Virginia, West Virginia, and Kentucky coal.
    - The markets for this coal include electric generators located close to East Coast shipping lanes and overseas electric utilities and steel manufacturers.

Figure 3-5: Map of Coal Transportation Network[70]



[69] Testimony from Buchanan County representatives before the Senate Committee on Agriculture, Conservation and Natural Resources, February 2010, at the public hearing on Senate Bill 564.
[70] VEPT, http://www.energy.vt.edu/vept/coal/virginiacoal.asp, June 28, 2010

Figure 3-6: Coal Shipments from Port of Hampton Roads, 1990–2009[71]



Coal Facility Siting Requirements

- It has become increasing difficult to develop sites for coal mines as EPA and other federal agencies tighten regulations over surface mining.
- Water quality is a critical issue related to permitting and operating coal mining. Additional controls will be needed to address water quality discharges from surface mines and as TMDLs are implemented in streams near coal mines.
- As discussed in the electricity section, it will become more difficult to permit new coal-fired generation plants if plant operators must address carbon controls in permitting proceedings.
- Coal ash management rules are becoming stricter.
    - The EPA issued proposed rules in May 2010 to require use of liners and groundwater monitoring in coal ash fills and transition to dry ash disposal.
    - Any future federal designation of coal ash as a hazardous waste would significantly increase the cost of ash disposal and could eliminate alternate uses such as concrete block and sheetrock.

[71] Virginia Energy Patterns and Trends: Coal Shipments from the Port of Hampton Roads, www.energy.vt.edu/vept/coal/basins.asp and the Port of Hampton Roads.

SECTION 4 - NUCLEAR POWER

Nuclear Power Generation in Virginia

- Dominion operates four nuclear units at its two Virginia nuclear power plants.
- These plants provided 38.4 percent of the electricity generated in Virginia during 2008.
- Two units are located at the South Anna Power Station in Louisa County and two are located at the Surry Power Station in Surry County.
    - Dominion owns an 88.4 percent share of the North Anna station. The Old Dominion Electric Cooperative owns the remaining 11.6 percent share.
    - Dominion owns 100 percent of the Surry Station. The Nuclear Regulatory Commission (NRC) has extended both Surry's and North Anna's operating licenses

Table 4-1: Virginia Nuclear Generating Units – Startup Date

Unit Name	Year	End of Operating License Term
Surry Unit 1	1972	2032
Surry Unit 2	1973	2033
North Anna Unit 1	1978	2038
North Anna Unit 2	1980	2040

- Dominion has made operating and capital improvements to the plants that have reduced down time for refueling and repairs and increased plant capacity.
    - Operating capacity for the four reactors in Virginia in 2009 ranged from 91.6 to 99.87 percent. Historic operating capacity has been between 74 and 83 percent.
- Virginia's four reactors consume approximately 1.6 million pounds of uranium oxide, or approximately 30 metric tons of uranium fuel, on average per year to fuel its four nuclear reactors.

Nuclear Power Plant Designs

- Nuclear power plant design has evolved since the first-generation prototypes were built.
    - Generation III+ reactors are under construction around the world (none in the United States as of 2010). These include the AREVA US-EPR reactor design and the Mitsubishi US–APWR (Advanced Pressurized Water Reactor). Dominion has identified the Mitsubishi US-APWR as the technology of choice for its proposed third unit at the North Anna Station.[72]

[72] Dominion, Dominion Virginia Power Selects Mitsubishi Reactor Technology for Potential North Anna Unit 3, http://dom.mediaroom.com/index.php?s=43&item=888, May 12, 2010

    - New reactor designs, such as the Babcock & Wilcox (B&W) mPower reactor and pebble bed reactors, are being developed to serve the smaller reactor market. [73]
- Operational costs of nuclear power plants are the lowest of any type of generation except for hydroelectric, wind, and solar.
- Nuclear power plant capital costs are very high. The capital cost risk may be mitigated through shared risk management among utilities, nuclear plant technology providers, and the federal government.

Spent Fuel Management

- Nuclear fuel is currently stored on the North Anna and Surry sites in spent fuel pools and dry storage casks.
- Dominion customers have been paying a fee of one tenth of one cent/kilowatt hour ($.001/kWh) generated by nuclear power plants into the federal Nuclear Waste Fund to finance a permanent spent nuclear fuel storage facility.
- The Nuclear Waste fund had financed design and construction of the canceled Yucca Mountain nuclear waste repository in Nevada.
- New plans, such as long-term storage sites or reprocessing, must be developed to address management of spent nuclear fuel.

The Nuclear Fuel Cycle

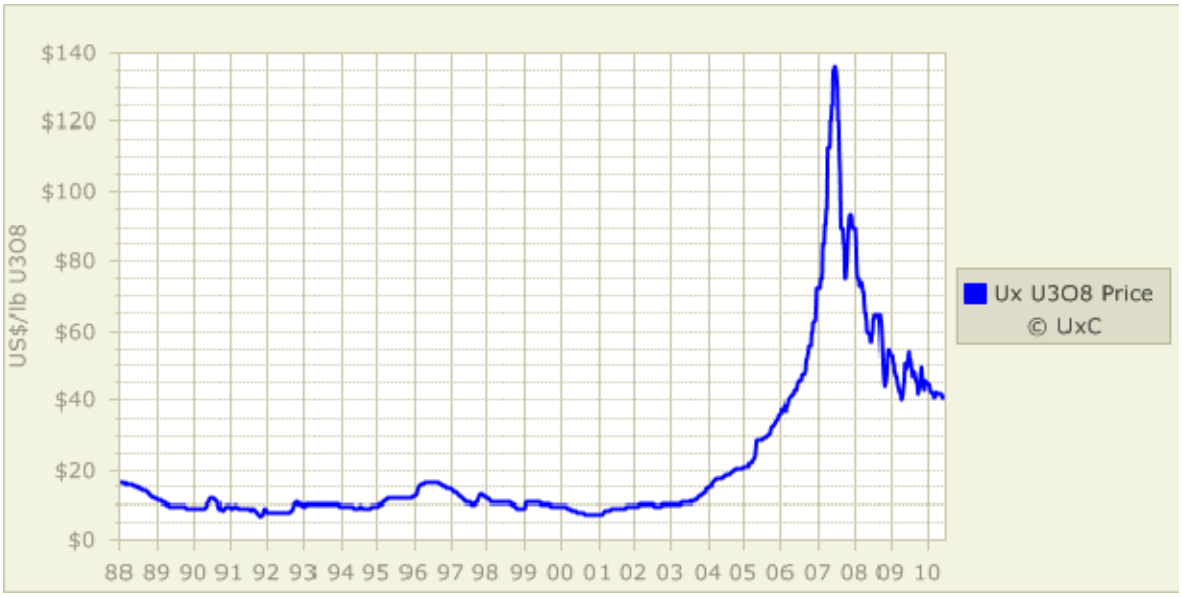
- The first step in the nuclear fuel cycle is mining and milling of uranium oxide, resulting in 0.7 percent U_{235}.
- The uranium oxide is then enriched to the 4.2 to 4.7percent level and fabricated into fuel pellets.
    - The United States has one enrichment plant, the USEC gaseous diffusion plant in Paducah, Kentucky. Four new nuclear fuel processing plants are under development:
        - Three centrifuge plants by AREVA in Idaho Falls, Idaho; URENCO in Eunice, New Mexico; and USEC in Piketon, Ohio; and
        - One global laser enrichment plant by GE-Hitachi in Wilmington, North Carolina.
    - These plants will have sufficient capacity to supply fuel to all existing nuclear power plants in the United States[74].
- Processed fuel pellets are then assembled into reactor fuel rods for use in nuclear power reactors.

[73] World Nuclear Organization, Small Nuclear Power Reactors, updated May 2010, http://www.world-nuclear.org/info/inf33.html, May 12, 2010
[74] World Nuclear News, Areva Selects Enrichment Site, May 7, 2008, http://www.world-nuclear-news.org/NN-Areva_selects_US_enrichment_site_070508.html

Nuclear Fuel Costs

- Prices of uranium oxide were consistently below $20/pound until the mid 2000s. Since then prices have jumped to nearly $140/pound in 2007 before falling to the current $40 to $50/pound range.

Figure 4-1: Uranium Oxide Costs[75]



- Changes in spot nuclear fuel cost have a limited impact on the cost of nuclear generated electricity. Nuclear fuel is generally purchased through long-term contracts and costs are a much smaller percentage of total nuclear power cost than with fossil fuel technologies.

Nuclear Plant Siting and Construction

- Nuclear power plant siting is largely regulated through the licensing process of the Nuclear Regulatory Commission (NRC).
    - Licensing requirements have been streamlined since plants were licensed in the 1960s and 1970s. Nuclear utilities now can receive an early site permit followed by a combined construction-operating permit.
- Dominion has received its early site permit for the proposed third North Anna unit.
- As of June 2010, Dominion's combined construction-operating permit application was pending before the NRC.
-

[75] The UxC Consulting Company, Ux U3O8 Price – Full History, http://uxc.com/review/uxc_PriceChart.aspx?chart=spot-u3o8-full, June 29, 2010

Nuclear plant permitting and construction is expensive and time-consuming, taking 8-10 years.

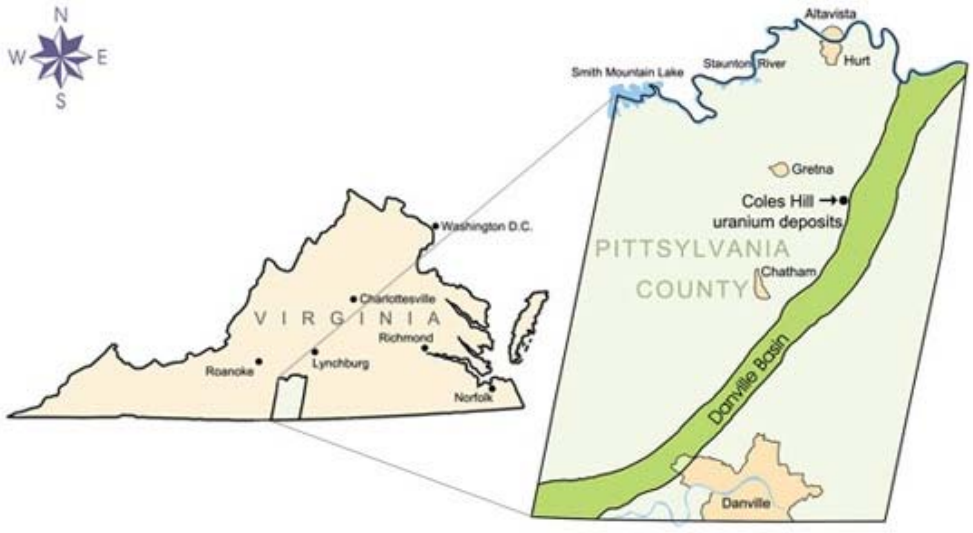
- Variations in technical standards and construction costs, cost of capital, and other factors contribute to the risk profile of investments in new nuclear power plant construction.
- Time and budget experience with new plant construction overseas has been mixed.
- Shared risk between utilities and project design and construction firms is necessary to support financing new nuclear projects.
- State and federal incentives, including providing a higher rate of return under Virginia law for utility investments in new nuclear power plants and federal loan guarantees, help mitigate the financial risk.
- U.S. nuclear reactor manufacturing capability is growing with the resurgence of the international nuclear power industry. New facilities include the AREVA-Northrop Grumman plant in Newport News and the Westinghouse-Shaw Group plant in Lake Charles, Louisiana.
- A single international standard for nuclear power plant certification would expand the markets for the AREVA-Northrop Grumman Newport News and other U.S. manufacturers.

Uranium Mining

- Wyoming, New Mexico, Arizona, Utah, Colorado, Texas, and Virginia have significant uranium reserves[76].
- Virginia has a uranium oxide resource in Pittsylvania County, estimated at 119 million pounds (at 0.025 percent uranium oxide cutoff) and worth around $5.4 billion at the mid-2020 price of $45/pound for uranium oxide.
- This site could be mined for 60 years at a production rate of 2 million pounds per year. Production of 2 million tons per year would be equivalent to adding 50 percent to 2008 domestic uranium production.[77]
- The Commonwealth has a moratorium on uranium mining due to questions about the safety of uranium mining in Virginia.
- The Virginia Coal and Energy Commission is undertaking two studies of uranium mining:
    - The Commission has contracted with the National Academy of Sciences' National Research Council to study the safety and environmental impacts of uranium mining.
    - The Commission is studying the social and community impacts of uranium mining.

[76] EIA, U.S. Uranium Reserves Estimates, June 2004, http://www.eia.doe.gov/cneaf/nuclear/page/reserves/ures.html, May 16, 2010
[77] EIA, Summary Production Statistics of the U.S. Uranium Industry, May 2009, http://www.eia.doe.gov/cneaf/nuclear/dupr/usummary.html, May 16, 2010

Figure 4-3: Map of Coles Hill Uranium Deposit[78]



- Federal laws and regulations controlling U.S. uranium mining include:
  - Uranium Mill Tailings Radiation Control Act of 1978;
  - Safe Drinking Water Act;
  - Underground Injection Control Program; and
  - National Emission Standards for Hazardous Air Pollutants.
- The federal government licenses uranium-processing mills and the disposal of associated mill tailings.
- States, including Wyoming, Colorado, and Texas, have developed uranium mining regulatory programs.

Nuclear Industry Workforce Development

- Virginia is a leader in design, construction, and maintenance of nuclear power plants through AREVA, B&W, Dominion, and Northrop Grumman.
  - AREVA, B&W, and Northrop Grumman have an ongoing need for nuclear and other engineers and service technicians.
  - Northrop Grumman employs thousands of workers at its Newport News shipyard constructing nuclear powered ships.
  - Additional jobs will be available when the AREVA/Northrop Grumman power plant component manufacturing plant is completed.
  - Dominion's current nuclear workforce is nearing retirement age and trained technicians and engineers are needed to replace those leaving.

[78] Virginia Uranium, Location, http://www.virginiauranium.com/location.php, June 29, 2010

    - Dominion will also need additional nuclear plant operation, engineering, maintenance, and other workers if it adds the third unit to the North Anna power station.

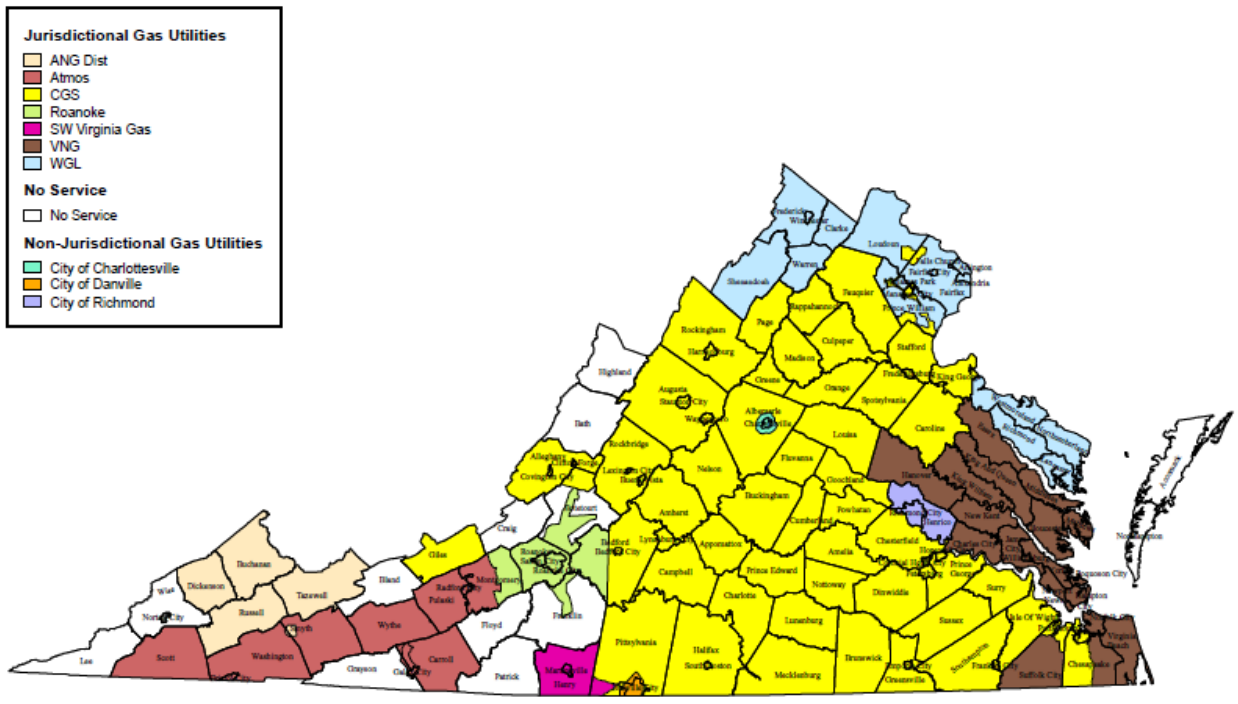
- The University of Virginia, Virginia Tech, Virginia Commonwealth University, and the Virginia Community College System are rebuilding their nuclear-related teaching and research capacity to serve the industry. These new training programs provide educational opportunities ranging from advanced nuclear engineering degrees to training nuclear technicians.

SECTION 5 - NATURAL GAS

Virginia's Natural Gas Providers

- Natural gas is used as an industrial fuel to heat and cool homes and businesses, to generate electricity, and for transportation.
- Natural gas is transmitted from production areas to population centers through transmission pipelines and distributed to end users by local distribution utilities (also called LDCs or Local Distribution Companies).
- Ten natural gas LDCs in Virginia serve customers in assigned territories.
    - Investor-owned LDCs include Columbia Gas of Virginia, Washington Gas, Virginia Natural Gas, Roanoke Gas, Atmos Energy, Appalachian Natural Gas Distribution Company, and Southwestern Virginia Gas Company.
    - Municipal LDCs include the Cities of Richmond, Charlottesville, and Danville.
- LDCs primarily sell gas to the residential and commercial markets. Large natural gas users have been able to contract directly for natural gas purchases under Federal Energy Regulatory Commission rules.
- The LDCs serve approximately 37 percent of households and 90,000 commercial natural gas customers.
- The LDCs operate approximately 20,000 miles of distribution pipelines.

Figure 5-1: Service Areas of Virginia Natural Gas Distribution Companies[79]



[79] State Crporation Commission, http://www.scc.virginia.gov/pue/gas/map.aspx. June 23, 2010.

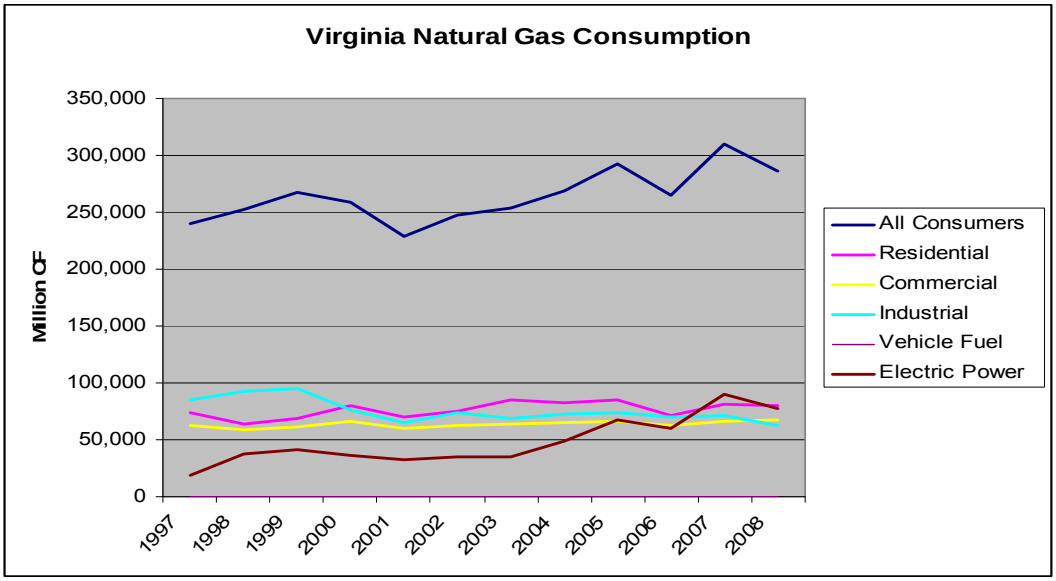
Natural Gas Consumption

- In 2008, Virginia consumers used 286.4 billion cubic feet (BCF) of natural gas. An additional 13 billion cubic feet was consumed for lease and pipeline operations.
- Natural gas use increased on average by 0.8 percent per year over the last decade. Growth was primarily attributable to new customer growth and use of natural gas for electric generation.
- The growth pattern changed and demand dropped by nearly 6 ½ percent from 2007 and 2008 primarily attributable to the economic downturn and warmer than normal winter weather.

Table 5-1: Natural Gas Consumption, 1997-2008 (million cubic feet)[80]

Year	All Consumers	Residential	Commercial	Industrial	Vehicle Fuel	Electric Power
1997	240,244	73,905	61,895	85,264	142	19,038
1998	252,233	63,186	58,283	92,801	154	37,808
1999	267,269	69,189	61,516	95,141	193	41,230
2000	258,975	79,701	66,098	76,263	212	36,700
2001	228,407	70,249	59,809	65,231	263	33,118
2002	247,351	75,476	62,699	73,973	268	34,936
2003	254,009	85,330	64,004	69,090	328	35,256
2004	268,307	82,755	64,518	72,250	368	48,784
2005	291,885	85,355	65,838	73,741	158	66,951
2006	264,786	71,693	62,352	70,420	168	60,321
2007	309,711	80,957	66,444	71,736	154	90,573
2008	286,355	79,725	67,006	62,642	177	76,983

Figure 5-1: Natural Gas Consumption



[80] EIA. Natural Gas Navigator. http://www.eia.doe.gov/dnav/ng/ng_cons_sum_dcu_SVA_a.htm. June 23, 2010

- Natural gas consumption in Virginia should grow over the next ten years.
    - Dominion has included construction of six new natural gas fired generation plants through 2020 in its Integrated Resource Plan.
    - Non-utility producers may also construct new natural-gas fired plants to serve Dominion and other electricity markets.
    - Additional retail consumers will hook up to natural gas distribution systems as Virginia's population grows.
    - Transportation uses may increase demand for natural gas. Natural gas is an efficient fuel for fleet uses such as school bus, public transit, and local fleet services. This use may create new markets for Virginia natural gas.

Virginia's Natural Gas Utility Regulatory Structure

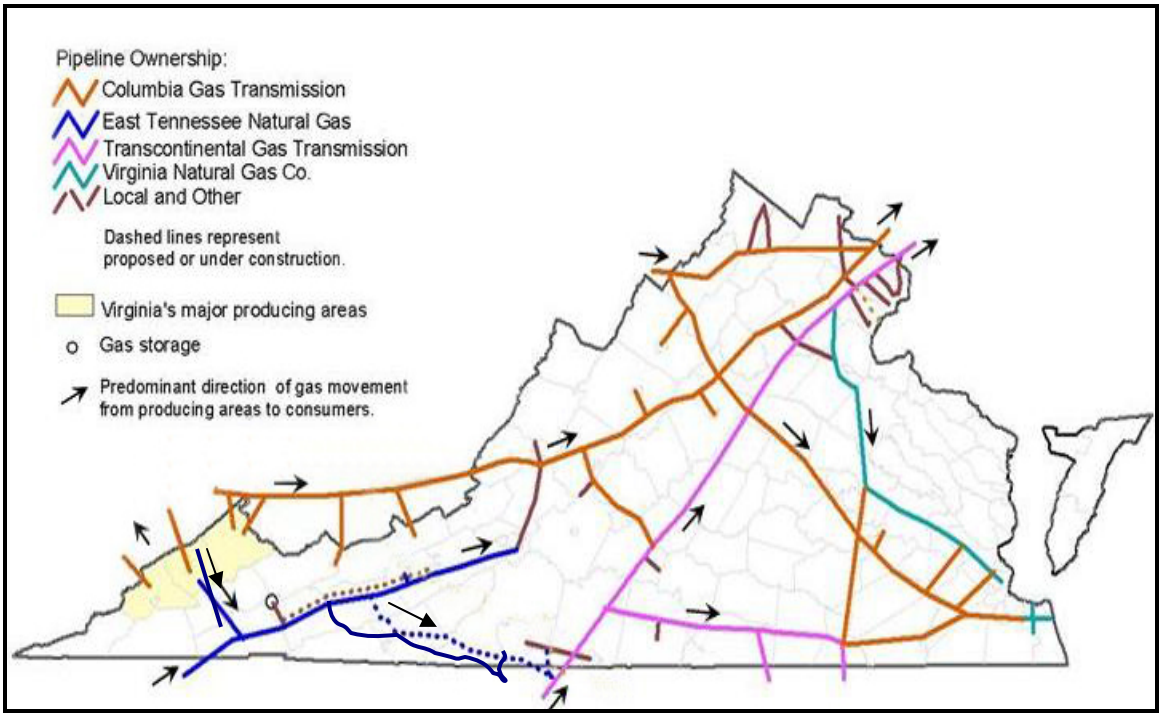
- Under traditional rate regulation, LDCs, in response to being given a monopoly service area, are required to offer service at just and reasonable rates and are limited to earn a maximum rate of return set through rate cases before the State Corporation Commission (SCC).
- Starting in 2000, LDCs were authorized to offer all customers direct access to natural gas suppliers, called retail supply choice.
    - Washington Gas and Columbia Gas offer this choice to all customers.
    - In 2008, 7.9% of eligible residential customers and 22.5 percent of eligible commercial customers participated in the choice programs.[81]
- LDCs have the opportunity to enter into performance-based ratemaking (PBR) agreements that allow higher rates of return on meeting performance standards. Columbia Gas, Virginia Natural Gas and Washington Gas have used SCC approved PBR plans.
- Natural gas LDCs are authorized to undertake Conservation and Ratemaking Efficiency (CARE) programs to decouple earnings from the volume of gas sold. Rate decoupling is conditioned upon adoption of an SCC approved plan for promoting and investing in conservation and efficiency by the company's customers.
    - As of summer 2010, Virginia Natural Gas and Columbia Gas have implemented CARE plans.
- Virginia enacted the Steps to Advance Virginia's Energy Plan (SAVE) program in 2010 to provide timely cost recovery for large-scale replacement of aging local distribution pipeline infrastructure.

[81] EIA. Retail Unbundling Virginia. http://www.eia.doe.gov/oil_gas/natural_gas/restructure/state/va.html. May 16, 2010.

Natural Gas Transmission

- Natural gas consumed in Virginia come from three main sources:
  - The Gulf of Mexico and other southern supply sources through the Transco natural gas transmission pipeline;
  - Virginia and other Appalachian natural gas production through the Spectra pipeline system in Southwest Virginia and the Columbia Gas Transmission pipeline system through West Virginia to Northern Virginia; and
  - The Cove Point Liquefied Natural Gas (LNG) import facility in Maryland through the Dominion/Virginia Natural Gas pipeline serving Eastern Virginia.
- There are approximately 2,950 miles of natural gas transmission pipelines in Virginia.

Figure 5-3: Major Natural Gas Pipelines in Virginia[82]

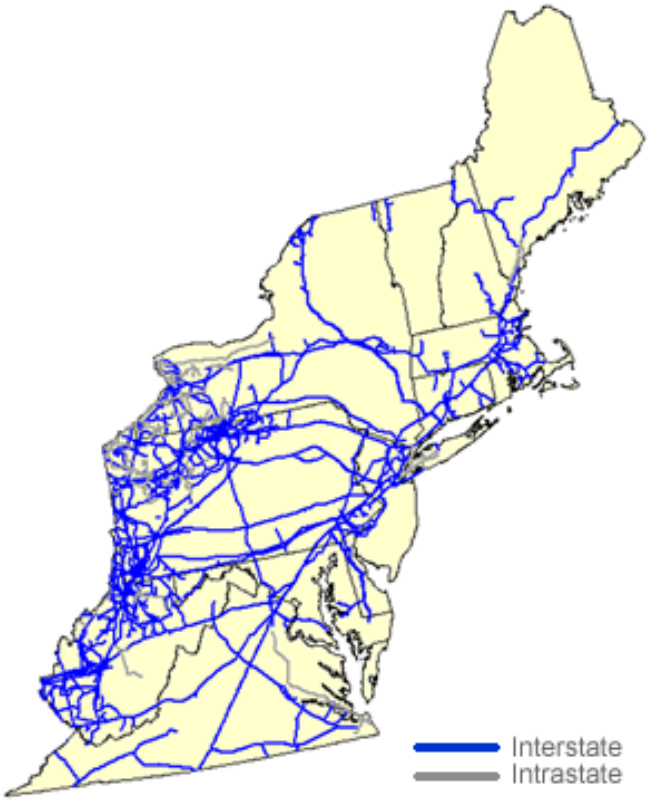


[82] Modified from VEPT. Major Natural Gas Pipelines. http://www.energy.vt.edu/vept/naturalgas/NG_pipelines.asp. June 23, 2010

Table 5-2: Principal Natural Gas Pipeline Companies Serving the Virginia[83]

Pipeline Name	Principal Supply Source(s)
Interstate & Importing Pipelines	
Columbia Gas Transmission Co	Southwest, Appalachia
Dominion Cove Point LNG LP	LNG Imports, Interstate System
Dominion Transmission Corp	Southwest, Appalachia
East Tennessee Natural Gas Co	Interstate System
NORA Gas Transmission Co	Interstate System
Transcontinental Gas Pipeline Co	Southwest
*Intrastate Pipelines***	
Virginia Natural Gas Co	Interstate System

Figure 5-4: Northeast Region Natural Gas Pipeline Network



- Natural gas companies have added new pipeline capacity across the state in recent years, including:
    - Virginia Natural Gas' HRX pipeline that provided a third pipeline water crossing in Hampton Roads;

[83] The pipeline table and following two pipeline figures are taken from EIA. About US Natural Gas Pipelines. http://www.eia.doe.gov/pub/oil_gas/natural_gas/analysis_publications/ngpipeline/northeast.html. June 23, 2010

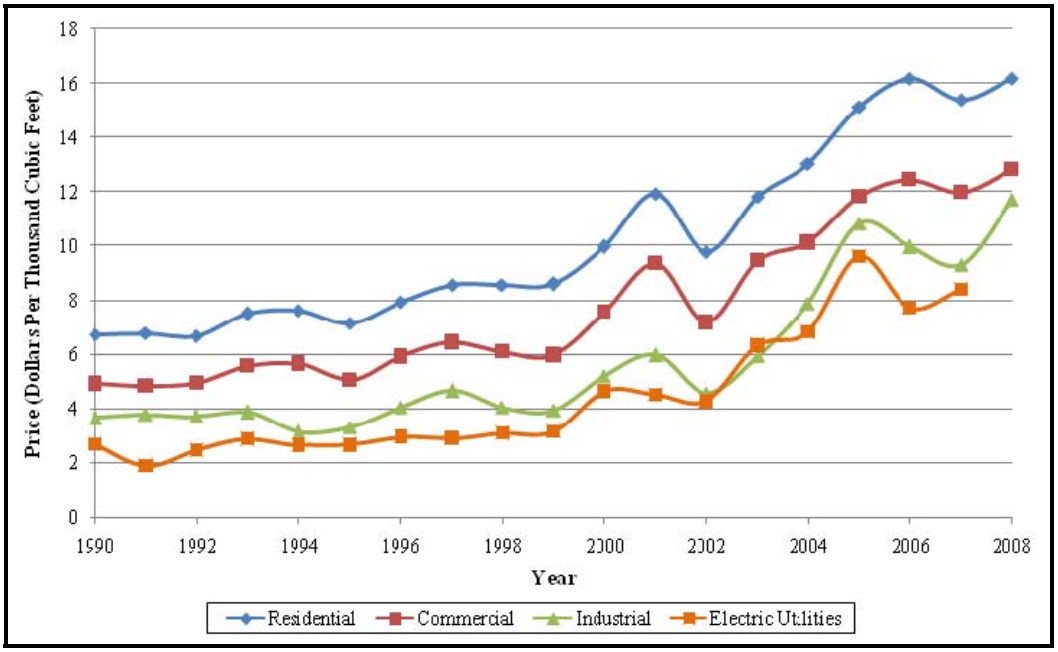
- Spectra's Patriot Line from the East Tennessee Line to Southside Virginia and North Carolina; and
- Spectra's Jewell Ridge Pipeline to deliver natural gas from Virginia's gas production areas to the East Tennessee line and Saltville natural gas storage facility.

- Spectra is adding additional pipeline capacity to the East Tennessee Pipeline to serve a new gas-fired power plant TVA is constructing near the Virginia border.

Natural Gas Prices

- Virginia's residential consumers paid on average $16.20/thousand cubic feet (MCF) in 2008. Commercial customers paid on average $12.98/MCF, industrial consumers paid on average $11.49/MCF, and utilities paid on average $10.87/MCF.

Figure 5-6: Average Natural Gas Price by Sector[84]



- Natural gas prices in Virginia have traditionally been higher than in producing sections of the country, such as the Southeast and Rocky Mountain areas.
- The higher price is largely attributable to the need to transport the natural gas long distances to Virginia.
- This cost structure may change as new production comes on line from the Marcellus shale deposits in the East that have lower transportation costs.

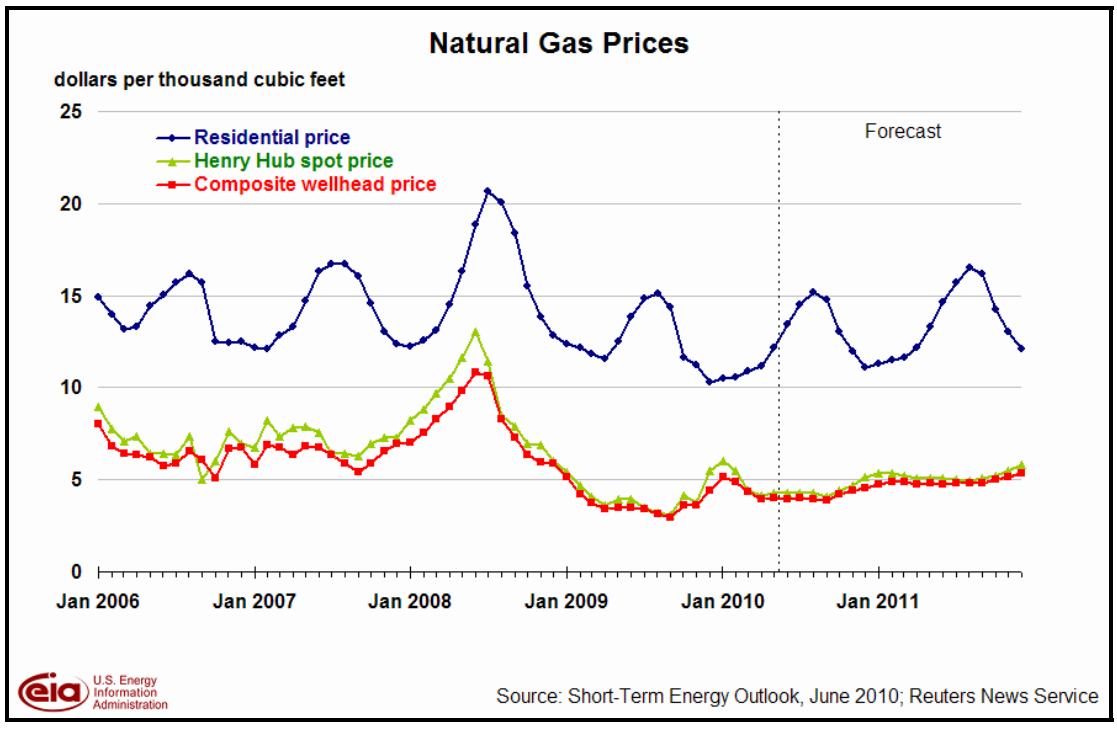
[84] VEPT. Natural Gas and Coal Bed Methane Average Price by Sector. http://www.energy.vt.edu/vept/naturalgas/price_chart.asp. June 23, 2010

Table 5-3: US Regional Natural Gas Prices

Sector/Region	2007	2008	2009	2010
Residential				
New England	16.5	17.29	16.77	15.58
Middle Atlantic	15.01	16.2	14.92	13.8
East North Central	11.62	12.71	10.73	10.28
West North Central	12.04	12.11	10.33	9.95
South Atlantic	16.45	16.91	15.09	14.69
East South Central	14.12	14.9	13.17	12.07
West South Central	12.35	13.7	11.69	11.35
Mountain	10.93	11.24	10.35	9.59
Pacific	11.98	12.77	10.37	10.26
U.S. Average	13.08	13.89	11.97	11.42

- The DOE EIA predicts natural gas prices will remain stable over the next 10 years, estimating that the average delivered price for natural gas in the United States will be $10.61/thousand cubic feet for all end users.[85]

Figure 5-7. EIA Natural Gas Price Projection



[85] EIA, Annual Energy Outlook 2010. Natural Gas Supply, Disposition, and Prices. http://www.eia.doe.gov/oiaf/aeo/excel/aeotab_13.xls. May 16, 2010.

Efficiency and Conservation

- Natural gas is more efficient as a direct fuel for uses such as heating and transportation than when it is burned as a fuel to generate electricity for those uses. Providing for direct use of natural gas can improve overall energy efficiency of energy use in the Commonwealth.
- Local distribution natural gas utilities must include plans to promote and invest in natural gas conservation and efficiency as part of Conservation and Ratemaking Efficiency (CARE) alternate ratemaking plans. As of summer 2010, Virginia Natural Gas and Columbia Gas have implemented CARE conservation and efficiency programs for their customers.
- Other local distribution natural gas utilities have implemented conservation and efficiency programs for their customers outside of the CARE program, such as the City of Richmond's online home energy audit and Washington Gas' energy efficiency and safety program.
- Virginia has included natural gas appliances and equipment in its energy efficiency rebate programs funded through ARRA grants. Customers are receiving rebates to replace old, less efficient appliances and equipment with more efficient, Energy Star appliances and equipment to reduce future natural gas bills.

Natural Gas Production

- Virginia's natural gas exploration and production companies produced 128.5 billion cubic feet of natural gas from 6,428 wells in 2008.
    - This amount is equal to 43 percent of the natural gas consumed in Virginia in 2008.
    - Approximately 80 percent of Virginia natural gas production is from coalbed methane wells. The remaining 20 percent is produced from shale formations located below the coal seams in Southwest Virginia.

Figure 5-8: Appalachian Basin Coalbed Methane Formations

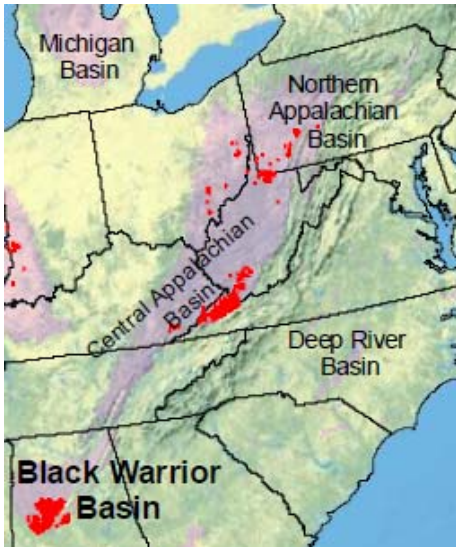
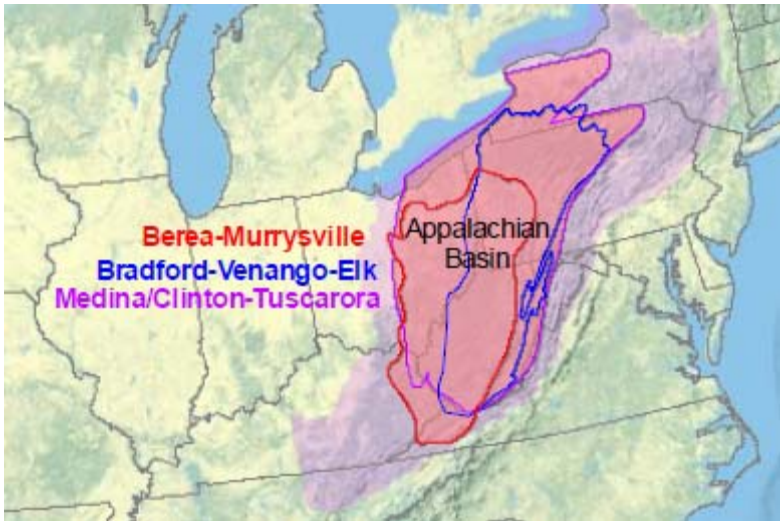
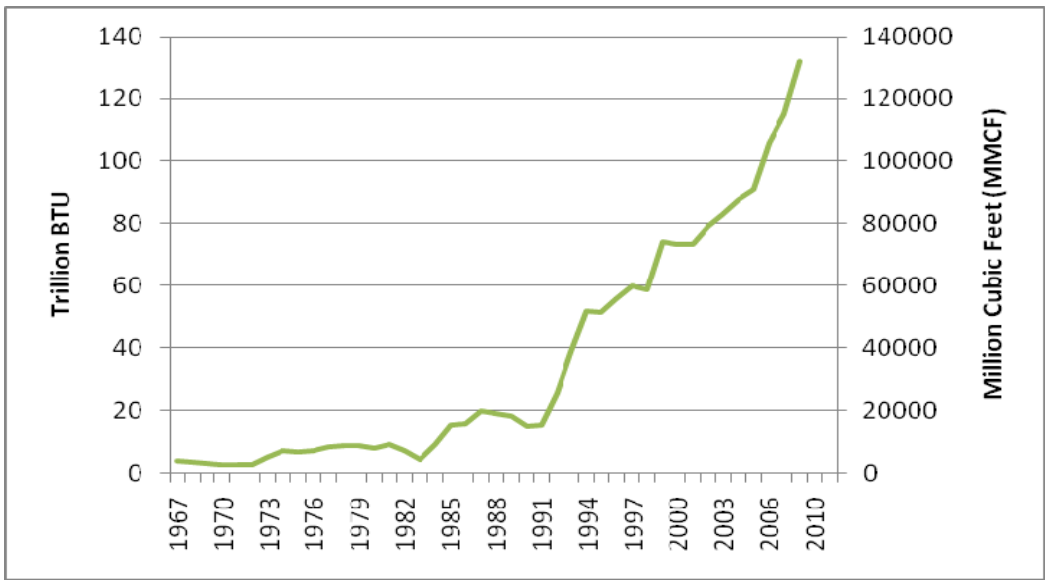


Figure 5-9: Appalachian Basin Natural Gas Shale Formations



- Virginia natural gas production has increased by an average of 12.4 percent per year over the last 10 years. Most of the increase has been from expanded coalbed methane production in Buchanan, Wise, and Dickenson Counties.[86]
- Virginia ranked 16th highest of the 32 states with natural gas production in 2008.

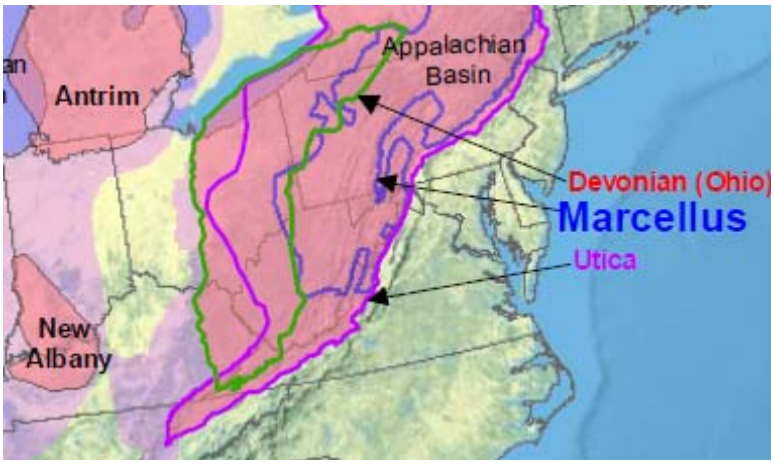
Figure 5-10: Natural Gas Production in Virginia, 1967–2008[87]



[86] VEPT. Gas Production By County. http://www.energy.vt.edu/vept/naturalgas/gas_county.asp
[87] VEPT. Virginia Total Historic Gas Production. http://www.energy.vt.edu/vept/naturalgas/historic_production.asp

Production may increase if the Marcellus Gas formation in Virginia is able to produce marketable quantities of natural gas.

Figure 5-11: Marcellus Shale Formations



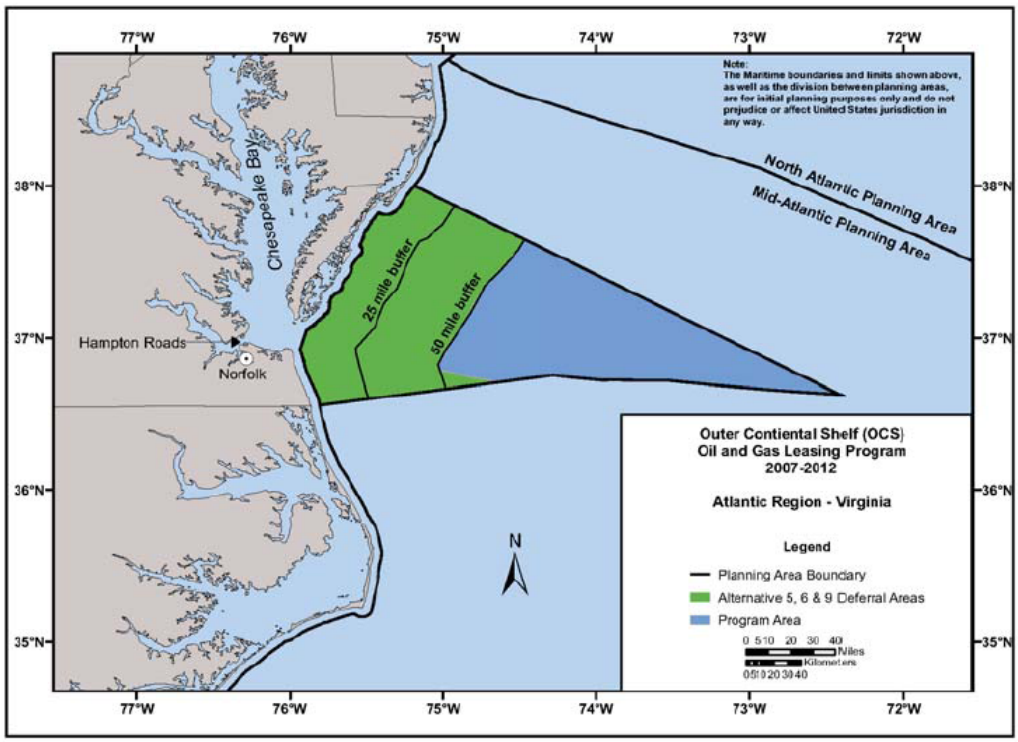
- Natural gas produced in Virginia is collected in gathering pipeline systems. These systems include low pressure pipelines from wells to compression facilities where the gas is cleaned and compressed. After being compressed, the gas is fed into the interstate pipeline network where it is delivered to customers.
- Natural gas produced in Virginia is sold in Tennessee, Southwestern Virginia, and Northeastern states because there is limited pipeline capacity to deliver the gas from Southwestern Virginia to the Central and Eastern Virginia markets.
- The capacity to deliver Virginia natural gas to the Northern, Central, and Hampton Roads regions of Virginia increased with the connection of the Spectra Patriot Pipeline to the Transco interstate pipeline.
- Natural gas producers can serve up to 35 customers and public schools in areas not located in a local natural gas distribution company service territory, allowing customers in Southwest Virginia not covered by a public utility to receive natural gas service.
- Prices for Appalachian region natural gas have stayed in the high $3 to low $4/thousand cubic feet range in 2010. The Dominion South hub price was $4.42 for the week of May 15, 2010.[88]. Future prices will depend on factors such as demand, price of oil, and regional natural gas production levels.
- As shown in Figure 5-7 above, the EIA projects natural gas wellhead prices will increase annually over the next decade, increasing from $4.06/thousand cubic feet in 2010 to $7.18 in 2020.[89]

[88] NTI Weekly Natural Gas Price Index, Firm Physical Natural Gas Price Bulletin History, For Natural Gas Delivered at Dominion-South. http://intelligencepress.com/features/intcx/gas/intcx_gas_point.emb?pointcode=ICENEACNG. May 16, 2010
[89] EIA, Annual Energy Outlook 2010. Natural Gas Supply, Disposition, and Prices. http://www.eia.doe.gov/oiaf/aeo/excel/aeotab_13.xls. May 16, 2010.

Offshore Natural Gas

- There is an estimated 1.66 trillion cubic feet of natural gas reserves in federal waters in the Virginia administrative boundary areas offshore Virginia.
- The value of natural gas in the Virginia offshore administrative boundary areas could total more than $10 billion (1.66 trillion cubic feet at $6/thousand cubic feet).
    - The value will depend on the actual amount of recoverable resources and the cost of gas.
    - Offshore natural gas production would support infrastructure expansion in Hampton Roads, attracting new business and creating jobs in the supply chain and exploration and production.
- Developing offshore natural gas resources is dependent on an extensive federal lease sale and permitting process.
- Offshore extraction will need to be compatible with Department of Defense operations in Virginia offshore waters. Federal-state cooperation can lead to developing a compatible exploration and production plan.
- The Bureau of Ocean Energy Management, Regulation and Enforcement (formally Minerals Management Service) has suspended offshore leases until the causes of the 2010 Deepwater Horizon accident and oil spill are better understood and suitable protections are put in place.

Figure 5-9: 2007-2012 Mid-Atlantic OCS Proposed Lease Area[90]



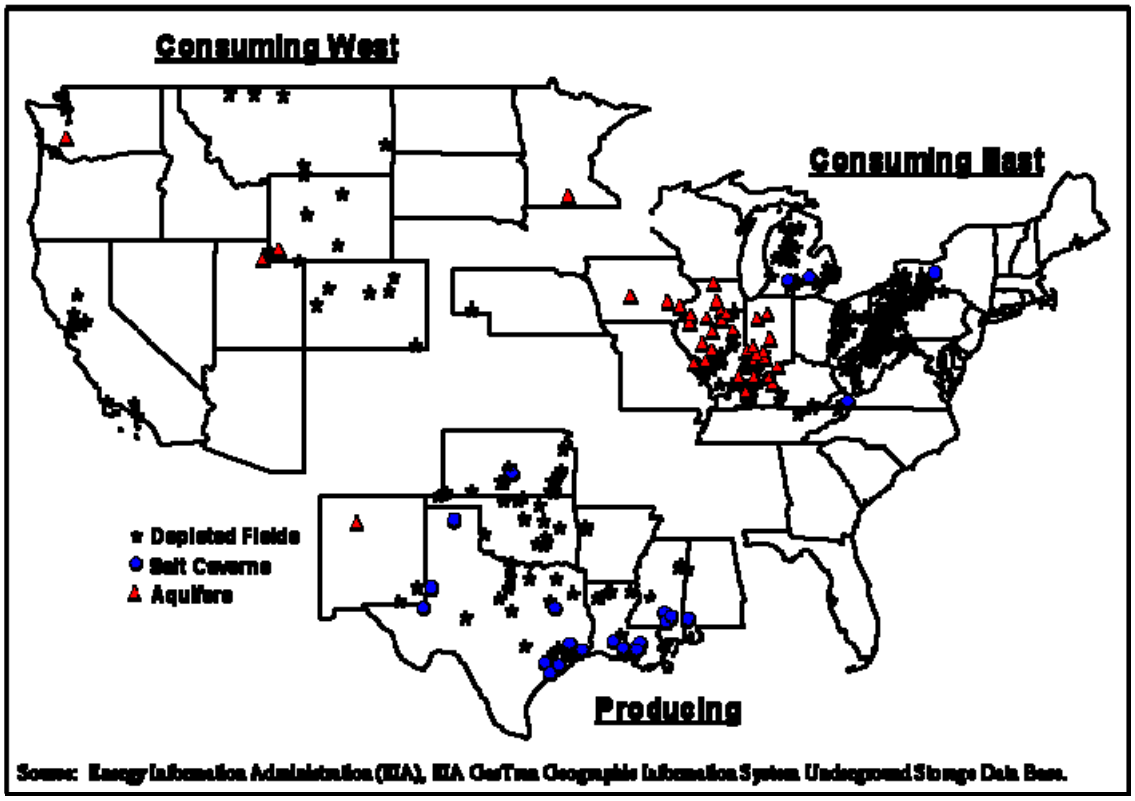
[90]Source: U.S. Department of the Interior, MMS, *Proposed Final Program of the Outer Continent Oil and Gas Leasing Program, 2007–2012*, April 2007, map 9, p. 68.

- Virginia's coastal regions may hold producible methane hydrate resources if the technology is developed to produce the methane hydrates from geologic formations found offshore Virginia. The technology to produce these resources is not expected to be developed in the 10-year term of this Plan.

Natural Gas Storage

- Virginia is home to two underground natural gas storage facilities, the Spectra salt cavern storage facility in Saltville and Early Grove underground storage field in Scott and Washington Counties.
- Other underground natural gas storage services available to Virginia utilities and consumes are located in West Virginia, Pennsylvania, and Ohio. Dominion is one of the largest operators of these underground natural gas storage facilities.

Figure 5-12: Underground Natural Gas Storage Facilities



- Virginia LDCs operate peaking natural gas storage facilities near their local distribution networks.
  - These facilities include compressed natural gas tanks, liquefied natural gas tanks, and one underground propane storage cavern.
  - Companies store gas in these facilities when demand is low and inject gas into the pipeline system during times of peak demand.

Adequacy of Supply

- Natural gas production in the coalfield region should rise incrementally as producers continue to drill new coalbed methane and conventional shale wells in Southwest Virginia.
- Virginia's natural gas reserves were estimated in 2008 to be 2,378 billion cubic feet.[91] Given current removal rates, this reserve would support production for about 20 years.[92]
- Additional reserves and production are available in the Marcellus Shale areas west of the Shenandoah Valley and offshore.
- A growing amount of out of state supply is available from shale production areas in Pennsylvania, West Virginia, and elsewhere.
- The federal Energy Information Administration predicts there should be adequate supplies from new domestic production for expanded uses of natural gas.[93]
- Disruptions in Gulf of Mexico supply or interstate transmission pipelines will affect multiple states including Virginia. States will need to work with the federal Department of Energy to coordinate responses to supply disruptions.

[91] EIA. Advance Summary: U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves, 2007 Annual Report. http://www.eia.doe.gov/pub/oil_gas/natural_gas/data_publications/advanced_summary/current/adsum.pdf

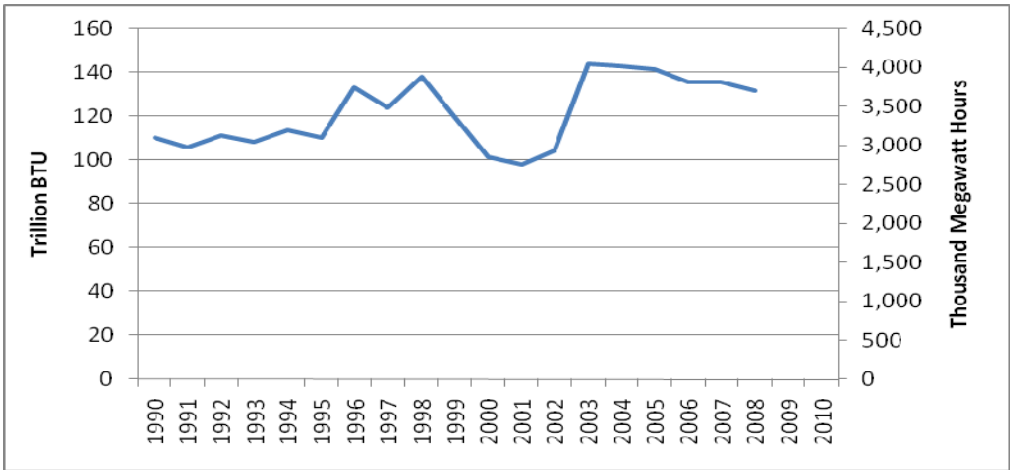
[92] This annual natural gas removal rate is based on a three-year average rate of production for the years 2006–2008 based on VEPT numbers.

[93] EIA. Annual Energy Outlook, 2010. http://www.eia.doe.gov/oiaf/aeo/pdf/0383(2010).pdf. May 16, 2010.

SECTION 6 - RENEWABLES

- Renewable energy is defined in the Virginia Electric Utility Regulation Act as energy derived from:
  - Sunlight;
  - Wind;
  - Falling water;
  - Biomass, sustainable, or otherwise (the definitions of which shall be liberally construed);
  - Energy from waste, including municipal solid waste;
  - Wave motion and tides; and
  - Geothermal power.
- Virginia's renewable resources include:
  - Biomass and waste;
  - Wind, both offshore and on-shore, and hydrokinetic;
  - Hydroelectric, both pumped storage and run-of-river;
  - Low temperature geothermal; and
  - Solar.
- Renewable energy resources often require a large up-front investment.
- Some technologies are not cost-competitive against traditional fuels.
- Hydro, biomass, waste-to-energy, landfill gas, and a small amount of solar provide about 2.8 percent of the electricity generated in Virginia in 2008.
- Ethanol provided approximately six percent of gasoline consumption in Virginia during 2008. Biodiesel met a small percentage of the diesel fuel and heating oil markets. The market for biodiesel was challenging as costs of traditional diesel and heating oil were generally less than biodiesel.

Figure 6-1: Renewable Energy Production in Virginia, 1990–2008[94]



[94] EIA, Virginia Electricity Profile, 2008 edition, http://www.eia.doe.gov/cneaf/electricity/st_profiles/virginia.html

- A Virginia Tech Center for Coal and Energy Research study found that Virginia has significant technical potential for renewable energy development.

Table 6-1: Virginia's Technical Renewable Energy Potential Generating Capacity[95]

Renewable Energy Resource	2007 Installed Capacity in Virginia (MW)	Potential Installed New Capacity in Virginia (MW)	Capacity Factor
Land-based wind	0.07	1,793	30–45%
Offshore wind	0	28,100	35–40%
Solar PV	0.91	11,000–13,000	14%–20%
Biomass combustion	418	760	83%
MSW/landfill gas	254	30	90%
TOTAL	673	41,840–43,840	

- There are three markets for renewable electricity produced in Virginia.
  - The primary use of renewable electricity has been for on-site use, either grid connected or off-grid. They typically use solar photovoltaic or small wind to produce the electricity.
  - Virginia's electric utilities are a second market. Larger projects, such as from biomass or wind, can sell their output to the utilities. These sales would typically be tied to a utility's renewable portfolio standard.
  - The third market is to sell power in the PJM marketplace. Renewable electricity system developers can gain access to higher-priced markets in other states through the PJM.
- Renewable energy project developers can gain additional value by selling the Renewable Energy Credits (RECs). RECs are a certificate that represents the value of the renewable project to the environment.
- REC markets in states with a mandatory renewable portfolio standard have a higher value than in Virginia.
- Virginia provides a number of incentives to advance renewable energy technology and production. These are intended to help early adoption of the technologies and provide the jobs and environmental co-benefits from renewable energy production and use. They include:
  - A renewable portfolio standard calling for 15 percent of 2007 base-line electric production from renewable sources, with utilities eligible to receive an enhanced rate-of-return for meeting the standard.

[95] VCCER: A Study of Increased Renewable Energy Resources in Virginia. November 11, 2005, Updated Jan 16, 2006, http://www.energy.vt.edu/Publications/Incr_Use_Renew_Energy_VA_rev1.pdf

- An enhanced rate of return for utility investments in renewable electric generating facilities.
- Net metering in which excess electricity from residential (up to 10 kilowatts) and small commercial (up to 500 kilowatts) projects is credited to the customer at the retail power rate (i.e. runs the meter backwards).
- A biofuels production incentive fund with a higher incentive for liquid fuels produced from non-conventional resource.
- Income tax credits for green jobs and jobs related to clean fuel vehicles and fueling systems.
- Grants for manufacturers producing solar panels in Virginia.
- Grants from the Tobacco Indemnification Commission for R&D and energy businesses development in Southside and Southwest Virginia.
- Rebates and other financial support using American Recovery and Reinvestment Act funding.
- A streamlined permitting process for renewable electric projects 100 megawatts and smaller (20 megawatts and smaller for biomass and waste to energy).
- Creation of the Virginia Coastal Energy Research Consortium (VCERC) to develop coastal energy technologies.
    - Twenty percent of revenue from offshore oil and gas production is to be provided to VCERC.
- The Virginia Offshore Wind Development Authority to assist development of an offshore wind industry in Virginia.
- The Universities Clean Energy Development and Economic Stimulus Foundation to support R&D of alternative fuels, clean energy production, and related technologies.
- Creation of the Virginia Wind Energy Collaborative and Onshore Wind Test Center at James Madison University.

Biomass and Waste-to-Energy

- Biomass and waste products include:
    - Wood and wood waste, including wood, sawdust, wood chips, and slash.
    - Energy crops such as fast growing trees, corn, barley, warm season grasses, winter cover crops, and others.
    - Agricultural waste such as crop residue, animal litter; and waste from food processing.
    - Municipal solid waste and landfill gas generated from waste.
    - Construction debris.
    - Algae.

- Biomass and waste is used as a fuel to generate electricity, make steam or heat, and make liquid fuels.

Table 6-1: Biomass Generated Electricity (MWh) 2000-2007[96]

Year	Municipal Waste	Wood and Wood Waste	Other Waste	Total Biomass
2000	461	1,677	6	2,144
2001	991	1,148	5	2,144
2002	1,106	1,408	4	2,518
2003	1,100	1,588	27	2,714
2004	1,148	1,764	42	2,954
2005	1,132	1,800	47	2,979
2006	662	1,780	17	2,458
2007	753	1,792	20	2,566

Table 6-2: Biomass and Waste-to-Energy Projects[97]

Project	Energy Produced
Fairfax County Covanta WTE plant	124 MW of electricity
Alexandria/Arlington Covanta WTE plant	29 MW of electricity
SPSA WTE plant	60 MW plus steam
Harrisonburg WTE plant	2.5 MW plus steam
Dominion Multitrade (sawdust and wood chips)	80 MW of electricity and steam
Dominion Altivista (wood chips co-fired with coal)	2 MW electricity
21 Landfill Gas generating plants	20.6 MW electricity
Sussex County Landfill	Process gas for Honeywell in Hopewell
Wood pellet manufacturing plants	Wood pellets for domestic/export markets
Six industrial CHP (wood, wood waste, black liquor)	182 MW electricity and steam
Institutional boilers such as Piedmont Geriatric Hospital and Longwood University	Steam
Piedmont Bioproducts	Green diesel
Five in-state biodiesel producers	Biodiesel
Osage	Ethanol
Five commercial biodiesel plants (soy, canola, waste greases)	Biodiesel
Farm and coop biodiesel operations (unknown number)	Biodiesel; filtered vegetable oil
Louisa County pellet plant	Wood pellets

[96] VEPT, http://www.energy.vt.edu/vept/renewables/biomass/renew_gen.asp, June 29, 2010
[97] Virginia Cooperative Extension, "Preliminary Residual Biomass Inventory for the Commonwealth of Virginia: Geographic Information System Based Multi-Feedstock Bioresidue Assessment"

- Virginia has substantial biomass resources. While the total amount available has not been inventoried, some individual biomass resource assessments have been completed.

Table 6-3: Biomass and Waste Inventories

Type of Biomass	Amount of Resource
Wood	16 million acres of forestland
Forest slash	2,253,244 dry tons
Sawdust and sawmill waste	2,538,140 dry tons
Crop residues	750,137 dry tons
Animal wastes	1,045,946 dry tons
Municipal solid waste	2,016,587 tons
Landfill gas	66 landfills; 21 operational projects; 11 candidate landfills
Construction debris	593,211 tons
Food processing waste	763,022 tons

- The law establishing Virginia's Renewable Portfolio Standard (RPS) placed a 1.5 million ton per year limit on use of woody material also used for paper manufacturing under the RPS.
- Multiple biomass-fired projects are under development. A sample of announced projects include:
  - Biomass co-firing in the Dominion Virginia City Hybrid Generating Station;
  - Fauquier County Landfill WTE project;
  - Two construction debris pellet plants in the Richmond region (Cephas Industries, Environmental Solutions);
  - Greensville wood pellet plant;
  - Van de Hyde Dairy digester in Pittsylvania County;
  - Wise County Correctional Unit waste wood burner;
  - Roanoke Regional Water Treatment Plant biogass digester;
  - Christiansburg Water Treatment Plant biogass digester;
  - Women's Correctional Center biomass boiler; and
  - Three LFG projects (Rockingham Hospital, Toigo Greenhouse, Martinsville Landfill) using the gas for heat and hot water and generating electricity.
- The Virginia Coastal Energy Research Consortium (VCERC) operates a test site growing algae to be used in producing biodiesel and other drop-in liquid fuels.
  - VCERC is developing an algae-to-biodiesel reformer technology to produce biodiesel meeting ASTM commercial diesel specifications.[98]

[98] The VCERC Algae Research Report is available at: http://www.vcerc.org/VCERC%20Final%20Report%20--%20Algal%20Biodiesel%20Studies.pdf

- The Virginia Institute for Marine Sciences is working with Statoil and other partners to develop the technology to grow algae in open water. The algae would be harvested for diesel fuel production.
- The Hopewell wastewater treatment plant is developing an algae project to strip excess nutrients out of the wastewater in algae ponds. The algae will be available as a feedstock for energy production.

Hydroelectric Power

- Virginia is home to 24 conventional hydropower facilities with a combined capacity of 439 megawatts, and two pumped storage facilities with a combined capacity of 2756 megawatts.

Table 6-4: Conventional Hydropower Generation

Year	Owner	Name	County	Summer Capacity (MW)
1927	Allegheny Energy Supply Co LLC	Luray	Page	1.6
1923	Allegheny Energy Supply Co LLC	Newport	Page	1.4
1912	Appalachian Power Co	Buck	Carroll	8.4
1912	Appalachian Power Co	Byllesby 2	Carroll	21.6
1939	Appalachian Power Co	Claytor	Pulaski	74.8
1964	Appalachian Power Co	Leesville	Campbell	40
1954	Appalachian Power Co	Niagara	Roanoke	3.6
1903	Appalachian Power Co	Reusens	Campbell	22.5
1993	Appomattox River Associates LP	Brasfield	Appomattox	3
1933 & 1981	Aquenergy Systems Inc	Fries Hydroelectric Project	Grayson	5.4
1987	Bedford City of	Snowden	Amherst	5
1938	Danville City of	Pinnacles	Patrick	11.1
1930	Dominion Virginia Power	Cushaw	Amherst	7.5
1987	Dominion Virginia Power	North Anna	Louisa	1
1920	Georgia Pacific Corp-Big Island Mill	Georgia Pacific Big Island	Bedford	0.4
1983	Holcomb Rock Company	Coleman Falls	Bedford	1.5
1920	Holcomb Rock Company	Holcomb Rock	Bedford	1.8
1924	Martinsville City of	Martinsville	Henry	1.3
1934	Radford City of	Radford	Pulaski	1
1986	Ridgewood Power Management LLC	Emporia	Greensville	2.4
1915	Ridgewood Power Management LLC	Halifax	Halifax	1.6
1990	STS HydroPower Ltd	Schoolfield Dam	Pittsylvania	4.5
1952 & 1953	USCE-Wilmington District	John H Kerr	Mecklenburg	204
1953	USCE-Wilmington District	Philpott Lake	Henry	14

Table 6-5: Pumped Storage Power Plants

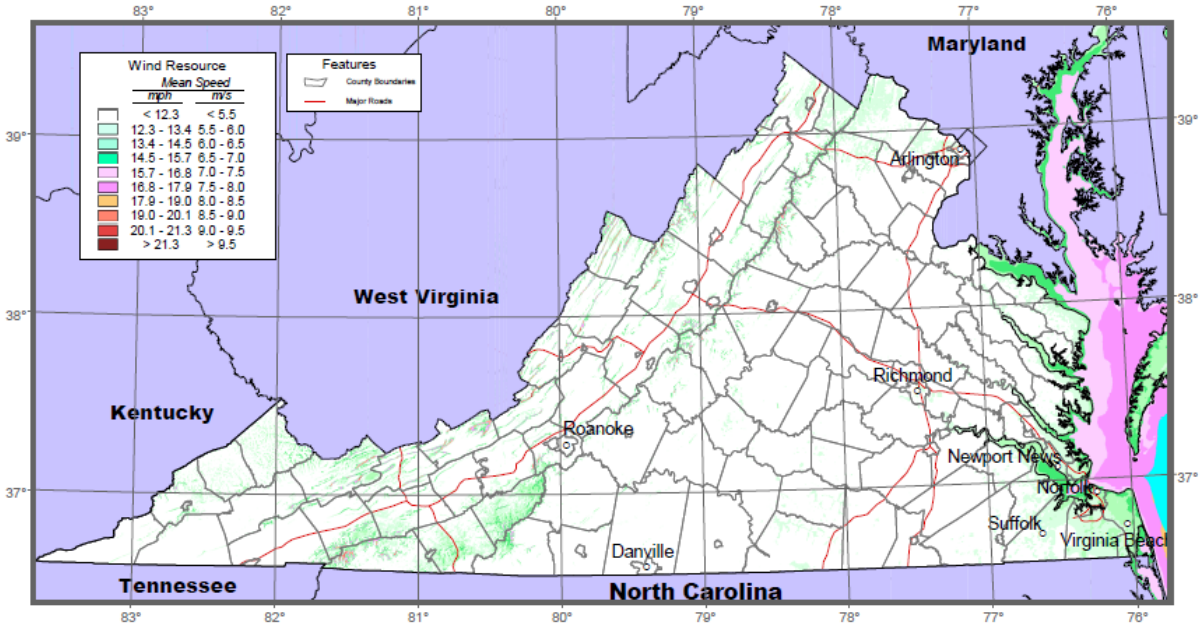
Plant	Capacity (MW)
Dominion Bath Power Station	2100
Appalachian Power Smith Mountain Lake	656

- Most sites in Virginia capable of hosting hydroelectric power generation have been developed.
- There are a few low-head hydro sites with existing impoundments available for development.
    - An inventory of potential sites was completed in the 1980s.
    - The cost of cleaning out sediment in the impoundment and retrofitting the dams, fish ladders, and power plants have has been the primary impediment to developing these sites.
    - A few impoundments are being removed to open streams to fish migration.

Onshore Wind

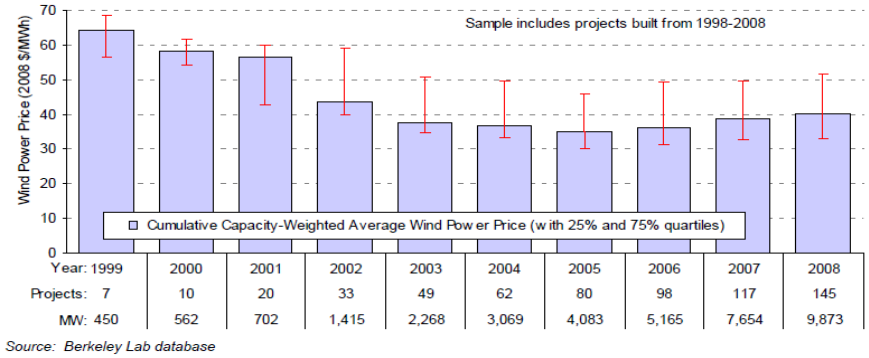
- Onshore wind resources suitable for commercial wind power generation are found along the ridges of the Appalachian Mountains and along the coast.
- The Virginia Wind Energy Collaborative provides support to individuals and localities to assess the proper locations for and uses of wind power generation. The Collaborative provides, among other products, maps showing wind speeds and wind densities at varying heights above the ground to help identify suitable locations for wind projects.

Figure 6-2: Virginia Wind Speeds – 70 meter height



- There are a number of onshore wind projects under development in Virginia, including:
  - One 39 megawatt wind project is under construction in Highland County;
  - Two wind developers have proposed commercial scale wind farms in Wise and Roanoke Counties; and
  - Community-scale wind projects (one to five megawatts in size) have been proposed for the NASA facility on Wallops Island and on Port Isabel near Tangier Island.
- Onshore wind resources suitable for farm or residential wind generation are found in many areas across Virginia. These projects typically qualify for net metering installations.
  - Suitability of any site must be assessed on a case-by-case basis.
  - The Virginia Wind Energy Collaborative developed the Wind Landscape Classification System for Virginia to assist landowners and local officials assess the suitability of sites for wind projects.
- Wind power only provides power when wind speeds are sufficient to run the turbines.
  - The percent of time a power plant runs is called its capacity factor, typically around 30 percent for Virginia onshore wind sites.
  - Intermittency means that the generation resource cannot be fully counted as generation capacity and other generation capacity must be available to provide power at times the wind projects are not generating.
- Wind projects have high capital costs and low marginal or operating costs. The average wholesale cost of power from a new onshore wind project in 2008 ran about five cents per kilowatt hour, including the effects of federal tax credits and production grants.[99]
  - Virginia projects would typically be on the high side of cost estimates as they would be smaller and would have increased construction costs due to ridge location.

Figure 6-3: Capacity-Weighted Average Wind Power Prices, 1999-2008[100]



Source: Berkeley Lab database

[99] Researchers at the Lawrence Berkley Laboratory's Energy and Environment Division, in an *Alternative Windpower Ownership Structures: Financing Terms and Project Costs*, estimate that a typical 50-MW wind plant would deliver power at just under 5 cents/kWh if financed by a wind developer.

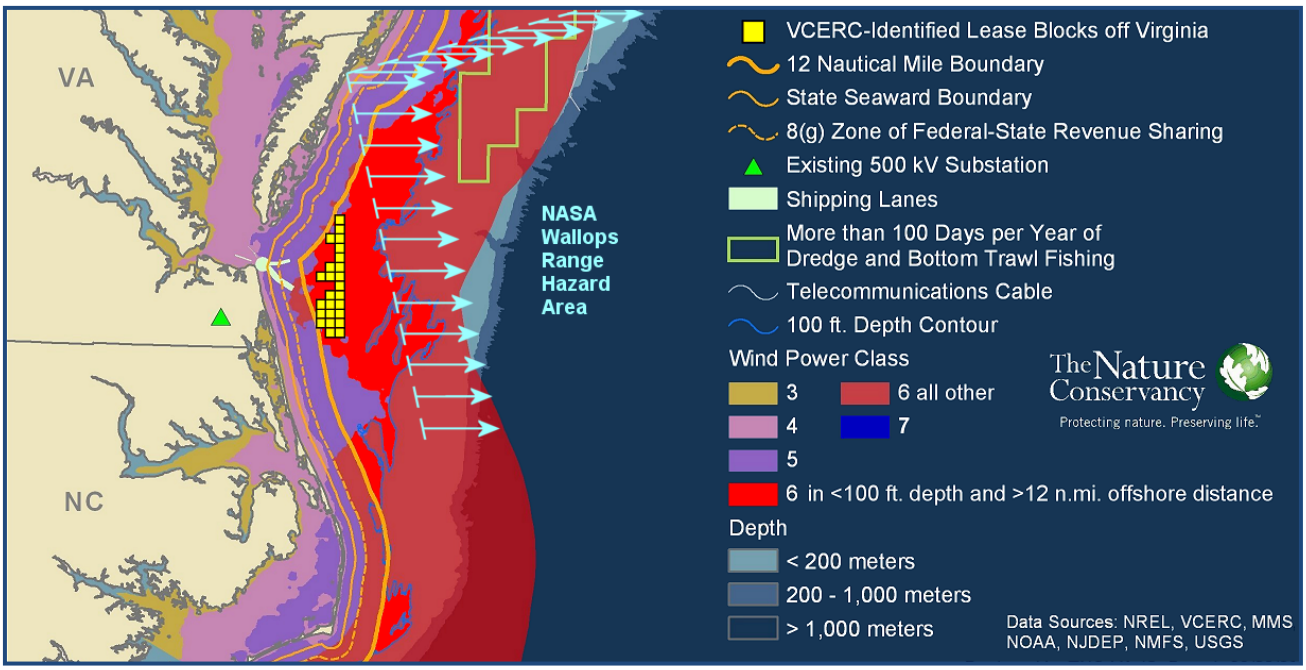
[100] Lawrence Berkley Laboratory, 2008 Wind Technologies Market Report, http://www1.eere.energy.gov/windandhydro/pdfs/46026.pdf, page 26, June 29, 2010

- Offshore wind projects support multiple jobs during their construction. They require few employees for operation and maintenance.

Offshore Wind

- Virginia has substantial offshore wind resources, primarily in federal waters.
  - The Virginia Coastal Energy Research Consortium (VCERC) has completed two years of study on offshore wind.
  - They show there is over 3,000 megawatts of offshore wind capacity in waters with depth less than 30 meters. This depth allows use of conventional foundations, improving the cost effectiveness of the technology.[101]

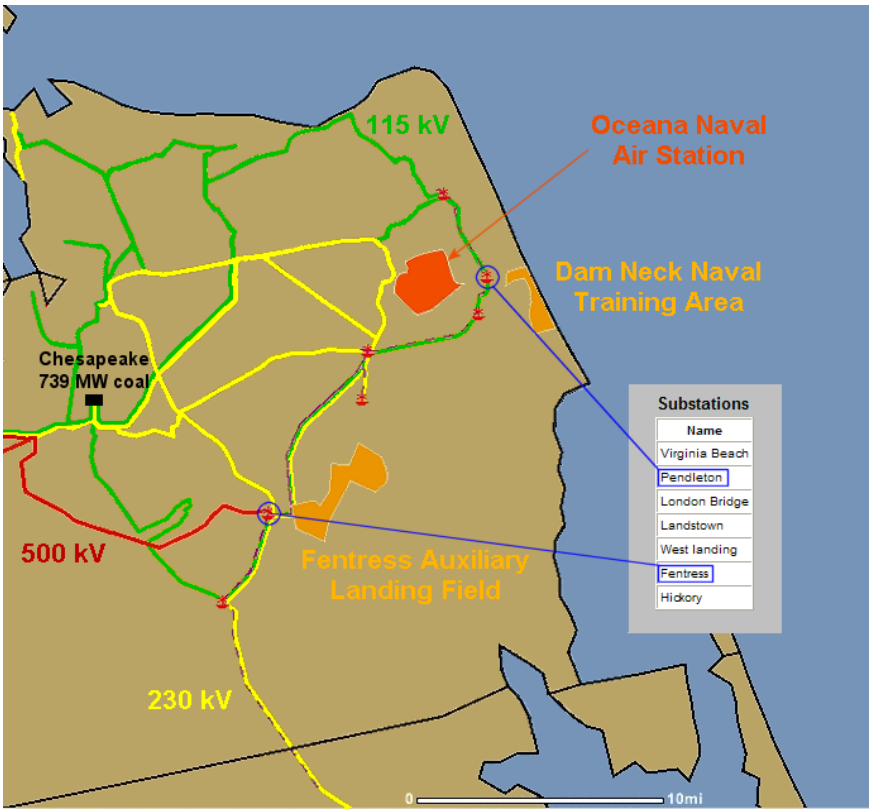
Figure 6-4: Virginia Offshore Wind Potential Analysis



[101] The VCERC offshore wind study is available at: http://www.vcerc.org/VCERC_Final_Report_Offshore_Wind_Studies_Full_Report_newest.pdf

The high-voltage transmission grid is located close to the shore in Virginia Beach, offering lower cost connection of offshore wind projects to the grid.

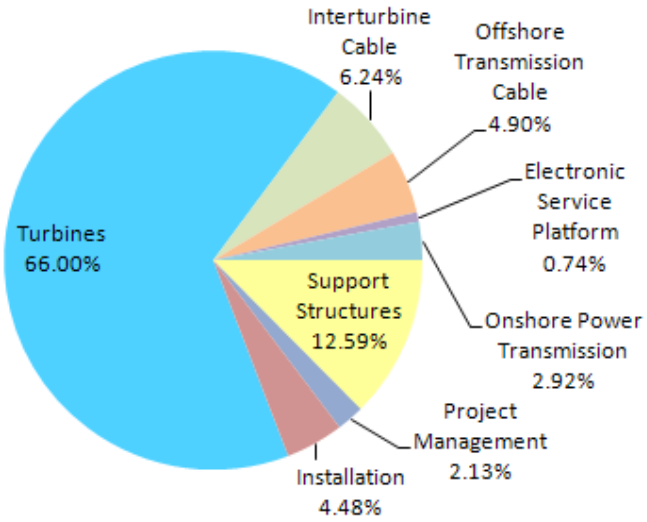
Figure 6-5: Offshore Wind Grid Access Points[102]



- The Port of Hampton Roads offers highly suitable port, manufacturing, and project development sites to support offshore wind development and wind turbine and supply chain manufacturing.[103]
- Offshore wind can support new jobs in project construction and operation, and in supply chain businesses.
- Offshore wind technology is estimated to cost between $125 and $225 per megawatt hour (12.5 to 22.5 cents per kilowatt hour). This would not be competitive with other power sources in today's market.
- VCERC estimates capital cost for a 588-megawatt wind project offshore Virginia to be (2008 dollars):
    - Plant cost at offshore busbar: $ 1,748 million
    - Transmission cost to Fentress: $ 153 million
    - Total plant investment: $ 1,901 million (~ $3,230 / kW)

[102] Presentation at the Virginia Manufacturing Association, 2010 Energy Summit, VIRGINIA WIND POWER OPPORTUNITIES - JOBS FOR VIRGINIA, March 2010
[103] The VCERC port study is available at: http://www.vcerc.org/FINAL%20HRMARITIME.pdf

Figure 6-6: Capital Cost Categories for Offshore Wind

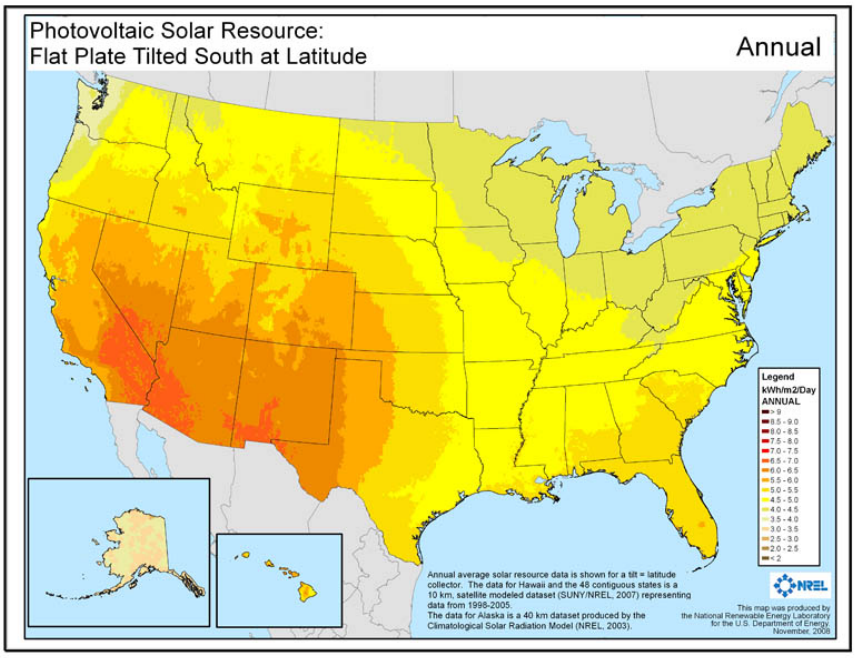


- Two companies have submitted unsolicited proposals to the federal Bureau of Ocean Energy Management, Regulation and Enforcement (BOE), formerly the Minerals Management Service, to lease waters off of Virginia's coast for offshore wind development.
- The BOE is the leasing agent for offshore waters suitable for offshore wind development.
    - The BOE, the state government, and interested localities are developing a Request for Interest to start the leasing of offshore Virginia waters for wind development.
- Offshore wind projects will need to be developed in areas not in conflict with Navy and other Department of Defense shipping, fishery, and other uses of the offshore areas.
- Virginia Governor McDonnell has joined the U.S. Secretary of the Interior and governors from nine other states to form the Offshore Atlantic Wind Energy Consortium to cooperate on developing offshore wind resources along the Atlantic coast.
- Regional electric transmission issues affecting wind are addressed through the PJM Interconnection.
    - PJM has begun an effort to assess the effect of state renewable portfolio standards and plans for offshore and onshore wind development. PJM plans to include these factors in its 2011 Regional Transmission Expansion Plan (RTEP).
- The Federal Energy Regulatory Commission (FERC) policies and cost-allocation structures that socialize costs by providing all end-users to pay for transmission system upgrades may subsidize transmission of Midwestern wind to the East Coast and undermine the economics of offshore wind and other Virginia-based renewable electricity resources.

Solar Power

- Solar-power can be used to generate electricity through photovoltaic cells or concentrating thermal plants, or to produce hot water for domestic or commercial use.
- Virginia has ample solar intensity to support photovoltaic and thermal uses. Virginia is not suited for concentrating thermal systems.

Figure 6-7: Solar Resource Map



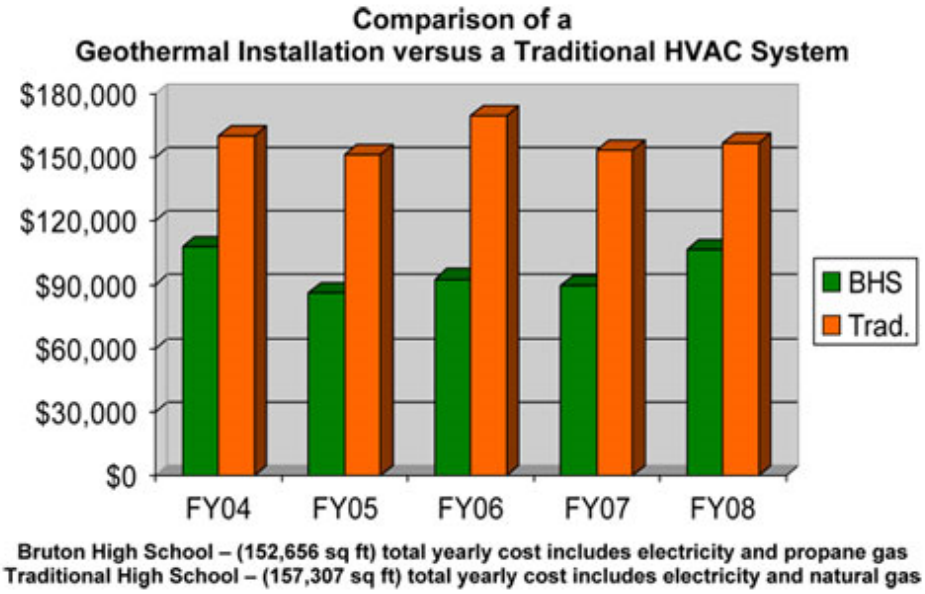
- Solar system owners can take advantage of Virginia's net metering laws to sell excess power generation back to the owner's electric utility.
- Solar systems can be cost effective when the installation avoids installation of electric line extensions.
- Solar is an intermittent power source, only generating power when the sun shines.
  - Battery technologies provide the potential to solve the intermittency problem with solar. Additional research and development leading to scale-manufacturing is needed to bring battery costs down.
- Solar thermal systems are cost effective for hot water and swimming pool heating.
  - Solar hot water systems typically have a five to eight year simple payback when compared to electric hot water heating.[104]
  - Newer technologies, such as evacuated tube collectors, have the potential to improve the cost effectiveness of solar thermal systems.

[104] House Energy, Solar Energy Systems Costs and Payback, http://www.house-energy.com/Solar/Costs-Payback-Solar.htm; and the Florida Solar Energy Center, Solar Hot Water simple calculator, http://www.fsec.ucf.edu/en/consumer/solar_hot_water/homes/calculator/SHW-calculator_simple.xls, June 13, 2010

Geothermal Energy

- Geothermal energy can provide heating and cooling through use of geothermal heat pumps.
- York County Schools have geothermal systems operating wells in nine school facilities. Energy costs for a typical York County geothermal school were reduced by approximately $60,000 per year.

Figure 6-3: Geothermal Heat Pump and Traditional Heating and Cooling Energy Costs[105]



- There are limited low-temperature geothermal resources in Bath County that are suitable for water and space heating.
- Hot-rock geothermal resources are found near the Virginia Atlantic coastline. Due to the depth of these rocks, they are not economical with current technology.

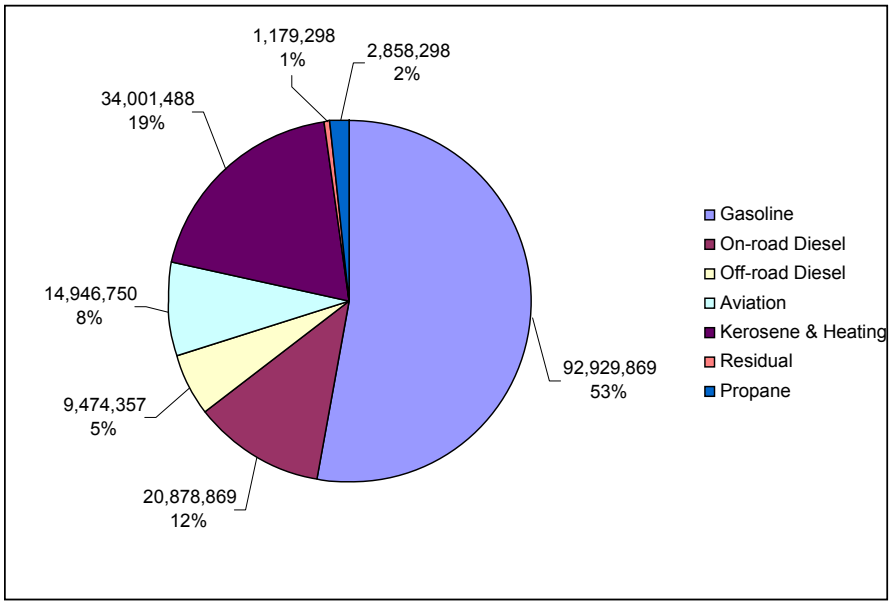
[105] York County Schools, Green YCSD Geothermal Heating and Cooling, http://yorkcountyschools.org/greenYCSD/geothermal.aspx

SECTION 7 - PETROLEUM

Petroleum Consumption

- Petroleum is used primarily to fuel transportation (65 percent) and as heating oil (20 percent). Smaller amounts are used for aviation (8 percent) and off-road use (5 percent). Use of propane accounts for the remaining two percent.

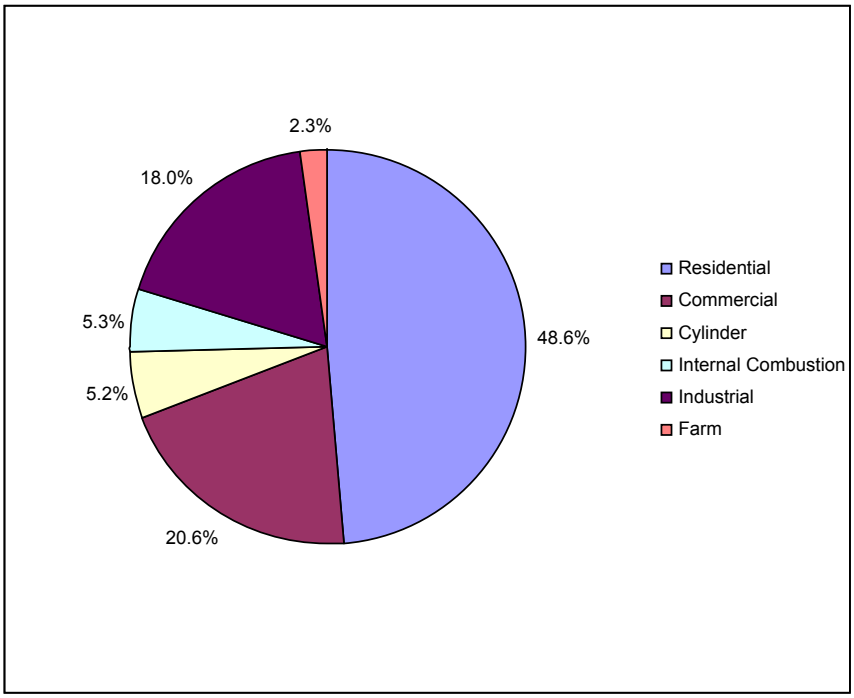
Figure 7-1: Petroleum Consumption, 2008[106]



- Petroleum use grew on average one percent per year from 1989 through 1998. Use has been stabile since 1999 as vehicle miles traveled stabilized and the oldest, low-mileage vehicles aged out of the fleet.
- Virginians used approximately 219.8 million gallons of propane in 2008. [107]
    - This was 2.21 percent of the propane used nationwide.
    - The 2000 U.S. Census reports that 5.1 percent of households in Virginia use propane or bottled gas for space heating.

[106] U.S. Energy Information Administration, http://tonto.eia.doe.gov/dnav/pet/PET_CONS_PRIM_DCU_SVA_A.htm
[107] Source: American Petroleum Institute

Figure 7-2: Propane Consumption, 2008[108]



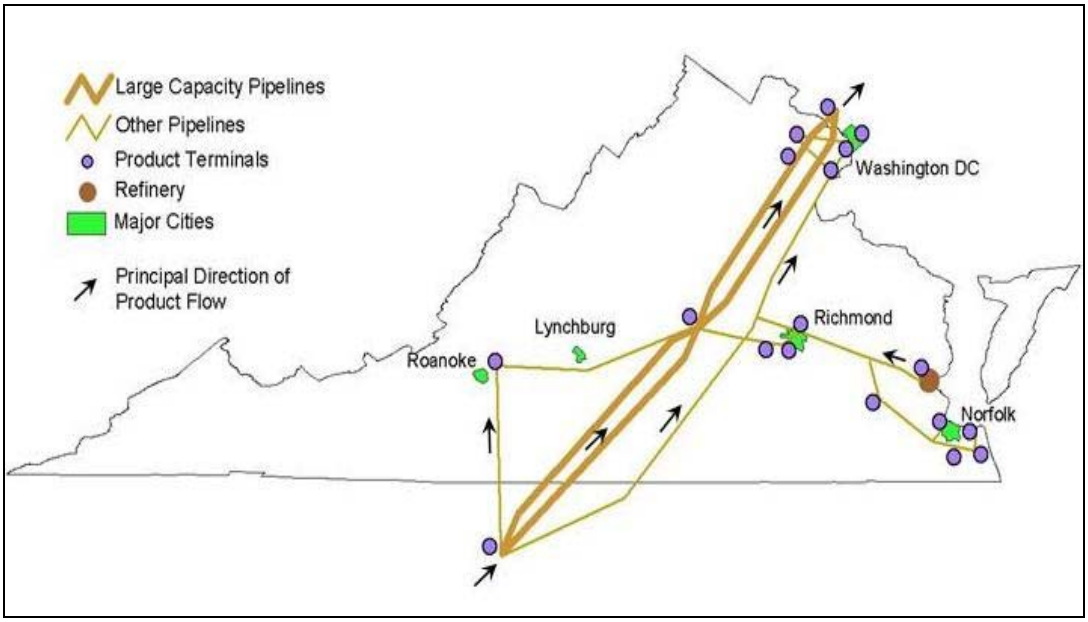
- Petroleum consumption is affected by the distance people drive and use of alternate forms of transportation.
  - Virginia has 160,097 lane miles of Interstate, state primary, state secondary, and local roads, [109] providing an extensive, state-maintained road system reaching all communities across the state.
  - Virginia's mass transit network primarily serves the eastern part of the state. Virginia's mass transit resources include:
    - Amtrak routes on the I-95 corridor and I-64 to Newport News, from Washington DC through Charlottesville, Lynchburg, and Danville to the Gulf Coast; and through Charlottesville, Staunton, and Clifton Forge to the Midwest;[110]
    - Virginia Rail Express, from Fredericksburg and Manassas to Washington DC;
    - Metro (subway) in the Washington DC area;
    - Intracity buses in urban areas and van service in many rural areas; and
    - Intercity bus service serving much of the state.
  - New light rail lines are under construction in Norfolk and under development in Northern Virginia.

[108] National Propane Gas Association, http://www.npga.org/files/public/Economic_Study_Propane_Value_Final.pdf
[109] http://www.fhwa.dot.gov/policyinformation/statistics/2008/hm60.cfm
[110] For Virginia Amtrak routes, see http://amtrakvirginia.com/

Petroleum Product Pipelines and Distribution

- Petroleum is supplied to Virginia through a network of refineries, pipelines, port facilities, terminals, and retail outlets.
  - Crude oil, which is mostly imported, is delivered by tanker to the Yorktown petroleum refinery where it is transformed into gasoline, fuel oil, jet fuel, and diesel.
  - Finished petroleum products are shipped to petroleum terminals across Virginia in various ways:
    - The Colonial and Plantation underground pipelines deliver product from refineries in the Gulf of Mexico region to distribution terminals in Fairfax, Richmond, Montvale/Roanoke, and Chesapeake.
    - Tankers and barges deliver product to coastal petroleum distribution terminals in Chesapeake and Richmond.
  - Virginia is also regularly supplied from out-of-state petroleum terminals in Baltimore, MD; Greensboro, NC; and Knoxville, TN.

Figure 7-3: Major Petroleum Pipelines and Terminals in Virginia[111]



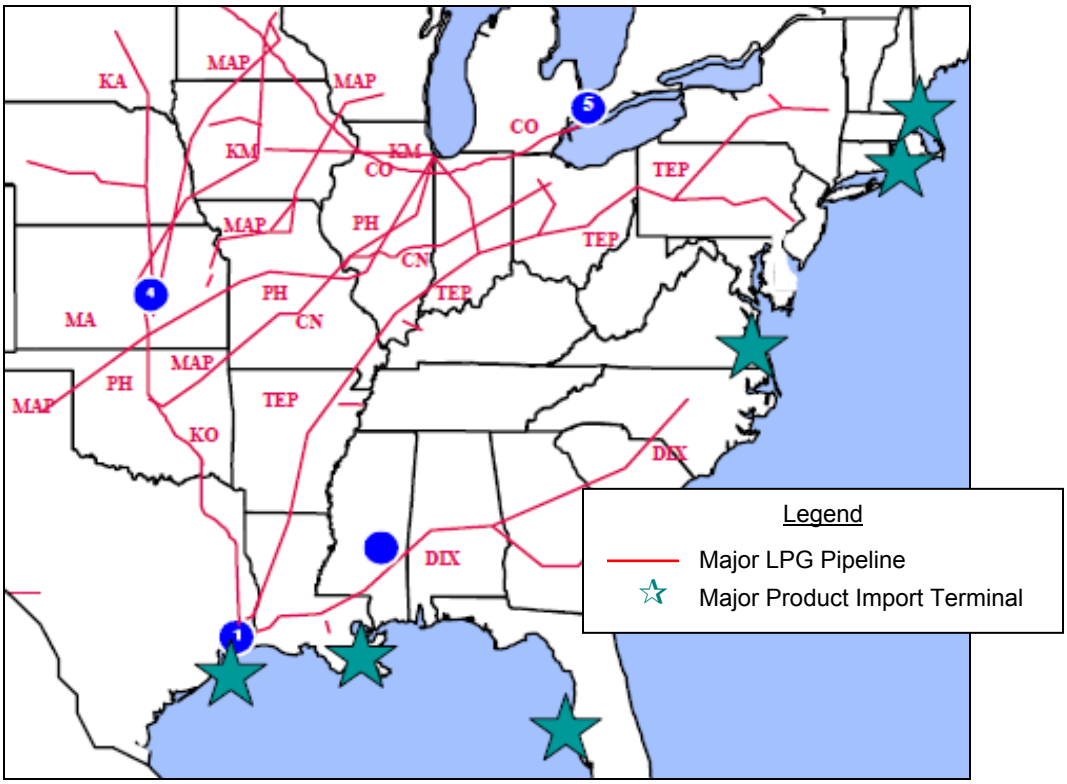
- Petroleum distributors, also called jobbers, purchase gasoline, diesel, heating oil, and other products from central terminals and truck them directly to large users, gas stations, and other retailers. Most jobbers also store gasoline, diesel, fuel oil, kerosene, lubricants, and other petroleum products in smaller storage facilities located in nearly every locality across Virginia.
-

[111] Virginia Energy Patterns and Trends: Major Petroleum Product Pipelines, www.energy.vt.edu/vept/petroleum/oil_pipeline.asp

The petroleum product supply chain has a limited ability to respond to delivery disruptions such as from storms, pipeline problems, or panic buying runs. On average, there is a larger volume of empty capacity in vehicle gas tanks than there is in the entire fuel delivery system.

- The majority of Virginia's propane gas is supplied by the interstate propane pipeline terminating in Apex, North Carolina, and the water-based terminal in Chesapeake.
- Propane is trucked from the North Carolina and Chesapeake terminals to bulk plants, and then distributed to end users.

Figure 7-4: Propane Pipelines and Major Terminals[112]



[112] Harry Hunter Hanger, Jr., Atlantic Energy Import Terminal, Presentation to the Pennsylvania Public Utility Commission Winter Meeting, November 9, 2006

Petroleum Prices

- Petroleum price and availability are affected more by national and international policies and events than from in-state factors. These include:
  - Political instability in oil producing countries;
  - Drops in productivity in some oil producing regions;
  - Effects of weather such as Gulf of Mexico hurricanes; and
  - Growth in demand in international markets such as China, India, Central America, and the Middle East.
- Gasoline prices have been volatile over time, increasing to $4.04 in June 2008 and dropping to $2.51/gallon 15 months later in September 2009.[113]
- Gasoline prices trended higher from year to year until 2009 when they declined.

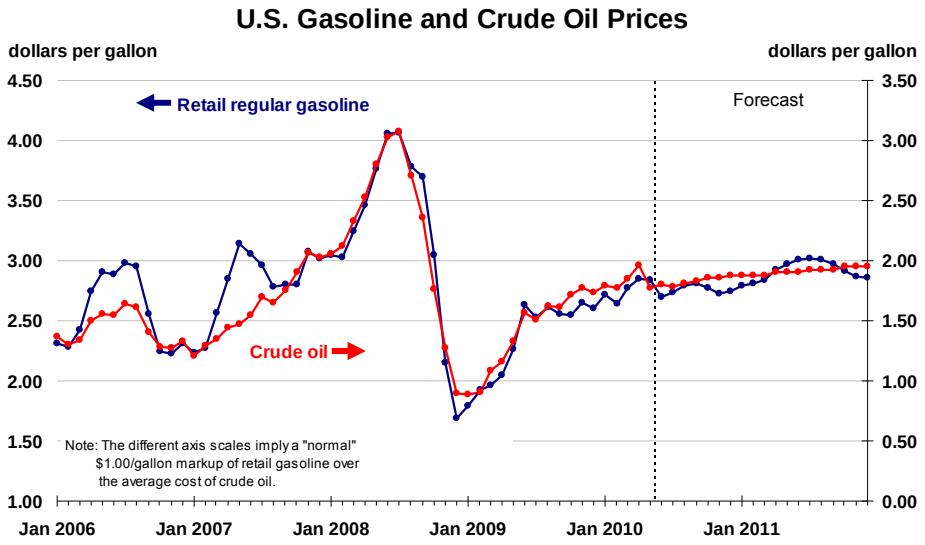
Table 7-1: Gasoline Prices, 1993-2009[114]

Year	Average Retail Gasoline – Price per Gallon (Including Federal and State Gasoline Taxes)
1993	1.033
1994	1.035
1995	1.136
1996	1.231
1997	1.211
1998	1.028
1999	1.115
2000	1.467
2001	1.373
2002	1.330
2003	1.534
2004	1.853
2005	2.306
2006	2.588
2007	2.794
2008	3.297
2009	2.366

- The Energy Information Administration (EIA) predicts that petroleum prices will rise over the next ten years,[115] with annual refined petroleum prices (nominal dollars) to increase from $2.69/gallon (including taxes) in 2010 to $4.12/gallon by 2020.

[113] EIA, Petroleum Navigator, http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=mg_tt_1c&f=m, June 29, 2010
[114] EIA, Petroleum Navigator, http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=MG_TT_1C&f=A, June 29, 2010
[115] EIA, Gasoline Prices by Formulation, Virginia, Sales to End Users, Average Through Retail Outlets, http://www.eia.doe.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=d100613512&f=m, June 1, 2010

Figure 7-5: U.S. Gasoline and Crude Oil Prices 2006 to 2012 ($/gal) [116]

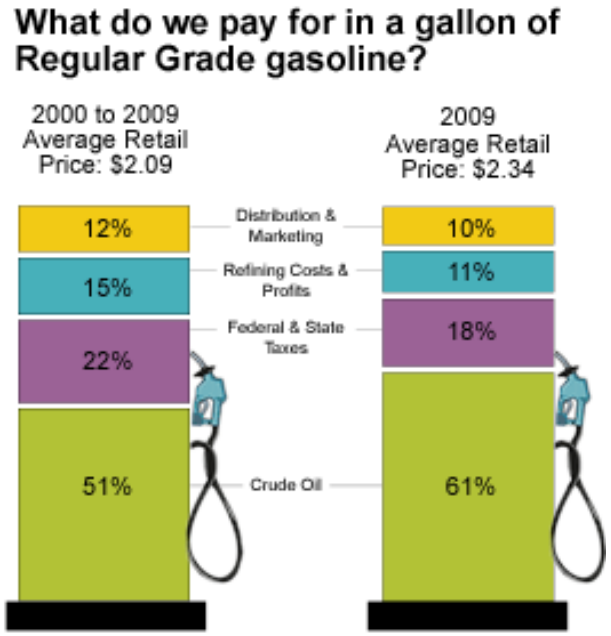


Note: Crude oil price is refiner average acquisition cost. Retail gasoline price includes State and Federal taxes.

U.S. Energy Information Administration

Source: Short-Term Energy Outlook, June 2010

- Petroleum product prices are also affected by changes in delivered input costs.
  - Crude oil prices were about $68/barrel in 2007, accounting for 58 percent of the $2.80/gallon regular grade gasoline price; $100/barrel in 2008, accounting for 69 percent of the $3.25/gallon price; and $62/barrel in 2009, accounting for 61 percent of the $2.34/gallon price.[117]



Source: U.S. Energy Information Administration.

[116] EIA, 2010 Annual Energy Review, Petroleum Product Prices, http://www.eia.doe.gov/oiaf/aeo/excel/aeotab_12.xls, June 1, 2010
[117] EIA, A Primer on Gasoline Prices, http://www.eia.doe.gov/bookshelf/brochures/gasolinepricesprimer/index.html, June 1, 2010

- Propane prices (residential) have been less volatile than petroleum prices, ranging from $3.09/gallon in October 2008 to $2.27 in October 2009. Annual prices are projected to increase from $2.12/gallon in 2010 and up to $3.17 in 2020.

Table 7-2: East Coast Propane Residential Price[118]

Year	Residential Price
2000	$1.43
2001	$1.51
2002	$1.33
2003	$1.60
2004	$1.82
2005	$2.09
2006	$2.28
2007	$2.54
2008	$2.93
2009	$2.68

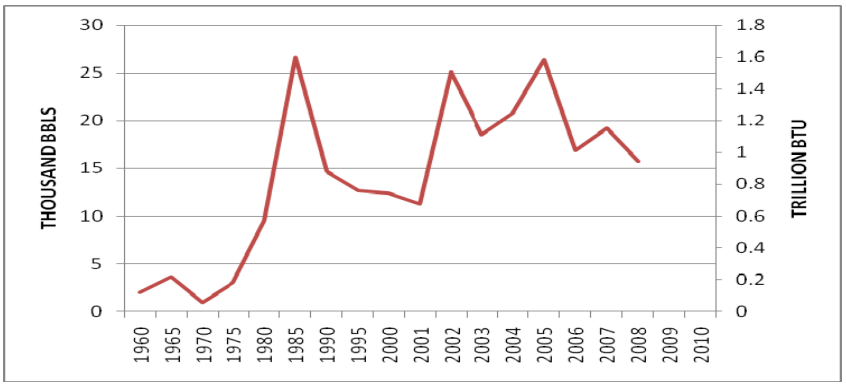
Conservation

- Use of petroleum can be reduced through:
  - Driving more efficiently;
  - Driving less – lowering Vehicle Miles Traveled (VMT) through increased use of mass transit and transit-oriented development; and
  - Weatherizing facilities to more efficiently use fuel oil for heating.

Petroleum Production

- Virginia's oil and gas operators produced 15,712 barrels of oil in 2008 from 75 stripper oil wells located in Lee, Wise, and Russell Counties, equivalent to less than one percent of the state's annual consumption. This production is typically shipped to refineries in Kentucky for processing.

Figure 7-6: Petroleum Production in Virginia, 1960–2008[119]

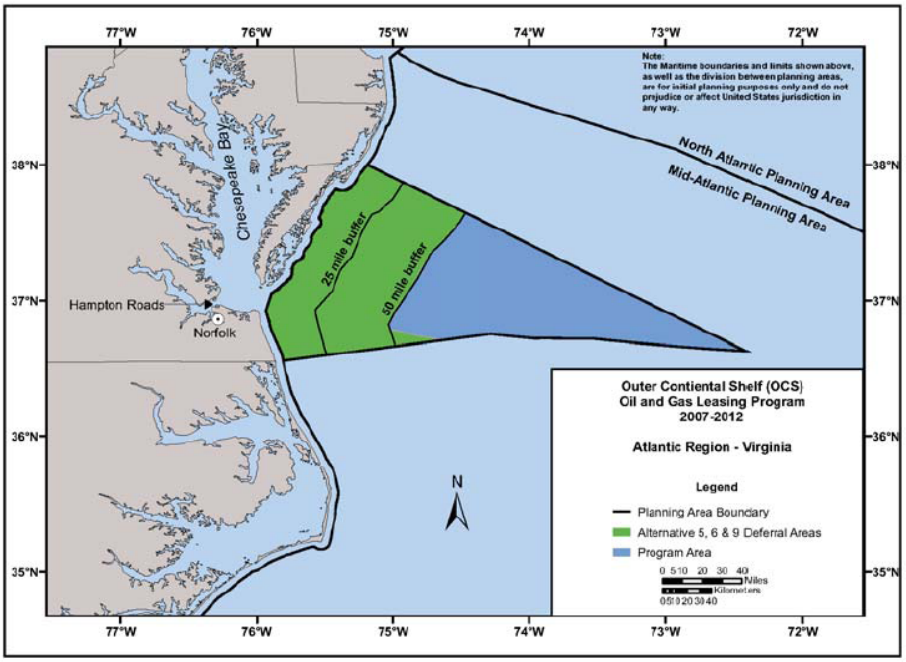


[118] EIA, East Coast (PADD1) Propane Residential Price, http://tonto.eia.doe.gov/dnav/pet/hist_xls/MPRREP14m.xls, June 23, 2010
[119] VEPT, Historical Petroleum Production, http://www.energy.vt.edu/vept/petroleum/Historical_Production.asp

Offshore Oil

- There is an estimated 165 million barrels of petroleum reserves in federal waters in the Virginia administrative boundary area offshore Virginia.
- The value of crude oil in the Virginia offshore administrative areas could total to more than $13 billion (165 million barrels at $80/barrel).
    - The ultimate value will depend on the actual amount of recoverable resources and the cost of oil.
- Offshore oil production would support infrastructure expansion in Hampton Roads, attracting new business and creating jobs in the supply chain and for exploration and production.
- Developing offshore oil resources is dependent on an extensive federal lease sale and permitting process.
- Offshore extraction will need to be compatible with Department of Defense operations in Virginia offshore waters. Federal-state cooperation can lead to developing a compatible exploration and production plan.
- The Bureau of Ocean Energy Management, Regulation and Enforcement (formerly Minerals Management Service) has suspended offshore leases until the causes of the 2010 Deepwater Horizon accident and oil spill are better understood and suitable protections are put in place.

Figure 7-7: 2007-2012 Mid-Atlantic OCS Proposed Lease Area[120]



[120]Source: U.S. Department of the Interior, MMS, *Proposed Final Program of the Outer Continent Oil and Gas Leasing Program, 2007–2012*, April 2007, map 9, p. 68

Petroleum Refining

- The state is home to one oil refinery in Yorktown.
  - Production capacity is 70,000 barrels of petroleum products per day, or 25 million barrels per year, less than 15 percent of the state's use.[121]
  - It is ranked 90th in size out of the 143 U.S. refineries.
  - Crude feedstock comes from Canada, the North Sea, South America, and the Far East, delivered by barge and tanker to the dock on the York River.
  - Products include gasoline, diesel, propane, butane, heavy fuel oils, and petroleum coke.
- The market for gasoline and diesel has been challenging for refiners in 2009 and 2010.
  - Demand has dropped with the drop in economic activity.
  - Capacity additions are underway, primarily at Port Arthur, Texas, and Daryville, Louisiana, totaling 500,000 barrels per day.

Adequacy of Supply

- There is sufficient capacity to supply petroleum products to users in Virginia under normal situations through the pipeline, tank farm, and distribution system.
- Disruptions in Gulf of Mexico supply or petroleum product pipelines will disrupt supply in multiple states, including Virginia.
- Virginia is updating its Energy Assurance Plan to enhance the Commonwealth's ability to respond to a supply disruption. This includes cooperation with petroleum distribution and pipeline companies, other states, and the federal government

[121] About Western Refining/Refining, http://www.wnr.com/Refining.aspx, June 24, 2010

SECTION 8 – FINDINGS, GOALS, AND RECOMMENDATIONS

Findings

In completing the 2010 Virginia Energy Plan, we find:

- Growing Virginia's economy and supporting the quality of life of our citizens requires a diverse portfolio of energy supplies. We must continue to rely on traditional energy sources such as coal, natural gas, nuclear, and petroleum, while at the same time making alternate sources such as biomass, wind, hydro, and solar a larger part of our energy mix.
- Virginia has ample in-state energy resources. Virginia's energy businesses can generate new jobs and investment developing these resources.
- Virginia's consumers have the opportunity to use energy resources more efficiently. Expanding conservation and efficiency will support new jobs for Virginians, reduce waste of our natural resources, and keep our financial resources inside the state's economy.
- Developing new and emerging energy technologies will require public universities and private businesses to partner in energy research and development, manage shared intellectual property, and expand the energy business sector in the Commonwealth.
- Virginia's energy environment is complex and dynamic. Therefore, the Department of Mines, Minerals and Energy will review and revise this plan periodically over the next four years in order to stay on target making Virginia the Energy Capital of the East Coast.

Goals and Recommendations

2. Make Virginia the Energy Capital of the East Coast.

- **Grow both traditional and alternative energy production, jobs, and investment in Virginia.**
- **Increase the use of conservation and efficiency in Virginia's homes and businesses, and support the establishment and expansion of energy efficiency businesses.**

Goal 1 Recommendations:

- Grow in-state production of energy, with resulting jobs and investment, by 20 percent over the next 10 years.
    - Begin offshore natural gas and oil development, and expand onshore oil and gas development in Virginia, through an open regulatory process that facilitates safe and environmentally sound energy production and eases market entry for new and expanding oil and gas businesses.
    - Develop the environmental response infrastructure to support offshore oil and gas production so the systems are in place when development is allowed in the future.
    - Expand development of renewable resources, particularly using biomass, waste, and wind resources, to generate electricity and produce liquid fuels. Particular emphasis should be placed on activities that provide secondary benefits such as water quality improvements.

        - Provide green job tax credits and other financial support to companies providing new jobs and investments in clean energy production. Support should be based on a positive return on investment to the Commonwealth and its localities for their support.
        - Revise the solar photovoltaic manufacturing incentive grant fund to broadly cover renewable energy manufacturing businesses.
        - Provide an efficient permitting process for biomass, wind, and other alternate energy resources to facilitate timely project development consistent with good environmental protection.
        - Support the private sector's efforts to grow Virginia's offshore wind development and supply chain industries. This should include:
            - Supporting work of the Virginia Coastal Energy Research Consortium (VCERC) and the Virginia Offshore Wind Development Authority; and
            - Working with the Bureau of Ocean Energy Management, Regulation and Enforcement (former Minerals Management Service) to streamline the federal offshore wind leasing process.
        - Support production of biomass and algae-based drop-in fuels to support military and private uses for transportation and heating.
    - Support development of new electric generating resources to meet growing electric demand, including the third nuclear reactor at the North Anna Power Station and new base-load, intermediate load, and peaking generation from conventional resources.
    - Support the development of the new generation of nuclear power plants, such as the AREVA Generation III+ boiling water reactor (BWR) and the B&W mPower reactor, and the manufacturing of plant components.
    - Facilitate partnerships between Virginia's electric utilities and private generation developers where private developers can deliver power more cost competitively for ratepayers.
    - Facilitate development of private power projects to serve out-of-state markets.
    - Balance the need for low-cost power to support Virginia manufacturing, commerce, and citizens' quality of life with the need to provide long-term, stable, clean energy supplies.
    - Support expansion of distributed generation options at industrial, commercial, and residential sites.
    - Assist Virginia's coal and natural gas industries comply with state and federal requirements for safety, environmental management, and reclamation. This will lead to strong mining companies working to support the economic and environmental health of the communities in which they work.
    - Complete the study of the efficacy of uranium mining in Virginia in order to decide whether the existing moratorium should be continued or removed in the Commonwealth.
- Expand jobs and investment in energy efficiency services.

- Facilitate development of local and utility energy efficiency programs that overcome market inefficiencies and market failures that reduce investment below optimal levels.
- Support energy efficiency as a way to help low-income, elderly, and fixed-income families address their energy needs.

- Provide necessary systems to support delivery of energy resources under emergency conditions, addressing civilian and military needs.

3. Expand public education about Virginia's energy production and consumption, its effect on our economy, and how Virginians can use energy more efficiently.

Goal 2 Recommendations:

- Implement State Corporation Commission's *Virginia Energy Sense* consumer energy education program.
- Coordinate energy efficiency public information efforts among utility, federal, state, and local sources to provide clear and easily understandable messages to consumers.
- Expand energy-related education in all phases of Virginians lives through:
  - Expanding community college jobs training in areas such as energy auditing and efficiency, utility and related trade activities, and renewable system operation and maintenance; and
  - Expand university programs in areas such as nuclear power, energy engineering, and environmental management.

4. Maximize the investment in clean energy research and development through the work of the Universities Clean Energy Development and Economic Stimulus Foundation.

Goal 3 Recommendations:

- Coordinate energy R&D actions among universities and private companies to maximize value of state resources.
  - Working with the Lieutenant Governor, serving as the Chief Job Creation Officer, and Cabinet offices, coordinate resources available through the Tobacco Commission, Virginia Economic Development Partnership, Departments of Mines, Minerals and Energy, Agriculture and Consumer Services, and Business Assistance to optimize growth of energy jobs across Virginia.
  - Implement Virginia Universities Clean Energy Development and Economic Stimulus Foundation.
  - Establish the Virginia Energy Initiative to bring together research capabilities of our major research universities under one canopy to help focus efforts on developing energy technologies for the 21st century.
  - Promote development of offshore oil and gas development as a source of VCERC research and development funding.
  - Support R&D for clean coal technologies and carbon sequestration.
  - Work with the Virginia Tobacco Commission, private sector energy leaders, community colleges, and our major research universities to establish Southside and Southwest Virginia as the nation's hub for traditional and alternative energy research and development.

APPENDIX – CODE OF VIRGINIA, TITLE 67, VIRGINIA ENERGY PLAN

Chapter 1 - Energy Policy of the Commonwealth

§ 67-100. Legislative findings.

The General Assembly hereby finds that:

1. Energy is essential to the health, safety, and welfare of the people of this Commonwealth and to the Commonwealth's economy;

2. The state government should facilitate the availability and delivery of reliable and adequate supplies of energy to industrial, commercial, and residential users at reasonable costs such that these users and the Commonwealth's economy are able to be productive; and

3. The Commonwealth would benefit from articulating clear objectives pertaining to energy issues, adopting an energy policy that advances these objectives, and establishing a procedure for measuring the implementation of these policies.

§ 67-101. Energy objectives.

The Commonwealth recognizes each of the following objectives pertaining to energy issues will advance the health, welfare, and safety of the residents of the Commonwealth:

1. Ensuring the availability of reliable energy at costs that are reasonable and in quantities that will support the Commonwealth's economy;

2. Managing the rate of consumption of existing energy resources in relation to economic growth;

3. Establishing sufficient supply and delivery infrastructure to maintain reliable energy availability in the event of a disruption occurring to a portion of the Commonwealth's energy matrix;

4. Using energy resources more efficiently;

5. Facilitating conservation;

6. Optimizing intrastate and interstate use of energy supply and delivery to maximize energy availability, reliability, and price opportunities to the benefit of all user classes and the Commonwealth's economy as stated in subdivision 2 of § 67-100;

7. Increasing Virginia's reliance on sources of energy that, compared to traditional energy resources, are less polluting of the Commonwealth's air and waters;

8. Researching the efficacy, cost, and benefits of reducing, avoiding, or sequestering the emissions of greenhouse gases produced in connection with the generation of energy;

9. Removing impediments to the use of abundant low-cost energy resources located within and outside the Commonwealth and ensuring the economic viability of the producers, especially those in the Commonwealth, of such resources;

10. Developing energy resources and facilities in a manner that does not impose a disproportionate adverse impact on economically disadvantaged or minority communities;

11. Recognizing the need to foster those economically developable alternative sources of energy that can be provided at market prices as vital components of a diversified portfolio of energy resources; and

12. Increasing Virginia's reliance on and production of sustainably produced biofuels made from traditional agricultural crops and other feedstocks, such as winter cover crops, warm season grasses, fast-growing trees, algae or other suitable feedstocks grown in the Commonwealth that will create jobs and income, produce clean-burning fuels that will help to improve air quality, and provide the new markets for Virginia's silvicultural and agricultural products needed to preserve farm employment, conserve farmland and forestland, and increase implementation of silvicultural and agricultural best management practices to protect water quality.

Nothing in this section shall be deemed to abrogate or modify in any way the provisions of the Virginia Electric Utility Regulation Act (§ 56-576 et seq.).

§ 67-102. Commonwealth Energy Policy.

A. To achieve the objectives enumerated in § 67-101, it shall be the policy of the Commonwealth to:

1. Support research and development of, and promote the use of, renewable energy sources;

2. Ensure that the combination of energy supplies and energy-saving systems are sufficient to support the demands of economic growth;

3. Promote research and development of clean coal technologies, including but not limited to integrated gasification combined cycle systems;

4. Promote cost-effective conservation of energy and fuel supplies;

5. Ensure the availability of affordable natural gas throughout the Commonwealth by expanding Virginia's natural gas distribution and transmission pipeline infrastructure; developing coalbed methane gas resources and methane hydrate resources; encouraging the productive use of landfill gas; and siting one or more liquefied natural gas terminals;

6. Promote the generation of electricity through technologies that do not contribute to greenhouse gases and global warming;

7. Facilitate the development of new, and the expansion of existing, petroleum refining facilities within the Commonwealth;

8. Promote the use of motor vehicles that utilize alternate fuels and are highly energy efficient;

9. Support efforts to reduce the demand for imported petroleum by developing alternative technologies, including but not limited to the production of synthetic and hydrogen-based fuels, and the infrastructure required for the widespread implementation of such technologies;

10. Promote the sustainable production and use of biofuels produced from silvicultural and agricultural crops grown in the Commonwealth, and support the delivery infrastructure needed for statewide distribution to consumers;

11. Ensure that development of new, or expansion of existing, energy resources or facilities does not have a disproportionate adverse impact on economically disadvantaged or minority communities; and

12. Ensure that energy generation and delivery systems that may be approved for development in the Commonwealth, including liquefied natural gas and related delivery and storage systems, should be located so as to minimize impacts to pristine natural areas and other significant onshore natural resources, and as near to compatible development as possible.

B. The elements of the policy set forth in subsection A shall be referred to collectively in this title as the Commonwealth Energy Policy.

C. All agencies and political subdivisions of the Commonwealth, in taking discretionary action with regard to energy issues, shall recognize the elements of the Commonwealth Energy Policy and where appropriate, shall act in a manner consistent therewith.

D. The Commonwealth Energy Policy is intended to provide guidance to the agencies and political subdivisions of the Commonwealth in taking discretionary action with regard to energy issues, and shall not be construed to amend, repeal, or override any contrary provision of applicable law. The failure or refusal of any person to recognize the elements of the Commonwealth Energy Policy, to act in a manner consistent with the Commonwealth Energy Policy, or to take any other action whatsoever, shall not create any right, action, or cause of action or provide standing for any person to challenge the action of the Commonwealth or any of its agencies or political subdivisions.

Chapter 2 - Virginia Energy Plan

§ 67-200. Definitions.

As used in this title:

"Division" means the Division of Energy of the Department of Mines, Minerals and Energy.

"Plan" means the Virginia Energy Plan prepared pursuant to this chapter, including any updates thereto.

§ 67-201. Development of the Virginia Energy Plan.

A. The Division, in consultation with the State Corporation Commission, the Department of Environmental Quality, and the Center for Coal and Energy Research, shall prepare a comprehensive Virginia Energy Plan covering a 10-year period. The Plan shall propose actions, consistent with the objectives enumerated in § 67-101, that will implement the Commonwealth Energy Policy set forth in § 67-102.

B. In addition, the Plan shall include:

1. Projections of energy consumption in the Commonwealth, including but not limited to the use of fuel sources and costs of electricity, natural gas, gasoline, coal, renewable resources, and other forms of energy resources used in the Commonwealth;

2. An analysis of the adequacy of electricity generation, transmission, and distribution resources in the Commonwealth for the natural gas and electric industries, and how regional generation, transmission, and distribution resources affect the Commonwealth;

3. An analysis of siting requirements for electric generation resources and natural gas and electric transmission and distribution resources;

4. An analysis of fuel diversity for electricity generation, recognizing the importance of flexibility in meeting future capacity needs;

5. An analysis of the efficient use of energy resources and conservation initiatives;

6. An analysis of how these Virginia-specific issues relate to regional initiatives to assure the adequacy of fuel production, generation, transmission, and distribution assets;

7. An analysis of siting of energy resource development, refining or transmission facilities to identify any disproportionate adverse impact of such activities on economically disadvantaged or minority communities; and

8. Recommendations, based on the analyses completed under subdivisions 1 through 7, for legislative, regulatory, and other public and private actions to implement the elements of the Commonwealth Energy Policy.

C. In preparing the Plan, the Division and other agencies involved in the planning process shall utilize state geographic information systems, to the extent deemed practicable, to assess how recommendations in the plan may affect pristine natural areas and other significant onshore natural resources.

D. In preparing the Plan, the Division and other agencies involved in the planning process shall develop a system for ascribing numerical scores to parcels of real property based on the extent to which the parcels are suitable for the siting of a wind energy facility or solar energy facility. For wind energy facilities, the scoring system shall address the wind velocity, sustained velocity, turbulence, proximity to electric power transmission systems, potential impacts to natural and historic resources and to economically disadvantaged or minority communities, and compatibility with the local land use plan. For solar energy facilities, the scoring system shall address the parcel's proximity to electric power transmission lines, potential impacts of such a facility to natural and historic resources and to economically disadvantaged or minority

communities, and compatibility with the local land use plan. The system developed pursuant to this section shall allow the suitability of the parcel for the siting of a wind energy facility or solar energy facility to be compared to the suitability of other parcels so scored, and shall be based on a scale that allows the suitability of the parcel for the siting of a such an energy facility to be measured against the hypothetical score of an ideal location for such a facility.

E. After July 1, 2007, upon receipt by the Division of a recommendation from the Department of General Services, a local governing body, or the parcel's owner that a parcel of real property is a potentially suitable location for a wind energy facility or solar energy facility, the Division shall analyze the suitability of the parcel for the location of such a facility. In conducting its analysis, the Division shall ascribe a numerical score to the parcel using the scoring system developed pursuant to subsection D.

§ 67-202. Schedule.

A. The Division shall complete the Plan by July 1, 2007.

B. Prior to completion of the Plan and updates thereof, the Division shall present drafts to, and consult with, the Coal and Energy Commission and the Commission on Electric Utility Regulation.

C. The Plan shall be updated by the Division and submitted as provided in § 67-203 by July 1, 2010, and every four years thereafter. Updated reports shall reassess goals for energy conservation based on progress to date in meeting the goals in the previous plan and lessons learned from attempts to meet such goals.

§ 67-202.1. Annual reporting by investor-owned public utilities.

Each investor-owned public utility providing electric service in the Commonwealth shall prepare an annual report disclosing its efforts to conserve energy, including but not limited to (i) its implementation of customer demand-side management programs and (ii) efforts by the utility to improve efficiency and conserve energy in its internal operations pursuant to § 56-235.1. The utility shall submit each annual report to the Division of Energy of the Department of Mines, Minerals and Energy by November 1 of each year, and the Division shall compile the reports of the utilities and submit the compilation to the Governor and the General Assembly as provided in the procedures of the Division of Legislative Automated Systems for the processing of legislative documents.

§ 67-203. Submission of Plan.

Upon completion, the Division shall submit the Plan, including periodic updates thereto, to the Governor, the Commissioners of the State Corporation Commission, and the General Assembly. The Plan shall be submitted as provided in the procedures of the Division of Legislative Automated Systems for the processing of legislative documents. The Plan's executive summary shall be posted on the General Assembly's website.