



CHMURA
Economics & Analytics

The Economic Impact of Dominion Capital Expenditure Projects

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Background

Dominion Resources, Inc. (Dominion) has planned many significant capital expenditure projects in Virginia in the next six years, from 2015 through 2020. Those projects (Table 1) are developed by two business units—Dominion Virginia Power (DVP) and Dominion Transmission, Inc. (DTI).

For Dominion Virginia Power, its projects include electric generation, electric transmission, and distribution, as well as environmental projects. As Table 1 shows, DVP's electric generation projects now underway or planned include those utilizing both fossil fuel and renewable sources such as solar and offshore wind. Its electric transmission and distribution projects are related to new transmission lines and the planned undergrounding of a significant part of its distribution networks. The environmental projects involve significant investment such as coal ash pond closures and other initiatives to comply with various EPA regulations. For Dominion Transmission, Inc., major projects include the Atlantic Coast Pipeline (ACP), as well as other non-ACP natural gas projects. Those Dominion projects represent total capital expenditure of \$11.7 billion from 2015 through 2020.¹

Table 1: Dominion Capital Expenditure (Total 2015-2020)

	Project	Amount (\$Million)
Dominion Virginia Power (DVP)		
Electric Generation	Brunswick Power Station	\$341.6
	Greenville Power Station	\$1,324.8
	Offshore Wind (VOWTAP)	\$378.7
	Nuclear (North Anna 3 Development Cost)	\$808.0
	Utility-Scale Solar	\$700.0
	Solar Partnership	\$43.0
Electric Transmission & Distribution	DVP Transmission	\$3,778.5
	DVP Undergrounding	\$1,000.0
Environmental Projects		\$727.1
Total DVP		\$9,101.7
Dominion Transmission, Inc. (DTI)		
	Atlantic Coast Pipeline (ACP)	\$2,378.4
	Non-ACP Projects	\$208.7
Total DTI		\$2,587.1
Total Dominion		\$11,688.8

Source: Dominion

Dominion contracted Chmura Economics & Analytics (Chmura) to conduct a study analyzing the economic impact of the above capital expenditure projects in Virginia from 2015 through 2020. Chmura

¹ Please see Appendix 1 for descriptions of those projects.

used the IMPLAN Pro® model to simulate the economic impact of these projects, for both the construction and ongoing operation phases. The direct, indirect, and induced impacts in spending and job creation were estimated.²

This report summarizes the economic impact of all Dominion capital expenditure projects, as well as the economic impact of projects for Dominion Virginia Power and Dominion Transmission, Inc.

Economic Impact of Dominion Capital Expenditure in Virginia

From 2015 through 2020, the total Dominion capital expenditure for the above projects was estimated to be \$11.7 billion in Virginia. This amount will be spent on a wide variety of products and services, including: land acquisition; construction of power stations, transmission lines, and natural gas pipelines; and installation of power generation and transmission equipment. There will also be soft costs—such as architecture, engineering, and other professional services.

Not every product and service necessary for the above projects is available in Virginia. Consequently, some of the capital expenditure for these projects will occur outside the state. Based on data from Dominion, it was estimated that \$5.7 billion of the total \$11.7 billion will be spent in Virginia.³

Table 2 details the estimated economic impact of Dominion's capital expenditure in the Commonwealth of Virginia. From 2015 to 2020, it was estimated that the construction activities of those projects will generate a total economic impact (including direct, indirect, and induced effects) of \$10.1 billion in Virginia, which can support 71,554 cumulative jobs.⁴ Of the total economic impact, \$5.7 billion will be direct spending by Dominion within the state, with cumulative direct jobs amounting to 38,367 from 2015 to 2020. The indirect impact in Virginia will total \$2.0 billion and support 14,138 cumulative jobs during the construction phase in industries serving construction. The induced impact in the state during the construction period is expected to be \$2.4 billion with 19,048 cumulative jobs concentrated in consumer service-related industries. On an annual average basis from 2015 to 2020, the total investment impact of Dominion's capital expenditure will be \$1.7 billion that can support 11,926 Virginia jobs.

² Direct impact is defined as the economic activity generated by the project under consideration. Indirect impact is secondary economic activity generated by the project due to suppliers to the development, construction, or ongoing operations. For a power generation plant, the induced impact is economic activity generated when the workers at the power station and their suppliers spend their income at retail stores, restaurants, and professional offices. Please see Appendix 1 for a glossary.

³ The \$5.7 billion does not include land cost.

⁴ Each cumulative job is defined as one job that lasts for one year. As a result, if one construction worker works on a project for 6 years, the number of cumulative jobs is 6, while the annual average number of job is 1.

Table 2: Economic Impact of Dominion Capital Expenditure in Virginia

		Direct	Indirect	Induced	Total
One-time Construction					
2015	Spending (\$Million)	\$777.1	\$266.9	\$311.8	\$1,355.8
	Employment	5,318	1,948	2,583	9,849
2016	Spending (\$Million)	\$1,309.2	\$454.3	\$537.6	\$2,301.1
	Employment	8,062	3,039	4,031	15,132
2017	Spending (\$Million)	\$1,400.4	\$490.6	\$590.8	\$2,481.9
	Employment	9,142	3,453	4,635	17,230
2018	Spending (\$Million)	\$1,015.8	\$349.6	\$429.2	\$1,794.6
	Employment	7,077	2,604	3,554	13,235
2019	Spending (\$Million)	\$619.9	\$208.3	\$254.1	\$1,082.4
	Employment	4,421	1,565	2,145	8,131
2020	Spending (\$Million)	\$616.6	\$207.1	\$252.1	\$1,075.8
	Employment	4,346	1,530	2,100	7,976
Total (2015-2020)	Spending (\$Million)	\$5,739.0	\$1,976.9	\$2,375.7	\$10,091.6
	Employment	38,367	14,138	19,048	71,554
Annual Average (2015-2020)	Spending (\$Million)	\$956.51	\$329.5	\$395.9	\$1,681.9
	Employment	6,395	2,356	3,175	11,926
Ongoing Operation					
Annual, 2021 Onward	Spending (\$Million)	\$146.0	\$40.1	\$26.0	\$212.1
	Employment	-388	262	208	82

Note: Impacts are measured in the year when they occur. Numbers may not sum due to rounding

Source: IMPLAN Pro 2013, Dominion, and Chmura

The ongoing economic impact of Dominion's capital expenditure was measured beginning the year 2021, when many of the projects listed in Table 1 will be in operation.⁵ For all Dominion projects' ongoing operations, the total annual economic impact (direct, indirect, and induced) was estimated to be \$212.1 million (measured in 2021 dollars), which can support 82 jobs in Virginia. This economic impact from the above projects is incremental to the impact generated by existing Dominion operations.⁶ The direct impact of the ongoing operations of all Dominion projects was estimated to have annual gross revenue of \$146.0 million. Permanent employment will be reduced by 388. The reason for the reduction is that for DVP's transmission projects, despite billions in capital expenditure, permanent employment of the department will be reduced by 551 in 2021 (compared to its 2014 level), which is more than the job increase resulting from DVP electricity generation and DTI projects. However, despite the net reduction in

⁵ Some of the projects will start operation before 2021. The ongoing operational impact of those projects was measured in 2021 dollars. The ongoing operations of projects that will not be in service in 2021 were not included in this study.

⁶ For many projects, such as environmental and distribution projects, the ongoing operation will be managed by existing employees. As a result, the incremental employment will be zero.

employment, overall operation expenses and revenue of the transmission department will rise, so the direct spending impact is positive.⁷ Similarly, the indirect and induced spending and employment impact is positive due to the fact that total revenue and payroll of the transmission department will expand in 2021, despite the reduction in direct employment.⁸ As a result, the indirect operational impact of all of Dominion's projects was estimated to be \$40.1 million and 262 jobs per year. The induced impact was estimated to be \$26.0 million, with associated jobs of 208 per year from 2021 onward.

Economic Impact of DVP Capital Expenditure in Virginia

From 2015 through 2020, total capital expenditure by Dominion Virginia Power was estimated to be \$9.1 billion. Based on data from Dominion, it was estimated that \$4.7 billion of total capital expenditure will be spent in Virginia.

Table 3 details the estimated economic impact of DVP capital expenditure in the Commonwealth of Virginia. From 2015 to 2020, it was estimated that construction activities of the DVP projects will generate a total economic impact (including direct, indirect, and induced effects) of \$8.2 billion in Virginia, which can support 59,555 cumulative jobs. Of the total economic impact, \$4.7 billion will be direct spending by DVP within the state, with cumulative direct jobs amounting to 32,244 from 2015 to 2020. The indirect impact in Virginia will total \$1.6 billion and support 11,613 cumulative jobs during the construction phase in industries supporting construction. The induced impact in the state during the construction period is expected to be \$1.9 billion with 15,698 cumulative jobs concentrated in consumer service-related industries. On an annual average basis from 2015 to 2020, the total investment impact of DVP's capital expenditure will be \$1.4 billion that can support 9,926 Virginia jobs.

The economic impact of ongoing operations of the DVP projects was measured beginning the year 2021, when many of the projects listed in Table 1 will be in operation. The total annual economic impact (direct, indirect, and induced) of all ongoing operations of DVP's projects was estimated to be \$169.5 million (measured in 2021 dollars). The direct impact was estimated to have annual gross revenue of \$120.7 million. Permanent employment will be reduced by 431 due to job reductions at DVP's transmission department. The indirect impact was estimated to be \$32.4 million and 238 jobs per year, while the induced impact was estimated to be \$16.4 million, with associated jobs of 172 per year from 2021 onward.

⁷ This can be achieved by the increase in employee productivity. The business can reach increased sales (revenue) with fewer employees.

⁸ Source: Dominion.

Table 3: Economic Impact of DVP Capital Expenditure in Virginia (2015-2020)

		Direct	Indirect	Induced	Total
One-time Construction					
2015	Spending (\$Million)	\$741.0	\$253.8	\$295.9	\$1,290.7
	Employment	5,102	1,858	2,465	9,426
2016	Spending (\$Million)	\$1,053.1	\$360.5	\$422.4	\$1,835.9
	Employment	6,522	2,403	3,188	12,114
2017	Spending (\$Million)	\$916.5	\$312.6	\$371.5	\$1,600.5
	Employment	6,268	2,268	3,063	11,599
2018	Spending (\$Million)	\$769.5	\$258.9	\$317.5	\$1,345.9
	Employment	5,640	2,011	2,768	10,419
2019	Spending (\$Million)	\$610.1	\$204.7	\$249.6	\$1,064.5
	Employment	4,365	1,542	2,114	8,021
2020	Spending (\$Million)	\$616.6	\$207.1	\$252.1	\$1,075.8
	Employment	4,346	1,530	2,100	7,976
Total (2015-2020)	Spending (\$Million)	\$4,706.8	\$1,597.6	\$1,909.0	\$8,213.4
	Employment	32,244	11,613	15,698	59,555
Annual Average (2015-2020)	Spending (\$Million)	\$784.46	\$266.3	\$318.2	\$1,368.9
	Employment	5,374	1,935	2,616	9,926
Ongoing Operation					
Annual, 2021 Onward	Spending (\$Million)	\$120.7	\$32.4	\$16.4	\$169.5
	Employment	-431	238	172	-21

Note: Impacts are measured in the year when they occur. Numbers may not sum due to rounding

Source: IMPLAN Pro 2013, Dominion, and Chmura

Economic Impact of DTI Capital Expenditure in Virginia

From 2015 through 2020, total capital expenditure for Dominion Transmission, Inc. projects in Virginia was estimated to be \$2.6 billion.⁹ Based on data from Dominion, it was estimated that \$1.0 billion of the total \$2.6 billion in capital expenditure will be spent in Virginia.

Table 4 presents the estimated economic impact of DTI capital expenditure in the Commonwealth of Virginia. From 2015 to 2020, it was estimated that construction activities of the DTI projects will generate a total economic impact (including direct, indirect, and induced effects) of \$1.9 billion in Virginia, which can support 11,999 cumulative jobs. Of the total economic impact, \$1.0 billion will be direct spending by DTI within the state, with cumulative direct jobs amounting to 6,124 from 2015 to 2020. The indirect impact in Virginia will total \$379.3 million and support 2,525 cumulative jobs during the construction phase in

⁹ For example, the Atlantic Coast Pipeline project's capital expenditure amounts in West Virginia and North Carolina are not included in this figure.

industries serving construction. The induced impact in the state during the construction period is expected to be \$466.7 million with 3,350 cumulative jobs concentrated in consumer service-related industries. On an annual average basis from 2015 to 2020, the total investment impact of Dominion capital expenditure will be \$313.0 million that can support 2,000 Virginia jobs.

Table 4: Economic Impact of DTI Capital Expenditure in Virginia (2015-2020)

		Direct	Indirect	Induced	Total
One-time Construction					
2015	Spending (\$Million)	\$36.2	\$13.1	\$15.9	\$65.1
	Employment	216	90	118	424
2016	Spending (\$Million)	\$256.1	\$93.9	\$115.3	\$465.2
	Employment	1,540	636	843	3,018
2017	Spending (\$Million)	\$484.0	\$178.0	\$219.3	\$881.3
	Employment	2,874	1,185	1,572	5,631
2018	Spending (\$Million)	\$246.2	\$90.6	\$111.7	\$448.6
	Employment	1,438	592	786	2,817
2019	Spending (\$Million)	\$9.8	\$3.6	\$4.4	\$17.9
	Employment	56	23	31	110
2020	Spending (\$Million)	\$0.0	\$0.0	\$0.0	\$0.0
	Employment	0	0	0	0
Total (2015-2020)	Spending (\$Million)	\$1,032.3	\$379.3	\$466.7	\$1,878.2
	Employment	6,124	2,525	3,350	11,999
Annual Average (2015-2020)	Spending (\$Million)	\$172.0	\$63.2	\$77.8	\$313.0
	Employment	1,021	421	558	2,000
Ongoing Operation					
Annual, 2021 Onward	Spending (\$Million)	\$25.3	\$7.7	\$9.6	\$42.6
	Employment	43	23	36	103

Note: Impacts are measured in the year when they occur. Numbers may not sum due to rounding

Source: IMPLAN Pro 2013, Dominion, and Chmura

The ongoing economic impact of DTI capital expenditure was measured beginning the year 2021, when the Atlantic Coast Pipeline and other non-ACP projects will be in operation. The total annual economic impact (direct, indirect, and induced) of the ongoing operation of DTI's projects was estimated to be \$42.6 million (measured in 2021 dollars) which can support 103 total jobs in Virginia. In terms of direct impact, the DTI projects were estimated to have annual gross revenue of \$25.3 million and employ 43 new permanent workers. The indirect impact was estimated to be \$7.7 million and 23 jobs per year. The induced impact was estimated to be \$9.6 million, with associated jobs of 36 per year from 2021 onward.

Appendix 1: Description of Dominion Projects in Virginia

Dominion Virginia Power (DVP)

Electric Generation

Brunswick Power Station

Brunswick Power Station is a natural gas-powered electric generating facility now under construction near Lawrenceville in Brunswick County. When operational, it will have a generating capacity of approximately 1,358 megawatts using combined-cycle technology and be capable of meeting the peak electrical needs of approximately 340,000 typical homes. The State Corporation Commission (SCC) approved construction of the project in an order issued in August 2013. The station is expected to begin commercial operation in the summer of 2016.

Greensville Power Station

Dominion Virginia Power has proposed constructing the Greensville Power Station, a natural-gas fired facility with a generating capacity of approximately 1,600 megawatts. To be built on a site in Greensville County, the station would use energy-efficient combined-cycle technology, consisting of three gas-fired combustion turbines and a steam turbine, and would produce enough power to meet the peak electrical demands of approximately 400,000 typical homes. The company submitted its application to build the project to the State Corporation Commission (SCC) in July 2015. Subject to SCC and environmental approvals, construction is scheduled to begin in mid-2016.

Offshore Wind (VOWTAP)

Dominion Virginia Power leads a consortium of private companies and government agencies that will develop the Virginia Offshore Wind Technology Advancement Project (VOWTAP) to test offshore wind generation. The project will be located approximately 27 miles off the coast of Virginia Beach. Dominion has received \$51 million in grants from the U.S. Department of Energy to support VOWTAP, which would consist of two 6-megawatt wind turbines connected to the onshore grid by underwater cable. Other members of the consortium include Alstom Power, Inc.; KBR; Virginia Department of Mines, Minerals and Energy; National Renewable Energy Laboratory; Virginia Tech Advanced Research Institute; Newport News Shipbuilding; and Tetra Tech. The company's 2015 Integrated Resource Plan projects an in-service date of 2019 for VOWTAP. Dominion Virginia Power is currently working with stakeholders to explore ways to support the continued development of the project.

Nuclear (North Anna 3 Development Cost)

Dominion Virginia Power is evaluating development of a third nuclear reactor at North Anna Power Station (North Anna 3) in Louisa County. The technology selected for North Anna 3 is the General Electric-Hitachi Economic Simplified Boiling Water Reactor (ESBWR). The company expects to receive a Combined Operating License (COL) for the facility from the U.S. Nuclear Regulatory Commission in 2017. Dominion Virginia Power emphasizes that it has not committed to building North Anna 3 and will make no final decision until after the issuance of the COL. However, the company recognizes for planning

purposes that the emissions-free characteristics of nuclear generation will be important considerations as the carbon-dioxide emissions reduction mandates of the U.S. Environmental Agency's Clean Power Plan are implemented. According to the company's 2015 Integrated Resource Plan, the earliest possible in-service date for the 1,453-megawatt reactor would be September 2027.

Utility-Scale Solar

Dominion Virginia Power announced plans in February 2015 to develop multiple large-scale solar projects totaling 400 megawatts of electricity in Virginia by 2020. Together, these solar facilities are anticipated to be capable of generating enough electricity at peak capacity to power 100,000 homes.

Solar Partnership Program

Under the Solar Partnership Program, Dominion Virginia Power constructs and operates small-scale solar facilities on leased rooftops or grounds of commercial businesses or public properties. Individual installations can generate up to 2 megawatts of electricity. The program is designed to study the benefits and impacts of solar distributed generation targeted electric distribution circuits.

Electric Transmission and Distribution

DVP Transmission

Dominion Virginia Power operates more than 6,400 miles of high-voltage electric transmission lines operating at voltages ranging from 69 kilovolts to 500 kilovolts. The company is engaged in a significant, long-term program to strengthen its transmission system, interconnect new electric generating units, expand the system to meet the needs of a growing customer base, and replace aging infrastructure. In addition to new construction, the company is undertaking projects to improve both the physical and cyber-security of its transmission assets. Capital investment in the transmission system is expected to approach \$3.8 billion in Virginia during the 2015-2020 period.

DVP Undergrounding

Dominion Virginia Power's Strategic Underground Program is the company's initiative aimed at improving service reliability by converting a significant part of its overhead electric distribution system to underground service. Using a data-driven process, the company is analyzing the 10-year outage history of tap lines that carry electricity to homes and neighborhoods to determine the segments most vulnerable to damage from wind, limbs, trees, and other hazards, particularly during severe weather events. Over more than a decade, the company plans to place as many as 4,000 miles of these vulnerable tap lines underground, improving local circuit reliability and significantly reducing the time needed to restore power to all customers after major events such as storms and hurricanes. To-date, the company has converted to underground service approximately 200 miles of overhead tap lines.

Environmental Projects

Dominion Virginia Power is planning a variety of environmental improvements at its power stations to meet new federal regulations, including those for the storage of coal combustion residuals; control of effluents that could impact surface and groundwater; and regulation of station cooling water intakes.

The company also faces increasingly strict federal air quality regulations and is responding through improvements such as the scheduled installation of equipment to reduce nitrogen oxide emissions from its Possum Point Power Station in Prince William County.

Dominion Transmission, Inc. (DTI)

Atlantic Coast Pipeline

Dominion Transmission, Inc. will construct and operate a major interstate natural gas transportation facility, the Atlantic Coast Pipeline, for a group of four regional energy companies (Atlantic Coast Pipeline, LLC) consisting of Dominion, Duke Energy, AGL Resources (parent of Virginia Natural Gas) and Piedmont Natural Gas. The 564-mile project will provide greatly improved access for Virginia and North Carolina to the expanding natural gas production in the Appalachian basin. In addition to serving commercial and residential natural gas customers, much of the fuel transported through the project will be used for electric generation. About 280 miles of the pipeline will run through western, central and southern Virginia, including a 79-mile extension carrying natural gas east to the Hampton Roads area. Atlantic Coast Pipeline, LLC, filed its application for approval of the project with the Federal Energy Regulatory Commission (FERC) on September 18, 2015. Pending needed regulatory and environmental approvals, construction is expected to begin in the second half of 2016 with the pipeline in service during the fourth quarter of 2018.

Non-ACP Projects

Dominion Transmission, Inc. also owns and operates other interstate natural gas transmission assets in Virginia. Planned improvements in this system are scheduled during the 2015-2020 period, primarily compressor station upgrades.

Appendix 2: Impact Analysis Glossary

IMPLAN Professional—an economic impact assessment modeling system. It allows the user to build economic models to estimate the impacts of economic changes in states, counties, or communities. It was created in the 1970s by the Forestry Service and is widely used by economists to estimate the impact of specific events on the overall economy.

Input-Output Analysis—an examination of business-business and business-consumer economic relationships capturing all monetary transactions in a given period, allowing one to calculate the effects of a change in an economic activity on the entire economy (impact analysis).

Direct Impact—economic activity generated by a project or operation. For construction, this represents activity of the contractor; for operations, this represents activity by tenants of the property.

Overhead—construction inputs not provided by the contractor.

Indirect Impact—secondary economic activity that is generated by a project or operation. An example might be a new office building generating demand for parking garages.

Induced (Household) Impact—economic activity generated by household income resulting from direct and indirect impacts.

Ripple Effect—the sum of induced and indirect impacts. In some projects, it is more appropriate to report ripple effects than indirect and induced impacts separately.

Multiplier—the cumulative impacts of a unit change in economic activity on the entire economy.