REPORT OF THE
STATE CORPORATION COMMISSION

Sixth Annual Report on the Pilot Program to Place Certain Transmission Lines Underground

TO THE GOVERNOR,
THE COMMISSION ON ELECTRIC UTILITY REGULATION, AND THE JOINT COMMISSION ON TECHNOLOGY AND SCIENCE

COMMONWEALTH OF VIRGINIA
RICHMOND
2013

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STATE CORPORATION COMMISSION

December 1, 2013

TO: The Honorable Robert F. McDonnell, Governor of Virginia
Commission on Electric Utility Regulation
Joint Commission on Technology and Science

The State Corporation Commission is pleased to submit its sixth annual report regarding progress on the pilot program to construct qualifying electric transmission lines underground, as required by Chapter 799 of the 2008 Acts of Assembly (House Bill 1319), as amended.

Respectfully submitted,

James C. Dimitri
Chairman

Mark C. Christie
Commissioner

Judith Williams Jagdmann
Commissioner

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GLOSSARY OF TERMS

APCo	Appalachian Power Company
CEUR	Commission on Electric Utility Restructuring
CPCN	certificate of public convenience and necessity
certificate	certificate of public convenience and necessity
Code	Code of Virginia
Commission	State Corporation Commission
DVP	Dominion Virginia Power
Delmarva	Delmarva Power & Light Company
FERC	Federal Energy Regulatory Commission
General Assembly	Virginia General Assembly
Staff Guidelines	Commission's Staff Guidelines of Minimum Requirements for Transmission Line Applications Filed Under Code § 56-46.1 and the Utility Facilities Act
HB 1319	House Bill 1319
HPFF	high-pressure fluid-filled cable technology
JCOTS	Joint Commission on Technology and Science
kV	kilovolts
OH	overhead transmission lines
Option 1	preferred underground alternative using two transmission circuits
Option 2	underground alternative using one transmission circuit
SCC	State Corporation Commission
Staff	Commission Staff
UG	underground transmission lines
W&OD	Washington and Old Dominion Trail
XLPE	cross-linked polyethylene solid dielectric cable

EXECUTIVE SUMMARY

House Bill 1319[1] ("HB 1319") of the 2008 Regular Session of the Virginia General Assembly ("General Assembly"), as amended[2] (the "Act"), collectively established a pilot program to construct four qualifying electrical transmission lines of 230 kilovolts ("kV") or less in whole or in part underground.[3] Among other provisions, the Act established the criteria necessary for certain transmission line projects to qualify for the pilot program. In addition, the Act directed the Commission to "report annually to the Commission on Electric Utility Restructuring,[4] the Joint Commission on Technology and Science, and the Governor on the progress of the pilot program by not later than December 1 of each year that this Act is in effect."

As of the date of this report, the Commission has approved three of Dominion Virginia Power's ("DVP") 230 kV transmission line projects for inclusion in the pilot program pursuant to the Act: (1) a two-mile segment of the Pleasant View–Hamilton transmission line in Loudoun County previously approved as an overhead line; (2) the 0.71-mile Beaumeade–NIVO transmission line in Loudoun County; and (3) the 3.7-mile Radnor Heights Project in Arlington County.[5] One more qualified transmission line of 230 kV or less may be approved for inclusion in the pilot program from utility applications submitted before July 1, 2014.

As required by the Act, the Commission will file a final report no later than December 1, 2014. The final report will include an analysis of the entire pilot program and make recommendations about the continued placement of transmission lines underground in the Commonwealth of Virginia, as required by the Act.

Although the primary focus of this report is the pilot program relative to the Act, the report also will address two experimental underground transmission line projects not directly encompassed by the Act,[6,7] both of which were approved by the Commission prior to enactment of the Act. The Commission believes that all relevant experience gained from these two experimental projects should be considered in conjunction with the projects under the Act for making recommendations about the placement of transmission lines underground in the Commonwealth of Virginia.

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[1] 2008 Va. Acts ch. 799 (*see* Appendix A).

[2] 2011 Va. Acts ch. 244 (extending the program for two years) (*see* Appendix A).

[3] The Act specified one qualifying project and directed the State Corporation Commission ("SCC" or "Commission") to approve three additional qualifying projects.

[4] The Commission on Electric Utility Restructuring, established pursuant to Chapter 885 of the 2003 Acts of Assembly, was continued, effective July 1, 2008, as the Commission on Electric Utility Regulation (Va. Code § 30-201).

[5] Appendix B provides the pilot status of all transmission line applications (230 kV or less) filed since the effective date of the Act, including those that did not qualify for the pilot program.

[6] The Commission approved the two experimental 230 kV underground projects to enable DVP to gain experience with cross-linked polyethylene ("XLPE") solid dielectric cable. These two experimental projects include the 2200-foot Clarendon-Ballston project in Arlington County and the 5.5-mile Garrisonville project in Stafford County (see Appendix C for additional details).

[7] To date, the Commission has approved approximately 39 miles of 230 kV transmission lines for underground construction that employ high-pressure fluid-filled ("HPFF") cable technology. These underground lines are located in various areas of DVP's service territory, including Alexandria, Arlington, Fairfax, Norfolk, and underneath the York River. In most cases the lines were located underground in highly congested urban areas because overhead construction was not feasible.

I. BACKGROUND AND INTRODUCTION

A. Historical Background

The placement of electric transmission lines has long been a topic of intense public interest. While the vast majority of transmission lines in the United States have been constructed overhead, a small portion of such lines have been located underground, including in Virginia. In recent years, the feasibility of placing more lines underground has been a topic of interest within the General Assembly. In 2005, the Joint Commission on Technology and Science ("JCOTS")[8] first began to study the technological feasibility of burying transmission lines. In 2007 JCOTS created the Underground Transmission Lines Advisory Committee to produce a policy statement with possible legislative implications for 2008. As a result of their deliberations, JCOTS and its Transmission Lines Advisory Committee developed an outline for proposed legislation for a pilot program to study the construction of underground transmission lines.

B. Legislation Establishing the Pilot Program

By legislation enacted in 2008 and amended in 2011,[9] the General Assembly established a pilot program to construct four qualifying electrical transmission lines of 230 kV or less, in whole or in part, underground. The Act directs the SCC to "report annually to the CEUR, the Joint Commission on Technology and Science, and the Governor on the progress of the pilot program by no later than December 1 of each year that this [A]ct is in effect." In addition, the Act now states that the SCC "shall submit a final report to the CEUR, the Joint Commission on Technology and Science, and the Governor no later than December 1, 2014, analyzing the entire program and making recommendations about the continued placement of transmission lines underground in the Commonwealth."

Specifically, the Act directs the SCC to approve as a qualifying project, and part of the pilot program, an approximately 1.8-mile section of DVP's Pleasant View–Hamilton transmission line, which had been granted a certificate of public convenience and necessity ("certificate" or "CPCN") for overhead construction by the SCC prior to the effective date of the Act, and to approve three additional qualifying projects from among "applications submitted by public utilities for certificates of public convenience and necessity for the construction of electrical transmission lines of 230 kilovolts or less filed between April 2, 2008, and July 1, 2014." For purposes of the Act, a project is qualified to be placed underground, in whole or in part, if it meets the following criteria:

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[8] The JCOTS was created by the 1997 Virginia General Assembly as a permanent legislative commission to generally study all aspects of technology and science. Each year, the JCOTS identifies technological issues of interest, develops a work plan, and creates advisory committees to study those issues. Once the studies have been concluded, advisory committees issue their final reports and recommendations, including legislative proposals.

[9] 2008 Va. Acts ch. 799; 2011 Va. Acts ch. 244 (extending the program for two years) (*see* Appendix A).

1. An engineering analysis demonstrates that it is technically feasible to place the proposed line, in whole or in part, underground;

2. The estimated additional cost of placing the proposed line, in whole or in part, underground does not exceed 2.5 times the cost of placing the same line overhead, assuming accepted industry standards for undergrounding to ensure safety and reliability. If the public utility, the affected localities, and the State Corporation Commission agree, a proposed underground line whose cost exceeds 2.5 times the cost of placing the line overhead may also be accepted into the pilot program; and

3. The governing body of each locality in which a portion of the proposed line will be placed underground indicates, by resolution, general community support for the line to be placed underground.

The Act also includes language relative to (1) a presumption of need for lines that will complete a network for qualifying underground projects that provide only radial service, (2) lines that would need to be completed within a specific amount of time to facilitate an economic development agreement, (3) qualifying projects chosen pursuant to the Act but not fully recoverable as charges for new transmission facilities pursuant to § 56-585.1 A 4 of the Code of Virginia ("Code"), (4) the placement of existing or future overhead facilities in the same area or corridor as a pilot project, (5) a requirement that utilities must seek low-cost and effective means to improve the aesthetics of new overhead transmission lines and towers, and (6) the necessary documentation required in the event four applications meeting the requirements of the Act are not submitted to the SCC.

II. PILOT PROJECT SELECTION PROCESS

A. Scope of SCC's Legislative Responsibilities

The General Assembly, through the legislative process, imparts certain responsibilities upon the SCC relative to the regulation of electric utility companies, including the certification of proposed electric transmission lines. The Commission's authority and responsibility with regard to the construction of transmission lines is established by Title 56 of the Code, primarily by §§ 56-265.2[10] and 56-46.1. Specifically, § 56-265.2 of the Code requires public utilities to obtain certificates from the Commission in order to construct facilities for use in public utility service.[11] Section 56-46.1 of the Code establishes certain procedural requirements and identifies specific factors to be considered in the approval process. Additionally, the Commission is authorized to issue its own rules and regulations to facilitate the implementation

[10] Section 56-265.2 is part of the Utilities Facilities Act, § 56-265.1 *et seq.* of the Code.

[11] This requirement is applicable to transmission lines not considered ordinary extensions or improvements in the usual course of business, including all transmission lines capable of carrying 138 kV.

of its statutory responsibilities. Furthermore, pursuant to the Act (and as noted above), the Commission was directed to select a number of qualifying transmission lines to be placed underground as part of the pilot program established by the Act.

B. Synopsis of the Transmission Line Application and Certification Process

A utility's application for a certificate to construct and operate a transmission line typically includes supporting written testimony for the certificate and a map and sketch of the applicant's preferred route, as well as other alternative routes that have been considered. Each application also includes other information in accordance with the Commission's Staff Guidelines of Minimum Requirements for Transmission Line Applications Filed Under Virginia Code Section 56-46.1 and the Utility Facilities Act ("Staff Guidelines"). The Staff Guidelines direct that the applicant address four major categories: (1) the necessity for the proposed project, including estimated cost; (2) a description of the proposed project and alternatives considered; (3) the impact of the line on scenic, environmental, and historic features, including impacts on residences and businesses; and (4) the health aspects associated with the electric and magnetic fields that will be generated by the proposed line.

Typically, after an application is filed, the Commission Staff ("Staff") reviews the application for general content, and the Commission enters an order for notice and hearing that usually provides for a Hearing Examiner to consider the case. Subsequently, any respondents may file testimony, the Staff develops a report or testimony on the application, and a formal regulatory proceeding ensues in accordance with the SCC's Rules of Practice and Procedure.[12] After a hearing including an opportunity for public comment and development of the evidentiary record, the Hearing Examiner enters a report summarizing the evidentiary record and making recommendations on the application to the Commission. The applicant, respondents, and the Staff may file comments on the Hearing Examiner's report. Then, after reviewing the case, the Commission makes a decision and issues a final order and, if the proposed transmission line is approved, a certificate for the line and route is issued.

C. Outline of Pilot Project Selection Process

In accordance with the Act and in addition to reviewing an application for general content, need and routing, the Staff analyzes the potential for any proposed transmission line of 230 kV or less to be constructed underground and included in the pilot program. As part of this determination, the Staff may request additional technical and cost analyses not already included in the utility's application. In its report on the application, the Staff will comment on whether or not the proposed transmission line potentially meets the criteria to be a qualified project in accordance with § 4 of the Act and will recommend for or against inclusion of the transmission line in the pilot program. After the hearing, the Hearing Examiner will enter a report summarizing the evidentiary record and making findings and recommendations to the Commission, including recommending for or against inclusion of the line in the pilot program. Finally, if the proposed transmission line is granted a CPCN, the Commission also will decide for or against inclusion of the line in the pilot program.

[12] 5 VAC 5-20-10 *et seq.*

III. PILOT PROGRAM PROGRESS

A. Introduction

As previously stated, the Act established a pilot program to construct four qualifying electrical transmission lines of 230 kV or less in whole or in part underground. For the first pilot project, the Act directed the SCC to approve an approximately 1.8-mile section of DVP's Pleasant View–Hamilton 230 kV transmission line, which originally had been granted a CPCN for overhead construction by the SCC prior to the effective date of the Act. In addition, the Act directed the SCC to approve three other qualifying projects from among applications submitted by public utilities for the construction of electrical transmission lines of 230 kV or less filed between the effective date of the Act and July 1, 2014.

From the effective date of the Act through November 1, 2013, the SCC received 26 applications from public utilities for CPCNs for the construction of electrical transmission lines of 230 kV or less. Delmarva Power & Light Company ("Delmarva") submitted one application and Appalachian Power Company ("APCo") submitted seven applications for 138 kV overhead transmission lines. DVP submitted 14 applications for overhead transmission lines, one application for an overhead/underground hybrid, and three applications for 230 kV underground transmission lines, one of which, in accordance with the Act, was for a portion of a transmission line previously approved by the SCC as an overhead line. Brief summaries of the three transmission line applications approved for the pilot program are provided below. The pilot status of all transmission line applications (230 kV or less) filed since the effective date of the Act, including those that did not qualify for the pilot program, are provided in Appendix B.

B. Transmission Lines Approved for the Pilot Program

From the effective date of the Act through November 1, 2013, DVP filed three applications for approval and issuance of CPCNs to construct and operate the following 230 kV transmission lines as pilot projects pursuant to the Act:

- DVP Pleasant View–Hamilton Project: 2-mile underground segment, 230 kV XLPE[13] cable, mostly on the Washington and Old Dominion Trail ("W&OD Trail") in Loudoun County (Case Number PUE-2005-00018, modified by Case Numbers PUE-2008-00027 and PUE-2008-00042). The Commission approved the request in accordance with the Act on May 28, 2008. The transmission line was energized in October 2010.

- DVP Beaumeade–NIVO Project: 0.71-mile, 230 kV XLPE underground transmission cable in Loudoun County. DVP requested the line be included as a pilot project, and the Loudoun County Board of Supervisors approved a resolution on September 2, 2008, indicating general community support for the line to be placed underground. The Commission approved the request in accordance with the Act on

[13] Although the dominant underground transmission line technology in the United States for decades has been HPFF pipe, XLPE is considered by some as an emerging technology that is gaining in popularity and use at certain voltages. XLPE cable often is referred to as "extruded" cable because of the method used to apply the solid polyethylene insulation to the electrical conductor. Cost is often noted as an advantage of XLPE over HPFF.

January 26, 2009 (Case Number PUE-2008-00063).[14] The line was energized in July 2010.

- DVP Radnor Heights Project: 3.7-mile, 230 kV XLPE/HPFF hybrid underground transmission line in Arlington County. DVP requested the line be included as a pilot project, and the Arlington County Board approved a resolution on July 10, 2010, indicating general community support for the line to be placed underground. The Commission approved the request in accordance with the Act on July 21, 2010 (PUE-2010-00004). The 2.6-mile, HPFF section was energized on February 6, 2013. The 1.1-mile XLPE section is scheduled to be energized by December 31, 2013. The transmission line's target in-service date is June 1, 2014.

Summaries of two other experimental underground transmission projects, approved separately from the Act, are provided in Appendix C.

C. Related Developments

In March 2010, Old Dominion Electric Cooperative and North Carolina Electric Membership Corporation (later joined by several other cooperatives) filed a complaint at the Federal Energy Regulatory Commission ("FERC") against DVP, alleging, among other issues, that it was improper to include the costs of constructing certain facilities underground, including projects built as pilot projects pursuant to the Act, because the facilities were placed underground for aesthetic reasons and not for reliability purposes. In September 2012, the parties submitted briefs to FERC regarding whether the incremental undergrounding costs should be included in the FERC rate or be borne entirely by DVP's retail customers. The treatment of such costs will be determined by FERC. The parties negotiated a settlement for the remaining issues.

IV. CONCLUSIONS

The SCC has regulated a pilot program to construct four qualifying electrical transmission lines of 230 kV or less, in whole or in part, underground as required by the Act. This report primarily addresses the status of 26 transmission lines that either have been or are being evaluated for inclusion in the pilot program. The 26 transmission lines are identified in Appendix B.

[14] The SCC hearing convened on January 26, 2009, and the Commission issued its Final Order on May 29, 2009. In its Final Order, the Commission noted that if the cost to ratepayers was the overriding concern in this proceeding, the proposed transmission line would be constructed overhead at a total cost of $7.9 million. However, DVP proposed to install the line as an underground pilot project pursuant to HB 1319. The Staff examined the proposed project under HB 1319 and recommended that the project might qualify as a pilot project and that it would provide DVP with additional experience regarding use of XLPE cable. The Hearing Examiner concluded that (1) it is technically feasible to construct the line underground; (2) the cost of installing the underground line is 1.3 times the cost of installing an overhead line; and (3) the governing body of Loudoun County has expressed its support for undergrounding the line. The Commission agreed with the Hearing Examiner that DVP's proposal complied with the requirements of HB 1319 and approved construction of the line underground as a pilot project.

As of the date of this report, three transmission lines have been approved for inclusion in the pilot program, two of which have been completed. As required by the Act, one more qualified transmission line may be approved for inclusion in the pilot program by 2014. Separate from the Act, the Commission also has approved the construction of two other experimental underground transmission line projects, both of which have been completed.

Experience gained from the analysis and construction of these projects will provide insight for evaluating the potential efficacy of placing transmission lines underground. Although construction of one of these projects is incomplete, it appears at this stage that underground construction costs may be highly variable and project dependent, particularly with respect to topography and soil conditions.

A summary of the estimated costs for these experimental and pilot projects, as well as comparisons with overhead cost estimates, is provided in Table 1.

As provided by the Act, the Commission will file a final report no later than December 1, 2014. The final report will include an analysis of the entire pilot program and make recommendations about the continued placement of transmission lines underground in the Commonwealth.[15]

[15] The 2010 Virginia General Assembly enacted legislation addressing the undergrounding of transmission lines. *See* Chapter 392 of the 2010 Acts of Assembly for amendments to § 15.2-2404 F of the Code concerning localities' imposition of taxes related to underground transmission lines.

Table 1. Costs for Experimental and Pilot Underground ("UG") Transmission Projects and Comparisons with Overhead ("OH") Estimates

Project	Length (miles)	Estimated OH Cost		Actual or Estimated UG or Hybrid Cost		Ratio of UG to OH Costs
		Project	Line Mileage	Project	Line Mileage	Mileage Basis
Pilot Program for Underground Transmission Projects Pursuant to the Act						
Pleasant View–Hamilton	10 OH/ 2 UG	$69.6 million	$7 million per mile	$90.4 million (57.5 OH + 32.9 UG)(actual)	$12.1 million per mile (UG section)	1.7
Beaumeade–NIVO	0.71	$7.9 million	$4.2 million per mile	$9.8 million (actual)	$6.9 million per mile	1.6
Radnor Heights	6.3	$280 million	$39 million per mile	$81 million (est.)	$8.3 million per mile	<1
Experimental Underground Projects Unrelated to the Pilot Program						
Clarendon–Ballston	0.42	N/A	N/A	$24.9 million (actual)	$14.7 million per mile	N/A
Garrisonville	11	$14.16 million	$0.9 million per mile	$137.6 million (actual)	$10.8 million per mile	12

Table 1 Notes:

1. Total project costs include transmission work at substations, transition station costs for hybrid lines, and land acquisition costs (if applicable). Project costs do not include distribution work at substations.
2. Line mileage costs do not include transition stations or transmission work at substations, which could distort the mileage cost for short underground segments. DVP estimates the cost per mile for Pleasant View-Hamilton would have been $2 million higher but for the fact that DVP already owned the land on the W&OD Trail.
3. The OH estimate for Garrisonville assumes $10 million (2006) for overhead line construction and $4.76 million to construct the Garrisonville switching station. DVP reportedly indicated a willingness to mitigate visual impacts by using galvanized steel monopoles and routing the line down the center of the right-of-way, which would have changed the original estimate submitted with the application for the line from $9.4 million to $10 million (Hearing Examiner's Report, PUE-2006-00091 at 50).
4. The OH estimate for Radnor Heights is high due to the densely developed, urban nature of the area, which contains numerous national monuments and historic resources.
5. DVP did not analyze an overhead option for Clarendon–Ballston.
6. The breakdown of estimated underground project costs is provided as follows:
   (a) Pleasant View–Hamilton: $32.9 million; total includes $5.4 million for transmission work at Hamilton Substation and $3.3 million for terminal stations and land;
   (b) Beaumeade–NIVO: $9.8 million; total includes $4.9 million in substation transmission work;
   (c) Radnor Heights: $81 million; total includes $28.6 million in substation transmission work;
   (d) Clarendon–Ballston: $24.9 million; total includes $18.7 million in substation transmission work; and
   (e) Garrisonville: $137.6 million; includes $11.9 million in substation transmission work.
7. For purposes of estimating mileage costs, DVP notes that Radnor Heights (3.7 mile route) and Garrisonville (5.5 mile route) are effectively 6.3 and 11 miles long, respectively, given they consist partially or totally of networked transmission lines with two distinct underground paths.

APPENDIX A

HOUSE BILL 1319
(CHAPTER 799 OF THE 2008 ACTS OF ASSEMBLY)

HOUSE BILL 2027
(CHAPTER 244 OF THE 2011 ACTS OF ASSEMBLY)

CHAPTER 799

An Act to establish a pilot program to place certain transmission lines underground.

[H 1319]

Approved April 2, 2008

Be it enacted by the General Assembly of Virginia:

1. *§ 1. There is hereby established a pilot program to construct qualifying electrical transmission lines of 230 kilovolts or less in whole or in part underground. Such pilot program shall consist of a total of four qualifying electrical transmission line projects, constructed in whole or in part underground, as set forth in this act.*

§ 2. A. Notwithstanding any other law to the contrary, as a part of the pilot program established pursuant to this act, the State Corporation Commission shall approve as a qualifying project a transmission line of 230 kilovolts or less that has received a certificate of public convenience and necessity from the State Corporation Commission prior to the effective date of this act that approved construction of an electrical transmission line in a right of way located upon land owned by a regional park authority used by the general public for park and recreation purposes, provided that the construction of such electrical transmission line has not commenced prior to the effective date of this act. The project shall be constructed in part underground, and the underground portion shall consist of a double circuit.

The State Corporation Commission shall approve such underground construction within 30 days of receipt of the written request of the public utility to participate in the pilot program pursuant to this section. The Commission shall not require the submission of additional technical and cost analyses as a condition of its approval, but may request such analyses for its review. The Commission shall approve the underground construction of one contiguous segment of the transmission line that is approximately 1.8 miles in length that was previously approved for construction upon or immediately adjacent to the right of way of the regional park authority, provided that the underground construction shall be located within the boundaries of such existing right of way upon the land owned by the regional park authority, excluding any substation or transition locations which may be required as a part thereof. The Commission shall make a finding establishing the termini of the underground portion of the line. The remainder of the construction for the previously approved transmission line shall be aboveground pursuant to the terms of the certificate of public convenience and necessity. The Commission shall not be required to perform any further analysis as to the impacts of this route, including environmental impacts or impacts upon historical resources.

The approval for constructing the above-described portion of the previously approved electrical transmission line as a double circuit underground shall not impair or delay the implementation of the certificate of public convenience and necessity and no further notice, testimony, or hearings shall be required in connection with such approval. The electric utility may proceed to acquire right of way and take such other actions as it deems appropriate in furtherance of the construction of the approved transmission line, including acquiring the cables necessary for the underground installation. Approval of a transmission line pursuant to this section for inclusion in the pilot program shall be deemed to satisfy the requirements of § 15.2-2232 and local zoning

ordinances with respect to such transmission line and any substations or transition locations that may be required.

B. If the qualifying project approved in subsection A provides only radial, rather than networked, electric service, there shall be a presumption of need in applications filed for a certificate of public convenience and necessity for electrical transmission lines that will complete the network for such qualifying project. The State Corporation Commission shall give priority on its docket for any such application of a public utility. Upon written request of the public utility for participation in the pilot program pursuant to this section, the Commission shall approve the construction of such additional network facilities in whole or in part underground, and such additional network facilities shall be considered a qualifying project for purposes of this act. The Commission shall not require the submission of additional technical and cost analyses as a condition of such approval, but may request such analyses for its review.

§ 3. In reviewing applications submitted by public utilities for certificates of public convenience and necessity for the construction of electrical transmission lines of 230 kilovolts or less filed between the effective date of this act and July 1, 2012, the State Corporation Commission shall approve three applications for qualifying projects to be constructed in whole or in part underground, as a part of the pilot program. The three qualifying projects shall be in addition to the qualifying project described in subsection A of § 2. If a public utility submits an application for a certificate of public convenience and necessity for an electrical transmission line that completes the network for a qualifying project as set forth in subsection B of § 2, the approval of such application shall constitute one of the three additional projects to be approved pursuant to this section.

§ 4. For purposes of this act, a project shall be qualified to be placed underground, in whole or in part, if it meets all of the following criteria:

1. An engineering analysis demonstrates that it is technically feasible to place the proposed line, in whole or in part, underground;

2. The estimated additional cost of placing the proposed line, in whole or in part, underground does not exceed 2.5 times the cost of placing the same line overhead, assuming accepted industry standards for undergrounding to ensure safety and reliability. If the public utility, the affected localities, and the State Corporation Commission agree, a proposed underground line whose cost exceeds 2.5 times the cost of placing the line overhead may also be accepted into the pilot program; and

3. The governing body of each locality in which a portion of the proposed line will be placed underground indicates, by resolution, general community support for the line to be placed underground.

§ 5. A. If the State Corporation Commission identifies an application as a potentially qualified project for purposes of the pilot program, the Commission shall request that the public utility provide technical and cost analyses for placing the proposed line overhead and for placing the proposed line, in whole or in part, underground.

B. If any application relates to the construction of a proposed line to meet a specific and identifiable industry's needs, and the project must be completed by the public utility within a

specific amount of time to facilitate an economic development agreement, then such application need not include the two analyses, so long as the public utility provides documentation regarding the economic development agreement.

§ 6. The State Corporation Commission shall report annually to the Commission on Electric Utility Restructuring, the Joint Commission on Technology and Science, and the Governor on the progress of the pilot program by no later than December 1 of each year that this act is in effect. The State Corporation Commission shall submit a final report to the Commission on Electric Utility Restructuring, the Joint Commission on Technology and Science, and the Governor no later than December 1, 2012, analyzing the entire program and making recommendations about the continued placement of transmission lines underground in the Commonwealth.

§ 7. For any qualifying project chosen pursuant to this act (regardless of whether such project is chosen pursuant to § 2 or 3) and not fully recoverable as charges for new transmission facilities pursuant to subdivision A 4 of § 56-585.1, the State Corporation Commission shall approve a rate adjustment clause. The rate adjustment clause shall provide for the full and timely recovery of any portion of the cost of such project not recoverable under applicable rates, terms, and conditions approved by the Federal Energy Regulatory Commission and shall include the use of the fair return on common equity most recently approved in a Commission proceeding for such utility, as defined by subsection A of § 56-585.1. Such costs shall be entirely assigned to the utility's Virginia jurisdictional customers. The Commission's final order regarding any petition filed pursuant to this subsection shall be entered not more than three months after the filing of such petition.

§ 8. If a transmission line is included in the pilot program pursuant to § 3 that includes only radial, rather than networked, electric service, there shall be a presumption of need in applications for a certificate of public convenience and necessity for electrical transmission lines that will complete the network for such qualifying project. The State Corporation Commission shall give priority on its docket for any such application of a public utility.

§ 9. Approval of a proposed transmission line for inclusion in this program shall not preclude the placing of existing or future overhead facilities in the same area or corridor by other transmission projects.

§ 10. Public utility companies granted a certificate of public convenience and necessity for a proposed transmission line not included in this program or not otherwise being placed underground shall seek to implement low-cost and effective means to improve the aesthetics of new overhead transmission lines and towers.

§ 11. The provisions of this act shall not be construed to limit the ability of the State Corporation Commission to approve additional applications for placement of transmission lines underground.

§ 12. If four applications are not submitted to the State Corporation Commission that meet the requirements of this act, the State Corporation Commission shall document the failure of the projects to qualify for the pilot program in order to justify approving fewer than four projects to be placed underground, in whole or in part.

§ 13. Insofar as the provisions of this act are inconsistent with the provisions of any other law or local ordinance, the provisions of this act shall be controlling.

2. That an emergency exists and this act is in force from its passage.

Legislative Information System

CHAPTER 244

An Act to amend and reenact §§ 3 and 6 of the first enactment of Chapter 799 of the Acts of Assembly of 2008, relating to a pilot program to place certain electric transmission lines underground.

[H 2027]

Approved March 18, 2011

Be it enacted by the General Assembly of Virginia:

1. That §§ 3 and 6 of the first enactment of Chapter 799 of the Acts of Assembly of 2008 are amended and reenacted as follows:

§ 3. In reviewing applications submitted by public utilities for certificates of public convenience and necessity for the construction of electrical transmission lines of 230 kilovolts or less filed between ~~the effective date of this act~~ *April 2, 2008,* and July 1, ~~2012~~ *2014*, the State Corporation Commission shall approve three applications for qualifying projects to be constructed in whole or in part underground, as a part of the pilot program. The three qualifying projects shall be in addition to the qualifying project described in subsection A of § 2. If a public utility submits an application for a certificate of public convenience and necessity for an electrical transmission line that completes the network for a qualifying project as set forth in subsection B of § 2, the approval of such application shall constitute one of the three additional projects to be approved pursuant to this section.

§ 6. The State Corporation Commission shall report annually to the Commission on Electric Utility Restructuring, the Joint Commission on Technology and Science, and the Governor on the progress of the pilot program by no later than December 1 of each year that this act is in effect. The State Corporation Commission shall submit a final report to the Commission on Electric Utility Restructuring, the Joint Commission on Technology and Science, and the Governor no later than December 1, ~~2012~~ *2014*, analyzing the entire program and making recommendations about the continued placement of transmission lines underground in the Commonwealth.

APPENDIX B:
PILOT STATUS OF TRANSMISSION LINE APPLICATIONS (230 KV OR LESS)

This Appendix provides the status for all transmission line applications of 230 kV or less submitted since the effective date of the Act, including those that either did not qualify for the program or have yet to be evaluated. From the effective date of the Act through November 1, 2013, the SCC received 26 applications from public utilities for certificates for the construction of electrical transmission lines of 230 kV or less. Delmarva submitted one application and APCo submitted seven applications for 138 kV overhead transmission lines. DVP submitted 14 applications for overhead transmission lines, one application for an overhead/underground hybrid, and three applications for 230 kV underground transmission lines, one of which, in accordance with the Act, was for a portion of a transmission line previously approved by the SCC as an overhead line. Brief summaries of these transmission line applications are provided below. Table 2 in this Appendix also summarizes the extent to which each transmission line meets the criteria necessary to qualify for the pilot program, as well as the status of each line.

DVP Transmission Lines

From the effective date of the Act through November 1, 2013, DVP filed 18 applications for approval and issuance of certificates to construct and operate the following 230 kV transmission lines:

- Pleasant View–Hamilton: 2-mile underground segment, 230 kV XLPE cable, mostly on the W&OD Trail in Loudoun County, Virginia (Case Number PUE-2005-00018, modified by Case Numbers PUE-2008-00027 and PUE-2008-00042). The Commission approved the request in accordance with the Act on May 28, 2008. The transmission line was energized in October 2010.

- Beaumeade–NIVO: 0.71-mile, 230 kV XLPE underground transmission cable in Loudoun County. DVP requested the line be included as a pilot project, and the Loudoun County Board of Supervisors approved a resolution on September 2, 2008, indicating general community support for the line to be placed underground. The Commission approved the request in accordance with the Act on January 26, 2009 (Case Number PUE-2008-00063). The line was energized in July 2010.

- Hayes–Yorktown: 8-mile, 230 kV overhead/underground hybrid transmission line in York County, Virginia, and Gloucester County, Virginia. HPFF underground construction is being proposed for 3.8 miles in order to cross the York River. The Commission determined the line should not be considered as an underground pilot project relative to the Act (Case Number PUE-2009-00049).

- Remington CT–Gainesville: 25-mile, 230 kV overhead transmission line in Fauquier County, Virginia, and Prince William County, Virginia. The line will be located on structures to be constructed for the new Meadowbrook–Loudoun 500 kV transmission line approved in Case Number PUE-2007-00031. The Commission determined the line should not be considered as an underground pilot project relative to the Act (Case Number PUE-2009-00050).

- Loudoun–New Road: 4-mile, 230 kV overhead transmission line in Loudoun County, Virginia, and Prince William County, Virginia. The Commission determined

the line should not be considered as an underground pilot project relative to the Act (Case Number PUE-2009-00134).

- Ballston–Radnor Heights: 3.7-mile, 230 kV underground transmission line project in Arlington County, Virginia. DVP requested the line be included as a pilot project, and the Arlington County Board approved a resolution on July 10, 2010, indicating general community support for the line to be placed underground. The Commission approved the request in accordance with the Act on July 21, 2010 (Case Number PUE-2010-00004). The transmission line's target in-service date is June 1, 2014.

- Landstown–Virginia Beach: 11-mile, 230 kV overhead transmission line rebuild in Virginia Beach, Virginia. The Commission authorized the Company to rebuild an overhead transmission line (Case Number PUE-2010-00012).

- Hopewell–Prince George: 3-mile, 230 kV overhead transmission line in the City of Hopewell, Virginia, and Prince George County, Virginia. The Commission authorized the Company to construct an overhead transmission line on existing right-of-way (Case Number PUE-2010-00032).

- Cannon Branch–Cloverhill: 2-mile, 230 kV overhead transmission line in the City of Manassas, Virginia, and Prince William County, Virginia. The Commission determined that the project does not meet the criteria necessary for consideration as an underground pilot project relative to the Act (Case Number PUE-2011-00011).

- Hollymead Tap: 8-mile, 230 kV overhead transmission line in Albemarle County, Virginia. The Commission determined that the project does not meet the criteria necessary for consideration as an underground pilot project relative to the Act (Case Number PUE-2011-00015).

- Bremo–Dooms: 43-mile, 230 kV overhead transmission line in Albemarle County, Virginia, and Fluvanna County, Virginia. The Commission determined that the project does not meet the criteria necessary for consideration as an underground pilot project relative to the Act (Case Number PUE-2011-00039).

- Lakeside–Northwest: 12-mile, 230 kV overhead transmission line in Henrico County, Virginia, and Hanover County, Virginia. The Commission determined that the project does not meet the criteria necessary for consideration as an underground pilot project relative to the Act (Case Number PUE-2011-00082).

- Dahlgren: 9.4-mile, 230 kV overhead transmission line in King George County, Virginia. The Commission determined that the project does not meet the criteria necessary for consideration as an underground pilot project relative to the Act (Case Number PUE-2011-00113).

- Waxpool and Brambleton–BECO: 1.5-mile and 11.2-mile, 230 kV overhead transmission lines in Loudoun County, Virginia. The Commission determined that

the project does not meet the criteria necessary for consideration as an underground pilot project relative to the Act (Case Number PUE-2011-00129).

- Surry–Skiffes Creek and Skiffes Creek–Whealton: 7.4-mile, 500 kV overhead transmission line and 20.2-mile, 230 kV overhead transmission line in Surry, James City, and York Counties and Cities of Newport News and Hampton, Virginia. The Commission has yet to determine whether this proposal is a qualified underground pilot project relative to the Act (Case Number PUE-2012-00029).

- Cloverhill–Liberty and Liberty Loop: 5.6-mile and 2-mile, 230 kV overhead transmission lines in Prince William County, Virginia, and City of Manassas, Virginia, respectively. The Commission authorized the Company to construct an overhead transmission line on existing right-of-way (Case Number PUE-2012-00065).

- Harrisonburg–Endless Caverns: 19.8-mile, 230 kV overhead transmission line in Rockingham County, Virginia. The Commission authorized the Company to construct an overhead transmission line on existing right-of-way (Case Number PUE-2012-00095).

- Brambleton–Beaumeade: 1.2-mile, 230 kV overhead transmission line relocation in Loudoun County, Virginia. The Commission has yet to rule on this application (Case Number PUE-2013-00002).

APCo Transmission Lines

From the effective date of the Act through November 1, 2013, APCo filed seven applications for approval and issuance of certificates to construct and operate the following 138 kV transmission lines:

- Sunscape: 1.4-mile, double-circuit 138 kV overhead transmission line in an urbanized area of southwestern Roanoke County (Case Number PUE-2008-00053).

- Matt Funk: 4.5-mile, double-circuit 138 kV overhead transmission line in southwestern Roanoke County (Case Number PUE-2008-00079).

- Huntington Court–Roanoke: 6-mile, double-circuit 138 kV overhead transmission line in the Roanoke area (Case Number PUE-2008-00096).

- Lockhart Extension: 138 kV overhead transmission line and associated substation in Dickenson County, Virginia (Case Number PUE-2008-00116).

- Saltville–Kingsport: 138 kV overhead transmission line rebuild in Washington County and the City of Bristol, Virginia (Case Number PUE-2009-00137).

- Falling Branch–Merrimac: 7.5-mile (6.25 miles single-circuit, 1.25 miles double-circuit), 138 kV overhead transmission line in Montgomery County and the Town of Christiansburg, Virginia (Case Number PUE-2012-00007).

- Wythe Area Improvements: 17.6-mile (5.1 miles single-circuit, 12.5 miles double-circuit), 138 kV overhead transmission line in Wythe County and the Town of Wytheville, Virginia (Case Number PUE-2012-00132).

APCo did not request that any of the above-proposed projects be considered as underground pilot projects relative to the Act. The Commission Staff, after reviewing the applications, concluded that constructing the proposed transmission lines underground would not be reasonable. The governing localities did not indicate, by resolution, general community support for the lines to be placed underground. After convening evidentiary hearings, including public comment and expert testimony, and reviewing the Hearing Examiners' reports summarizing the evidentiary record in the cases, the Commission approved the proposed projects for overhead construction.

Delmarva Transmission Line

From the effective date of the Act through November 1, 2013, Delmarva filed one application for approval and issuance of a certificate to construct and operate the following 138 kV transmission line:

- Oak Hall–Wattsville: 4-mile, 138 kV overhead transmission line in Accomack County. Delmarva proposed to install the line adjacent to an existing 69 kV line and operate both lines as a double circuit. Existing wooden poles would be replaced with taller steel poles. The Commission authorized the Company to construct an overhead transmission line (Case Number PUE-2009-00106). Delmarva did not request that this project be considered as an underground pilot project relative to the Act.

Table 2. Pilot Status of Transmission Line Applications (230 kV or Less)
(pilot projects are shaded)

TRANS. LINE / SCC CASE No.	FEASIBILITY TEST	COST TEST*	RESOLUTION BY LOCALITY	PILOT STATUS
DVP 230 kV Transmission Lines				
Pleasant View–Hamilton PUE-2008-00027 Filed 4/21/2008	Technically Feasible	Not Required	Not Required	Required by Act
Beaumeade–NIVO PUE-2008-00063 Filed 7/21/2008	Technically Feasible	1.4 times the cost of OH for the total project	Approved 9/2/2008	Requested by DVP; Approved by SCC
Hayes–Yorktown PUE-2009-00049 Filed 7/1/2009	Detailed UG engineering analysis not completed for OH portion of line	Cost analysis not applicable	None Filed	Did not qualify
Remington CT–Gainesville PUE-2009-00050 Filed 6/15/2009	Detailed UG engineering analysis not completed	25 times the cost of OH for the total project	None Filed	Did not qualify
Loudoun–New Road PUE-2009-00134 Filed 12/28/2009	Detailed UG engineering analysis not completed	3.3 times the cost of OH for the total project	None Filed	Did not qualify
Ballston–Radnor Heights PUE-2010-00004 Filed 2/9/2010	Technically Feasible	Less than the cost of OH for the total project	Approved 7/10/2010	Requested by DVP; Approved by SCC
Landstown–Va. Beach PUE-2010-00012 Filed 3/1/2010	Detailed UG engineering analysis not completed	4.7 times the cost of OH for the total project	None Filed	Did not qualify
Hopewell–Prince George PUE-2010-00032 Filed 4/26/2010	Detailed UG engineering analysis not completed	2.4 times the cost of OH for the total project	None Filed	Did not qualify

Table 2 (cont'd). Pilot Status of Transmission Line Applications (230 kV or Less)

DVP 230 kV Transmission Lines (cont'd.)				
TRANS. LINE / SCC CASE No.	**FEASIBILITY TEST**	**COST TEST***	**RESOLUTION BY LOCALITY**	**PILOT STATUS**
Cannon Branch–Cloverhill PUE-2011-00011 Filed 2/7/2011	Detailed UG engineering analysis not completed	1.8 times the cost of OH for the total project	None Filed	Did not qualify
Hollymead Tap PUE-2011-00015 Filed 2/18/2011	Detailed UG engineering analysis not completed	Cost analysis not applicable	None Filed	Did not qualify
Bremo–Dooms PUE-2011-00039 Filed 4/29/2011	Detailed UG engineering analysis not completed	Cost analysis not applicable	None Filed	Did not qualify
Lakeside–Northwest PUE-2011-00082 Filed 7/20/2011	Detailed UG engineering analysis not completed	4.6 times the cost of OH for the total project	None Filed	Did not qualify
Dahlgren PUE-2011-00113 Filed 10/26/2011	Detailed UG engineering analysis not completed	5.5 times the cost of OH for the total project	None Filed	Did not qualify
Waxpool and Brambleton–BECO PUE-2011-00129 Filed 12/16/2011	Detailed UG engineering analysis not completed	Cost analysis not applicable	None Filed	Did not qualify
Surry–Skiffes Creek and Skiffes Creek–Whealton PUE-2012-00029 Filed 6/11/2012	Detailed UG engineering analysis not completed	To be determined	None Filed	Proceeding pending before SCC
Cloverhill–Liberty and Liberty Loop PUE-2012-00065 Filed 6/29/2012	Detailed UG engineering analysis not completed	Cost analysis not applicable	None Filed	Did not qualify
Harrisonburg–Endless Caverns PUE-2012-00095 Filed 8/13/2012	Detailed UG engineering analysis not completed	Cost analysis not applicable	None Filed	Did not qualify
Brambleton-Beaumeade PUE-2013-00002 Filed 1/17/2013	Detailed UG engineering analysis not completed	To be determined	None Filed	Proceeding pending before SCC

Table 2 (cont'd). Pilot Status of Transmission Line Applications (230 kV or Less)

TRANS. LINE / SCC CASE No.	FEASIBILITY TEST	COST TEST*	RESOLUTION BY LOCALITY	PILOT STATUS
APCo 138 kV Transmission Lines				
Sunscape PUE-2008-00053 Filed 6/20/2008	Detailed UG engineering analysis not completed	3 times the cost of OH for undergrounding the total route	None Filed	Did not qualify
Matt Funk PUE-2008-00079 Filed 8/18/2008	Detailed UG engineering analysis not completed	Cost analysis not applicable	None Filed	Did not qualify
Huntington Court–Roanoke PUE-2008-00096 Filed 10/10/2008	Detailed UG engineering analysis not completed	Cost analysis not applicable	None Filed	Did not qualify
Lockhart Extension PUE-2008-00116 Filed 12/19/2008	Detailed UG engineering analysis not completed	Cost analysis not applicable	None Filed	Did not qualify
Saltville–Kingsport PUE-2009-00137 Filed 12/16/2009	Detailed UG engineering analysis not completed	Cost analysis not applicable	None Filed	Did not qualify
Falling Branch–Merrimac PUE-2012-00007 Filed 2/9/2012	Analysis completed by APCo Consultant	6 times the cost of OH for undergrounding an alternative route	None Filed	Did not qualify
Wythe Area Improvements PUE-2012-00132 Filed 11/15/2012	Feasibility/cost inferred from similarity with Falling Branch–Merrimac	6 times the cost of OH for undergrounding an alternative route	None Filed	Did not qualify
Delmarva 138 kV Transmission Line				
Oak Hall–Wattsville PUE-2009-00106 Filed 9/24/09	Detailed UG engineering analysis not completed	3.9 times the cost of OH for undergrounding the total route	None Filed	Did not qualify

The estimated cost of placing the proposed line in whole or in part underground should not exceed 2.5 times the cost of placing the same line overhead unless otherwise agreed to by the public utility, the affected localities, and the Commission.

APPENDIX C:
EXPERIMENTAL UNDERGROUND TRANSMISSION LINE PROJECTS SEPARATE FROM THE ACT

This Appendix provides a summary of two experimental underground transmission line projects not undertaken relative to the Act. These projects are included in this report for the purpose of aggregating and tracking all ongoing underground transmission line projects in one document. The experience gained from the analysis and construction of these two projects, in addition to the pilot projects under the Act, should be useful in making recommendations about the continued placement of transmission lines underground in the Commonwealth. A summary of these two projects is included in Table 3 in Appendix C.

Clarendon-Ballston 230 kV Transmission Line

On February 2, 2007, DVP filed its application with the SCC for the 2200-foot Clarendon-Ballston 230 kV transmission line in Arlington County. The utility proposed the construction of the line under streets in the highly urbanized area because there was no practical overhead route for the line.

In addition, the utility proposed the use of a different underground construction technology, XLPE, than in past projects. Previous underground transmission projects in urban areas employed HPFF cable. DVP argued that the proposed facility would provide the utility an opportunity to gain experience with XLPE lines operating at 230 kV. The utility noted that any failures could be managed with limited service disruption since the proposed facility would be located in an urban area with significant transmission facilities already in place. To date, DVP has not experienced any service disruptions with regard to this underground transmission line. The utility also noted that the cost of underground urban construction for an XLPE line is reasonably comparable to HPFF construction.

The Commission approved the line by its Final Order of May 25, 2007, in Case Number PUE-2006-00082. In approving the line, the Commission commended DVP's decision to use a different technology for the project and encouraged the utility to investigate and employ new technologies while also considering the reliability of its system and financial impact on all ratepayers. The Commission also directed the utility to inform the Commission's Division of Energy Regulation of the progress of this installation and to provide information on cost, engineering, construction, and future operation.

The actual cost of the 230 kV underground transmission line was $6.2 million ($14.7 million per mile equivalent). The 230 kV substation transmission work cost an additional $18.7 million.[1] The utility did not perform comparable cost estimates for either HPFF technology or overhead construction. The utility also expected construction to require nine months, with an anticipated completion date of May 2008; however, the completion date was extended primarily due to unforeseen difficulty in obtaining local permits. The line was energized in February of 2010.

[1] In its application, DVP estimated the cost of the proposed underground 230 kV transmission line to be $4 million with an additional $11 million for substation transmission work.

Garrisonville 230 kV Transmission Line

On August 30, 2006, DVP filed its application with the SCC for the five-mile Garrisonville 230 kV overhead transmission line in Stafford County. On February 27, 2007, DVP filed a Motion for Leave to File Underground Alternative Supplement. The utility attached to its Motion an Underground Alternative Supplement which presented the underground alternative as part of the utility's direct case to be considered along with its other proposals.[2]

To address the cost and visual impact issues, the utility proposed treating the Garrisonville project as an underground XLPE pilot project, which would allow the cost to be recovered through the ratemaking process. The utility stated that the prospect of gaining further experience and familiarity with the construction, operation, and performance of XLPE technology through a much larger underground project could justify incurring the additional cost of underground construction and recovering it from the broad range of the utility's customers. According to the utility, apportioning the costs across the utility's entire rate base would add approximately $0.10 to every DVP residential customer's monthly bill. On a percentage basis, bills would increase approximately one tenth of one percent.

The Commission approved the underground line by its Final Order of April 8, 2008, in Case Number PUE-2006-00091. In approving the line, the Commission emphasized that the approval of this project as an underground pilot project, and the rate treatment afforded thereto, in no way established a precedent for future transmission lines, either in the subject right-of-way or elsewhere.

DVP originally estimated the cost of the proposed 230 kV underground transmission line to be $70.4 million, or approximately $6.4 million per mile. The 230 kV substation work was expected to cost an additional $11.9 million, for a total project cost of $82.3 million. The total cost for the overhead alternative was estimated to be $14.16 million, a $68.14 million difference. Thus, the underground option was expected to cost approximately six times the cost of the overhead alternative. The utility also expected preconstruction activities and construction to require a total of 36 months,[3] with an anticipated completion date of June 2009. The overhead alternative was expected to require 24 months, including six months for preconstruction and 18 months for construction.

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[2] The preferred underground alternative ("Option 1") consisted of two transmission circuits and was designed with a spare conduit to add an additional cable in the event the rating needs to be increased in the future. Constructing two underground double circuits will assure that service to the Garrisonville Switching Substation would be maintained in the event of a fault on the new line and will provide transfer capability and redundancy equivalent to the proposed overhead line. From a transmission planning perspective, Option 1 of the underground alternative provides an electrically acceptable alternative to the proposed overhead line. Option 1 would assure continued service to Garrisonville substation, at a higher cost, by providing transfer capability and redundancy equal to the proposed double circuit overhead line configuration. In the event of an extended outage on one underground circuit, the Garrisonville station could continue to receive service from the other until the outage is repaired. The utility recommended against using an underground alternative that consisted of only one circuit ("Option 2") built in a radial configuration. Although less expensive at $48.44 million (still 3.4 times the overhead alternative), Option 2 would have been less reliable.

[3] The 36-month estimate included eighteen months for preconstruction activities (acquiring underground rights and clearing right-of-way) and eighteen months for construction.

The project was divided into three phases. The first phase of the project was energized in 2010. Phases two and three of the project were completed in July 2012.

Adverse soil conditions, large amounts of rock in the right-of-way, unfavorable topography, and interstate road crossings resulted in significant increases in the cost estimates for the project. As opposed to conventional trenching, these difficult conditions necessitated directional drilling to depths in the range of 60-70 feet. Additional costs were incurred for larger gauge cable due to poorer thermal dissipation at such depths. The cost was estimated to be $137.6 million ($11.9 million per mile *excluding* land acquisition costs), or approximately nine times the project cost using overhead construction.

Table 3. DVP Experimental Transmission Line Projects Separate from the Act

PROJECT	LENGTH/ ACTUAL COST	CONSTRUCTION STATUS	APPLICATION
Clarendon – Ballston 230 kV (Arlington County) PUE-2006-00082 Filed: 2/2/2007 Approved: 5/25/2007	2,200 feet $15 million for 230 kV work (incl. $11 million for substation work)	Construction completed	Initiated by DVP, approved by Commission (OH option not feasible, and to gain experience with XLPE technology)
Garrisonville 230 kV (Stafford County) PUE-2006-00091 Filed: 8/30/2006 Approved: 4/8/2008	11 miles[4] $137.6 million (incl. $11.9 million for substation work)	Construction Completed	Initiated by DVP, approved by Commission (to gain experience with XLPE technology on a longer project)

[4] DVP notes that the new underground transmission line is effectively 11 miles long when considering it is a networked transmission line. The line will run approximately 5.5 miles from the existing "252 Line" into Garrisonville substation and then approximately 5.5 miles back to the 252 Line along the same 5.5 mile right-of-way but creating two distinct 5.5-mile double-circuit underground paths.