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PUBLIC SERVICE COMMISSION OF THE DISTRICT OF COLUMBIA
1333 H STREET, N.W., 2nd FLOOR, WEST TOWER
WASHINGTON, D.C. 20005

ORDER

February 27, 2015

FORMAL CASE NO. PEPACR-2014-01, IN THE MATTER OF THE COMMISSION'S FUEL ADJUSTMENT CLAUSE AUDIT AND REVIEW PROGRAM – ANNUAL CONSOLIDATED REPORT, Order No. 17816

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I. INTRODUCTION

1. On February 18, 2014, as supplemented on June 2, 2014, the Potomac Electric Power Company ("Pepco" or "Company") filed with the Public Service Commission of the District of Columbia ("PSC" or "Commission") its 2014 Annual Consolidated Report ("2014 Consolidated Report").[1] By this Order, the Commission accepts Pepco's 2014 Annual Consolidated Report as being in substantial compliance with applicable reporting obligations imposed by the Commission upon Pepco and denies the motion filed by the District's Office of the People's Counsel ("OPC") for leave to file comments on the Staff Report prepared in this matter.[2] This Order also accepts, in whole or in part, multiple recommendations offered by OPC and Staff and directs Pepco to provide in its 2015 Annual Consolidated Report additional information to complete or to clarify information provided in the 2014 Annual Consolidated Report, consistent with those recommendations. This Order also directs Pepco to provide as a separate report due within 180 days of this Order an analysis that compares the results of the corrective actions undertaken with respect to Phase III of its Manhole Inspection Program with the results of the corrective actions undertaken in Phases I and II of its Manhole Inspection Program.

2. Finally, the Commission is incorporating into this Order its consideration and disposition of issues deferred in our prior order accepting Pepco's 2013 Annual Consolidated Report.[3] In addressing both the 2014 Consolidated Report and the issues deferred in our prior order accepting Pepco's 2013 Annual Consolidated Report, the Commission is taking into account relevant information, findings and recommendations described in the audit reports prepared, respectively, by Siemens Industry, Inc. and Liberty Consulting Group.[4]

II. BACKGROUND

A. Annual Consolidated Report

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[1] *PEPACR-2014-01, In the Matter of the Commission's Fuel Adjustment Clause Audit and Review Program – Annual Consolidated Report ("PEPACR-2014-01")*, dated February 18, 2014, supplemented on June 2, 2014 ("2014 Consolidated Report").

[2] Pursuant to 15 DCMR § 513.9, the Staff Report is a document internal to the Commission and is used to assist the Commission in its deliberations in this matter.

[3] *Formal Case No. 766-ACR-13-1, In the Matter of the Commission's Fuel Adjustment Clause Audit and Review Program – Annual Consolidated Report, Order No. 17455*, rel. April 18, 2014 ("Order No. 17455").

[4] On April 11, 2014, Siemens filed its *Final Report: Siemens Management Audit of Pepco System Reliability* ("Siemens Audit Report") with the Commission and notice of the Siemens Audit Report, together with dates for filing initial and reply comments, was published in the D.C. Register on May 2, 2014, see 61 DC Reg. 19 (2014). On June 25, 2014, Liberty filed in Formal Case No. 1076 its *Final Report: Management and Operations Audit of Potomac Electric Power Company* ("Liberty Audit Report"). Notice of the Liberty Audit Report and dates for filing initial and reply comments was published in the D.C. Register on July 4, 2014, see 61 D.C. Reg. 28 (2014).

3. Pepco began filing its Annual Consolidated Report in its current form in 2006.[5] The current form of Pepco's Annual Consolidated Report is the result of a series of Commission directives that came about when, in 2003, the Commission ordered Pepco to annually file, by February 15th of each year, an updated Comprehensive Plan with the Commission.[6]

4. Pepco's initial Comprehensive Plan, developed as an outgrowth of hearings held in 2001, focused on Pepco's long-term planning on its underground system, its 10-year construction plans, its distribution load growth forecasts by substation, and its transmission/substation supply load growth forecasts.[7] Two years later, the Commission began requiring Pepco to address in the Comprehensive Plan, by ward, both its customer growth projections (including historical comparisons) and its load growth projections encompassing commercial and residential development (also with historical comparisons).

5. In its 2003 Order, the Commission combined the filing of Pepco's annual Productivity Improvement Plan (PIP) with the Comprehensive Plan.[8] The PIP was created under Commission rules adopted in 1981 to identify operating factors and practices contributing to productivity losses and to propose productivity measures that would yield net benefits for District ratepayers. The PIP originally addressed specific elements focused on total production expenses, power plant productivity and fuel procurement effectiveness.[9] After Pepco divested or otherwise transferred its generating stations to other entities, the primary focus of the PIP shifted to two areas: first, transmission and distribution productivity improvement projects that increased system efficiency and deferred more costly additions to the electric system; and second, to performance and reliability projects.[10]

6. Thus, beginning with its 2004 filing, Pepco began filing both Plans together, labeling its filing an Annual Consolidated Report.[11] As the PIP has focused, most recently, more on reliability than productivity improvement, its content has frequently overlapped with that of the Comprehensive Plan.

7. In 2005, Pepco filed with the Commission the unanimous request of the Productivity Improvement Working Group ("PIWG") that the annual Manhole Event Report

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5 *Formal Case No. 766, In the Matter of the Commission's Fuel Adjustment Clause Audit and Review Program ("Formal Case No. 766")*, Order No. 14093, rel. October 27, 2006.

6 *Formal Case No. 991, In the Matter of an Investigation into Explosions Occurring in or Around the Underground Distribution Systems of the Potomac Electric Power Company ("Formal Case No. 991")*, Order No. 12735, rel. May 16, 2003 ("Order No. 12735"), ¶ 140.

7 *Formal Case No. 991*, Order No. 12293, rel. January 11, 2002 ("Order No. 12293").

8 Order No. 12735, ¶ 140.

9 The description of the PIP in *15 DCMR § 513* still reflects its origin as a plan that was created prior to the restructuring of the electric markets in the District.

10 *See* Order No. 15152.

11 *Formal Case No. 766, Pepco's 2004 Consolidated Report: Productivity Improvement Plan and Comprehensive Plan*, filed February 23, 2004.

(which Pepco began filing in 2000), be filed each year as Part 3 of the Consolidated Report.[12] A goal of the Commission has been, and continues to be, that Pepco file a single, integrated document each year that contains key information about the year-to-year changes in Pepco's operations, together with other information that the Commission and stakeholders need to consider when reviewing Pepco's planning and operational decisions for its distribution system. The Annual Consolidated Report ("ACR") serves as that document.

B. Notice of Inquiry – Format, Content and Procedures Applicable to Future Annual Consolidated Reports:

8. Since the Annual Consolidated Report assumed its present format, a number of new policy initiatives and changes external to Pepco that impact Pepco's operations have taken hold in the District. These include the increase in the use of renewable energy resources and their integration into Pepco's electric distribution system; the introduction of distribution automation (including remote switching capability) and installation of AMI-enabled Smart Meters; a recent period of steady population growth in the District after a period of population decline; implementation of demand side management programs (such as energy efficiency and sustainability programs) that are leading to a reduction in energy use; and the recent introduction of planned construction that will relocate underground a significant number of the least reliable of Pepco's overhead electric circuits ("feeders") in the District.

9. In Order No. 17455, the Commission announced its intention to address the format and content of the ACR, and to also examine the process used by the Commission Staff and by other parties to review and comment on the ACR.[13] On May 9, 2014, the Commission issued a Notice of Inquiry in Formal Case No. RM5-2014-01-E.[14] The NOI requested comments addressing what changes, if any, should be made to the content of the ACR, together with responses to seven ACR content-related questions.[15] The NOI also sought comments addressing what changes, if any, should be made to the process by which the ACR is reviewed, together with responses to three ACR process-related questions.[16]

10. On July 1, 2014, Pepco filed comments in response to the NOI. Among other matters, Pepco addressed the currently applicable procedural schedule for the filing and review of its ACR. In its Comments, Pepco stated that the current February 15th filing date has been difficult to meet in recent years, noting that areas of the ACR require end-of-year data, some of which are not available for reporting purposes until several weeks into the following year.

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[12] *Formal Case 766*, The Commission's Fuel Adjustment Clause Audit and Review Program, Reporting Changes to Annual Manhole Event Report: Report of the Productivity Improvement Working Group in Response to Commission, Order No. 13754, rel. October 26, 2005.

[13] Order No. 17455 at ¶ 135.

[14] *Formal Case No. RM5-2014-01-E, In the Matter of the Annual Consolidated Report of the Potomac Electric Power Company ("Formal Case No. RM5-2014-01-E"), 61 D.C. Reg. 20 at 004811* (2014) ("NOI").

[15] NOI, ¶ 6.

[16] NOI, ¶ 7.

Accordingly, Pepco proposed to change the filing date to April 1 of each year.[17] After soliciting and considering public comment, the Commission issued Order No. 17684 on October 27, 2014, in which we waived certain of our rules in order to permit Pepco to file its 2015 ACR on or before April 1, 2015.[18]

C. Taking Administrative Notice of Pepco's Third-Party Management Audits in Formal Case 1076 and Formal Case 1103, Pepco's Last Rate Case

11. As part of our review of the ACR, we take administrative notice of the audits that were conducted as part of Formal Case No. 1076. In that case, the Commission directed Pepco to undertake, through a third party, an independent management audit.[19] The purpose of the management audit was to examine management, operating practices and procedures, as well as the services provided to Pepco, to determine their effectiveness and efficiency (Task One), and determine whether the allocation of Pepco Holdings Inc.'s ("PHI") service company costs for the services it provides to Pepco in the District were reasonable and appropriate (Task Two).[20] In subsequent orders[21] the Commission clarified the scope of the management audit, refined Pepco's proposed Request for Proposals ("RFP") to obtain the services of a third-party auditor, and approved for issuance the final RFP submitted by Pepco. In Order No. 17020, the Commission selected Siemens Industry, Inc. ("Siemens") to audit Pepco's system reliability (Task One) and selected Liberty Consulting Group ("Liberty") for the management audit of Pepco's and PHI's operations, including the matter of PHI's service company costs (Task Two).[22]

12. On April 11, 2014, Siemens filed its *Final Report: Siemens Management Audit of Pepco System Reliability* ("Siemens Audit Report") with the Commission. Notice of the Siemens Audit Report, together with dates for filing initial and reply comments, was published in the D.C. Register on May 2, 2014.[23] In Order No. 17534,[24] the Commission extended the original filing dates for initial and reply comments to August 15, 2014 and September 4, 2014, respectively. Pepco timely filed a Response to the Siemens Audit Report and on August 28, 2014, OPC filed Comments on the Siemens Audit Report. On September 9, 2014, Pepco filed a Reply to OPC's Comments.

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17 *Formal Case No. RM5-2014-01-E*, Comments of the Potomac Electric Power Company to the Public Service Commission of the District of Columbia's Notice of Inquiry Regarding the Annual Consolidated Report, filed July 1, 2014, at 4.

18 *Formal Case No. RM5-2014-01-E*, Order No. 17684, rel. October 27, 2014 ("Order No. 17684").

19 *Formal Case No. 1076*, Order No. 16087, rel. December 10, 2010 ("Order No. 16087").

20 Order No. 16087 at 2.

21 *See Formal Case No. 1076*, Order No. 16231, rel. March 7, 2011; Order No. 16585, rel. October 14, 2011; Order No. 16656, rel. December 20, 2011; and Order No. 16710, rel. February 16, 2012.

22 *Formal Case No. 1076*, Order No. 17020, rel. December 20, 2012 ("Order No. 17020").

23 61 DC Reg. 19 (2014).

24 *Formal Case No. 1076*, Order No. 17534, rel. July 2, 2014 ("Order No. 17534").

13. On June 25, 2014, Liberty filed in Formal Case No. 1076 its *Final Report: Management and Operations Audit of Potomac Electric Power Company* ("Liberty Audit Report"). Notice of the Liberty Audit Report and dates for filing initial and reply comments was published in the D.C. Register on July 4, 2014.[25] In Order No. 17643,[26] the original dates for filing initial and reply comments were extended by the Commission, in response to a motion filed by OPC, to October 14, 2014 and November 3, 2014, respectively. Pepco timely filed a Response to the Liberty Audit Report and on October 16, 2014, OPC filed Comments on the Liberty Audit Report. On November 3, 2014, Pepco filed a Response to OPC's Comments.

14. Section IV of the Liberty Audit Report is entitled, "System Design, Configuration, Operation and Maintenance" and Section V is entitled, "Underground Systems". These sections overlap the subject matter addressed in the Siemens Audit Report and engendered comments from OPC which are similar to the comments OPC filed in response to the Siemens Audit Report. Subjects touched upon in both Audit Reports were also subjects reported upon by Pepco in its 2013 and 2014 Consolidated Reports. For example, Pepco's load forecasting model was described in both Consolidated Reports and was challenged by OPC in its comments filed in response to the both Consolidated Reports. Pepco's load forecasting model was also placed at issue by OPC in its comments filed in response to both Audit Reports.

15. The accuracy of Pepco's load growth forecasts and the extent to which Pepco will use AMI-generated data in demand and energy forecasting, energy efficiency and load management, and in distribution and substation planning were issues considered in Formal Case No. 1103, Pepco's most recent base rate case.[27] In deciding this base rate case, the Commission directed Pepco to establish, file and periodically update a Load Research Plan ("Plan") that would address these issues concerning Pepco's load growth forecasts.[28] Since this Plan contains information relevant to deciding upon matters concerning Pepco's 2014 Consolidated Report, we take official notice of it here.[29]

16. Certain matters in the 2013 ACR touched upon subjects considered in the audits and were deferred for further consideration until after the audits became available. In the chart provided at Appendix A to this Order, we identify the issues that were deferred from Pepco's 2013 Consolidated Report and the specific paragraphs of Order No. 17455 in which these issues were described and by which they were deferred. Generally, these issues fall into the following categories: load growth forecasts, vegetation management, priority feeders, overhead feeder inspections, underground cable (PILC) replacement, equipment failure rates, and distribution

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[25] 61 D.C. Reg. 28, 006904-006906 (2014).

[26] *Formal Case No. 1076*, Order No. 17643, rel. September 25, 2014 ("Order No. 17643").

[27] See, *Formal Case No. 1103, In the Matter of the Application of the Potomac Electric Power Company for Authority to Increase Existing Retail Rates and Charges for Electric Distribution Service, Opinion and Order*, Order No. 17424, rel. March 26, 2014 ("Order No. 17424") at ¶¶ 401-403, 526-529, 532-533, and 537-528.

[28] Order No. 17424 at ¶¶ 401-402.

[29] *Formal Case No. 1103*, Potomac Electric Power Company, Load Research Plan – 2014 (filed May 27, 2014); First Update (filed August 27, 2014); and Second Update (filed November 25, 2014).

automation and segmentation (isolating and restoring outage faults through remote operations). We will address each of these subject areas in our discussion further below.

D. Comments, Reply Comments and OPC's Motion for Leave to File Comments on Staff Report:

17. Concurrent with its filings at the Commission, Pepco provided copies of its February 18, 2014, 2014 Consolidated Report and of its June 2, 2014, supplement thereto ("Supplement") to OPC and others. Comments on the 2014 Consolidated Report were filed by OPC on July 16, 2014.[30] On July 31, 2014, Pepco filed its "Response to the Office of the People's Counsel Comments Addressing Pepco's 2014 Consolidated Report."[31]

18. On September 24, 2014, the Commission placed on the docket a Staff Report addressing the 2014 Consolidated Report.[32] The Staff Report includes eight recommendations directed at improving Pepco's analysis and reporting. The Commission did not solicit public comment on the Staff Report. On November 19, 2014, OPC filed comments on the Staff Report and requested, by separate motion, that the Commission accept them for the record.[33]

19. In its Comments, OPC further addresses items it already discussed in its previously-filed comments and urges the Commission to add further information to that which would be reported by Pepco, should the Commission adopt recommendations three and six of the Staff Report. In addition, OPC seeks assurance that it will have the opportunity in the future to comment on Staff comments, reports, and recommendations concerning future Annual Consolidated Reports ("ACR"). On December 1, 2014, Pepco filed a Response to the Motion. In its Response, Pepco asks that OPC's motion be denied, claiming that OPC filed to state good cause for accepting OPC's comments, particularly since the comments were filed nearly two months after the Staff Report was placed into the docket, and especially since the Commission did not solicit comment on the Staff Report in the first place.[34] For the reasons described below, we deny OPC's Motion.

20. As OPC concedes in its Motion,[35] the Commission's Rules[36] do not require that the Staff Report be made available for public comment. OPC has already filed comments on the

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30 *PEPACR-2014-01*, Office of the People's Counsel Comments Addressing Pepco's 2014 Consolidated Report, filed July 16, 2014 ("OPC Comments").

31 *PEPACR-2014-01*, Pepco Response to PEPACR-2014-01"The Office of the People's Counsel Comments Addressing Pepco's 2014 Consolidated Report," filed July 31, 2014 ("Pepco Response").

32 *PEPACR-2014-01, Siemens Staff Report on Pepco's Annual Consolidated Report*, September 24, 2014.

33 *PEPACR-2014-01*, Motion for Leave to File Comments and Comments of the Office of the People's Counsel on Staff Report on Potomac Electric Power Company's 2014 Consolidated Report, dated November 19, 2014 ("Motion").

34 *PEPAR-2014-01, Potomac Electric Power Company Response to OPC Motion*, December 1, 2014.

35 Motion to File Comments at 1.

36 See 15 DCMR § 513.9 and 513.10 (1987).

ACR and we decline to accept further comments by OPC on the Staff Report, especially when they largely reiterate the same views OPC expressed in its earlier filing.

III. DESCRIPTION OF THE 2014 CONSOLIDATED REPORT

21. Pepco's 2014 Consolidated Report is a combination of three Commission-required filings: (a) the Comprehensive Plan, which is used to assess Pepco's planning methodology and its ability to anticipate and respond to changing conditions in its distribution system; (b) the Productivity Improvement Plan ("PIP"), the vehicle through which Pepco reports on ongoing productivity improvement projects; and (c) the Manhole Event Report, which details all manhole incidents, reports on the manner in which Pepco conducts its manhole inspections and reports on the ways that Pepco is addressing the conditions that caused these reported incidents. The 2014 Consolidated Report also contains a fourth part, References, which contains a list of abbreviations and acronyms; definitions of technical terms and a list of diagrams; descriptions of prior Commission Orders and Directives concerning the content of Pepco's 2014 Annual Consolidated Report; and an explanation of Pepco's Composite Performance Index ("CPI") which is a reliability metric formerly applicable to certain of Pepco's priority feeders.

A. Comprehensive Plan

22. Part 1 of the Consolidated Report consists of the Comprehensive Plan, containing three sections. The first section provides an overview of Pepco's transmission and distribution electric system, the second section provides a description of Pepco's system planning, and the third section describes the various means Pepco uses to maintain the reliability of its system.

1. Electric System Overview

23. In the first section, Pepco states that it is a member of the PJM Interconnection ("PJM"), the Regional Transmission Organization responsible for coordinating the movement of wholesale electricity in all or parts of 13 states and the District.[37] PJM directs the operation of Pepco's transmission system.[38] Pepco can exchange electric power with its neighboring utilities through three transmission interconnections with Potomac Edison to the west, through two interconnections with Dominion Resources to the south, and through seven interconnections with other PJM companies that are located north and east of Pepco.[39]

24. Pepco serves both the District and Maryland through an integrated transmission and distribution electric system, in which system components located in Maryland are important to serving District load and vice-versa.[40] Therefore, Pepco's planning process for meeting load growth is the same across both the District and Maryland.[41] As growth occurs, work plans are

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37 2014 Consolidated Report at 10.

38 2014 Consolidated Report at 10.

39 2014 Consolidated Report at 10.

40 2014 Consolidated Report at 9.

41 2014 Consolidated Report at 9.

issued in advance of meeting peak load conditions to add new facilities and capacity that will provide service to the existing and new load growth.[42]

2. **System Planning**

25. In the second section of the Comprehensive Plan, Pepco states that its load growth projections are an important tool in Pepco's system planning. Pepco describes its development of load growth projections as follows:

> Short-term, summer-peak forecasts are developed for three years to allow adequate time to complete routine 4 kV and 13 kV construction work. Long range forecasting (four to ten years) is used to develop advance plans for large 4 kV and 13 kV construction projects that require more than two or three years to complete, to develop routine and advance plans for 34.5 kV to 230 kV construction work, and to identify future capital projects in the Construction Budget Forecast process.[43]
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> * * * * *
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> Forecasting begins with the examination of the summer historical loads for each feeder and substation on a two year cycle. Actual new customer loads from submitted class of service forms and other available development reports and planned changes in feeder configuration and emergency transfers, are also analyzed. The individual feeder and feeder group loads for each year are calculated and adjusted to produce the substation load predictions for each year of the plan.[44]

26. Table 1.2-C in the 2014 Consolidated Report[45] provides Pepco's projected load growth (in terms of Mega-Volt-Amperes or "MVA") for each of its substations in each Ward of the District for the 10-year period 2014 to 2023. According to this Table, the 10-year average load growth projections for each Ward in the District range from a low of 0.93% (Ward 3) to a high of 2.59% (Ward 5). Overall, this Table depicts a 10-year District average load growth rate of 1.46%. In comparison, Pepco projected at 1.71% 10-year District average load growth rate in

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42 2014 Consolidated Report at 11.

43 2014 Consolidated Report at 12.

44 2014 Consolidated Report at 12-13.

45 2014 Consolidated Report at 18.

its 2013 Annual Consolidated Report[46] and a ten-year District average load growth rate of 1.66% in its 2012 Annual Consolidated Report.[47]

27. Pepco's system planning activities are governed by Pepco's planning criteria for its transmission, sub-transmission and distribution systems and also by standards imposed by the North American Electric Reliability Corporation/Reliability First Corporation.[48] These planning criteria are to provide for rational and orderly changes to the electric system that will provide reliable electric service to customers and support load growth in a cost effective manner.[49] The three major components of Pepco's system planning criteria are voltage and reactive support, ratings of facilities, and reliability.[50]

28. In Order No. 16975, the Commission required that Pepco include information on its substation additions and enhancements in its future Annual Consolidated Reports, stating:

> The Commission agrees with the Staff that continued updates on Substation Additions and Enhancements would be helpful. We also agree with OPC that a better understanding of the need for additions and enhancements is necessary. Consequently, we require Pepco to include a report on substation additions and enhancements in future Consolidated Reports. In addition to the information provided in the 2012 Consolidated Report, the Commission requires that Pepco provide details concerning the justification for these projects, including, as applicable, load growth projections and equipment age and condition in future consolidated reports.[51]

29. Pepco's transmission and distribution electric system consists primarily of substations that are remotely monitored and operated from a centralized control center, plus nearly 1,000 miles of transmission lines, including major portions of a 100-mile 500 kV loop that

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46 2013 Consolidated Report at 22.

47 *Formal Case No. 766-ACR-12, In the Matter of the Commission's Fuel Adjustment Clause Audit and Review Program – Annual Consolidated Report*, Order No. 16975, rel. November 29, 2012 ("Order No. 16975"), ¶ 8.

48 2014 Consolidated Report at 11. Reliability First Corporation is one of the eight Federal Energy Regulatory Commission-approved Regional Entities responsible for ensuring the reliability of the North American bulk power system. ReliabilityFirst performs this function pursuant to its delegation agreement with North American Electric Reliability Corporation (NERC). *See* http://www.linkedin.com/company/reliabilityfirst-corporation (accessed February 10, 2014). NERC is the Federal Energy Regulatory Commission-approved Electric Reliability Organization which, among its other responsibilities, develops and enforces Reliability Standards for the nation's electric grid. *See* http://www.nerc.com/AboutNERC/Documents/NERC%20FAQs%20AUG13.pdf (accessed February 10, 2014).

49 2014 Consolidated Report at 11.

50 2014 Consolidated Report at 12.

51 Order No. 16975, ¶ 50.

encircles the Washington, D.C. metropolitan area.[52] Distribution circuits radiate from the substations and are used to supply customers. Distribution lines may deliver energy to customers using circuits that are located underground, overhead on poles, or a combination of the two. These lines typically deliver energy at 4,160 or 13,200 volts.[53] Distribution transformers are connected to these distribution lines to further reduce the voltage in order to supply residential or commercial customers. Pole-mounted transformers are used on the overhead system, and pad-mounted [surface] or submersible [sub-surface] transformers are used on the underground system.[54] Altogether, Pepco owns and maintains approximately 4,200 circuit miles of overhead and underground primary and secondary distribution and transmission lines in the District.[55]

30. Table 1.2-G in Pepco's 2014 Consolidated Report, entitled "Substation Additions and Enhancements" lists eight substation addition and enhancement projects,[56] seven of which were previously listed the Company's 2013 Consolidated Report[57] and six of which were previously listed in both the 2013 and 2012 Consolidated Reports. Pepco's 2014 cost estimate for these six projects is $3.1 million less than its 2012 cost estimate for the same six projects (Table A below).[58] Pepco's cost estimate in its 2014 Consolidated Report for its new Mt. Vernon Square substation project increased by 8% above the project's 2013 estimate. In its 2014 Consolidated Report, Pepco added an eighth project to this list – rebuilding of its Harvard substation at a projected cost of $140.0 million[59] (see Table A below).

Table A: Pepco Substation Additions/Enhancements

Project Description	2012 Cost Estimate ($ million)	2013 Cost Estimate ($ million)	2014 Cost Estimate ($ million)
Install a fourth transformer at the Florida Avenue substation	13.8	13.6	19.0
Install a fourth transformer at the Northeast substation	32.8	24.6	22.4
Install two 100 Mvar reactors at the Alabama Avenue substation	9.4	9.7	14.6
Construct the new Waterfront substation	116.0	84.6	103.7
Construct the new Northwest substation	107.5	107.1	112.0
Double-leg supply feeders at the L Street substation	38.8	43.5	43.5
New Mt. Vernon Square substation	n/a	131.2	141.8
Rebuilding of Harvard substation	n/a	n/a	140.0
TOTAL	**$318.3**	**$414.3**	**$597.0**

Sources: Table I-2.G: Pepco 2013 Consolidated Report at 27 and Pepco 2014 Consolidated Report at 23.

52 2014 Consolidated Report at 10.

53 2014 Consolidated Report at 9.

54 2014 Consolidated Report at 9.

55 2014 Consolidated Report at 10.

56 2014 Consolidated Report at 23.

57 2013 Consolidated Report at 27.

58 2012 Consolidated Report at 22-23, Table 1.2-G; 2013 Consolidated Report at 27, Table 1.2-G; 2014 Consolidated Report at 23, Table 1.2-G.

59 2014 Consolidated Report at 23.

31. In summary, these projects consist of the future construction of three new substations (in-service dates December 2016, June 2017 and June 2020) and upgrades to five others (to be completed in June 2014, December 2015, June 2016, June 2019 and June 2021). The total construction cost for all eight projects is estimated at approximately $457.0 million.[60] Pepco provided load growth projections and summer ratings to justify the need for each project, below.[61]

- According to Pepco, capacity improvements to the Northwest and Florida Avenue substations are to serve new load in the Mt. Vernon Triangle/Convention Center and NoMa areas;[62]

- Capacity improvement to the Alabama Avenue substation is to serve new load in the St. Elizabeths' area, the new Northwest substation is proposed to replace the existing Harrison substation, which was built in 1940 and would require substantial work to maintain, as well as to serve new load in the Chevy Chase and Friendship Heights areas;

- The new Waterfront substation is proposed to serve load in the Navy Yard area.[63] Capacity improvements to the L Street substation are to serve new load in the West End and Georgetown areas;[64] and

- The rebuild of the Harvard Substation is to replace aging infrastructure at both the Harvard and Champlain Substations and to create capacity to serve the growing Columbia Heights area of the District.[65]

32. Pepco reconciled in its 2014 Consolidated Report its budgeted and actual 2013 expenditures for capital projects on its overhead and underground distribution system, and also forecast its capital spending on distribution projects in 2014.[66] Pepco classifies its capital spending into one of three project categories: customer driven, reliability, and load. The difference between budgeted and actual 2013 capital spending on distribution projects in these categories is shown in Table B, below:

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60 2014 Consolidated Report at 23, Table 1.2-G, the total of Column 2 (Project Cost).

61 2014 Consolidated Report at 24-35.

62 2014 Consolidated Report at 23. The term "NoMa" indicates the neighborhood and business district located immediately north of Massachusetts Avenue, just north of the U.S. Capitol and Union Station.

63 2014 Consolidated Report at 23.

64 2014 Consolidated Report at 23-24.

65 2014 Consolidated Report at 24.

66 2014 Consolidated Report at 23, Table 1.2-I at 37 and Table 1.2-J at 38.

Table B: Pepco's Projected and Actual 2013 Capital Spending on Distribution Projects ($ million)

Construction Category	2013 Budget	2013 Actual	Variance
Customer Driven	47.0	57.3	10.3
Reliability	138.0	115.9	(22.1)
Load	36.4	55.7	19.3
TOTAL	**221.4**	**228.9**	**7.5**

Source: Pepco 2014 Consolidated Report at 37, Table 1.2-I.

33. For 2013, Pepco budgeted $221.4 million in capital spending on distribution projects, allocated as follows: customer driven: $47.0 million; reliability: $138.0 million; and load: $36.4 million. In the prior proceeding that considered Pepco's 2013 Consolidated Report, the company stated that when new feeders are required specifically for the connection of new customers, that work is included in the customer driven category.[67] In addition, Pepco stated that load growth projects that the Company classifies as reliability projects are not related to the connection of new customers; according to Pepco, these projects are required to provide increased capacity to comply with equipment ratings and system design requirements.[68]

34. Pepco's 2014 Consolidated Report also includes three tables depicting, respectively: i) historical capital budgets 2008-2013; ii) Pepco's 2013 capital budget as allocated between customer-driven, reliability and load-based projects, with a comparison between budgeted amounts and actual spending; and iii) Pepco's capital budget forecasts 2014-2018.[69] This information shows that Pepco under-spent its 2013 capital budget for reliability projects by approximately $22.1 million (or 16%).[70]

35. Pepco attributes this under-spending primarily to the suspension of selective undergrounding work and delays associated with permitting, equipment procurement, and designs of several substation reliability projects.[71] Pepco's 2013 spending on load-driven projects was $19.3 million over budget (53%).[72] The Company states that this was primarily due to the purchase of land for the Waterfront Substation.[73] Pepco over-spent its budgeted amount in

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67 *Potomac Electric Power Company Response to Formal Case No. 766 "Staff Report on the Potomac Electric Power Company's 2013 Consolidated Report: Productivity Improvement Plan, Comprehensive Plan and Manhole Event Report,*" filed August 14, 2013 ("Pepco Response to 2013 Staff Report") at 4.

68 Pepco Response to 2013 Staff Report at 4.

69 2014 Consolidated Report at 36-38, Tables 1.2-H, I.2-I and 1.2-J.

70 2014 Consolidated Report at 37, Table 1.2-I, Column 4, Row 4 ($22.1 million), divided by Column 2, Row 4 ($138.0 million).

71 2014 Consolidated Report at 37.

72 2014 Consolidated Report at 37, Table 1.2-I, Column 4, Row 5 ($19.3 million), divided by Column 2, Row 5 ($36.4 million).

73 2014 Consolidated Report at 37.

the customer-driven project category by $10.3 million (22.0%), and provided no explanation for this variance.[74]

36. Pepco's five-year capital budget projections (2014-2018) represent collective expenditures approximately 64.6% higher than actual expenditures for the immediately preceding five years.[75] The Company explains its projected year-to-year variances in budgeted amounts for load-driven projects reflect the anticipated beginning and completion of two new substations, improvements at existing substations and the addition of feeder capacity to accommodate predicted increased load growth at various stations.[76]

3. Maintaining System Reliability

a. Technology

37. In the third section of the Comprehensive Plan, Pepco discusses system reliability, including technology initiatives that contribute to improve reliability performance and other subjects. A System Control and Data Acquisition ("SCADA") system is the primary tool used by Pepco's system operators to monitor and operate the Company's electric system.[77] The SCADA system provides the system operator at Pepco's control center with the ability to remotely monitor and operate all major equipment at all substations and selected equipment outside of the substations.[78] Remote Terminal Units ("RTU") at each substation gather data from all monitored substation equipment and provide an interface to pass the data to Pepco's central computer system, its Energy Management System and to the control center system operator.[79]

38. Major substation equipment status (open or closed) and equipment metering (watts, reactive volt-amperes ("var"), is monitored and specific equipment alarms are present to indicate abnormal conditions (high temperature, low oil pressure or overloads on a particular device or feeder.)[80] Any change of electric system status at a substation is displayed to the system operator within approximately four seconds.[81] The SCADA system also compares the design limits of certain equipment with present loading on that equipment.[82]

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74 2014 Consolidated Report at 37, Table 1.2-I, Column 4, Row 3 ($10.3 million), divided by Column 2, Row 3 ($47.0 million).

75 2014 Consolidated Report at 39.

76 2014 Consolidated Report at 38.

77 2014 Consolidated Report at 40.

78 2014 Consolidated Report at 40.

79 2014 Consolidated Report at 40.

80 2014 Consolidated Report at 41.

81 2014 Consolidated Report at 41.

82 2014 Consolidated Report at 42.

39. Through the SCADA system, automatic switching activities can be performed or the system operator can take action manually to protect remote system equipment (relieving conditions that cause equipment to operate outside of its design limits.)[83] All of Pepco's 13 kV substations have full SCADA control, but some of Pepco's 4 kV substations have only limited monitoring capability so as to provide remote control and operation.[84] Pepco is installing full RTU capability in the 4 kV substations that are not scheduled for conversion or retirement.[85] This will be accomplished by installing smart relays on all critical equipment (in certain applications, the smart relays can also provide information on the distance from the substation to the fault location on a feeder.)[86] The 4 kV substation RTUs completed by the end of 2013 include the following 11 substations:[87]

Wesley	Fort Chaplin	Queseda
Veazey East	Veazey West	Nebraska
Westmoreland	Oliver Street	Fulton Street
Palisades Substation 145	Randle Highlands Substation 71	

Pepco states that it will automate the following 4 kV substations over the next 10 years:[88]

MacArthur Blvd No. 152	Texas Ave. No. 111	Seat Pleasant No. 30
Fort Dupont No. 58	53rd St. SE No. 48	
Twining City No. 150	Chesapeake St. No. 181	
Fort Davis No. 100	Congress Heights No. 64	

40. As part of its Distribution Automation efforts, in August of 2013 Pepco completed the addition of communications capability and Automatic Sectionalizing and Restoration ("ASR") activation on 10 feeders out of the Harrison, Van Ness and Little Falls Substations, and four feeders out of the 12th & Irving, Fort Slocum, Green Meadows and Takoma Substations.[89] The Company plans to expand the use of ASR to include nine additional feeders in the Anacostia area, involving the Alabama Avenue, Naval Research Lab, Beech Road and St. Barnabas Substations, serving 11,000 customers in the District.[90] However, the scope of this latter project will be reviewed by Pepco after the Commission has reviewed and approved the first joint Pepco/DDOT Triennial Undergrounding Projects Plan.[91] Pepco also plans to install

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83 2014 Consolidated Report at 40-41.

84 2014 Consolidated Report at 41.

85 2014 Consolidated Report at 41.

86 2014 Consolidated Report at 41.

87 2014 Consolidated Report at 41.

88 2014 Consolidated Report at 41-42.

89 2014 Consolidated Report at 43.

90 2014 Consolidated Report at 43.

91 2014 Consolidated Report at 43. The jointly-filed first Triennial Underground Infrastructure Improvement Projects Plan was approved by the Commission in Order No. 17697 (*Formal Case No. 1116, In the Matter of the*

additional 13 kV and 69 kV remotely operated switches on feeders that are not equipped with ASR systems.[92] The remote control capability of these switches allows Pepco's system operator to perform switching without the need for field crews, thus reducing customer outage time.

41. In 2013, Pepco completed the second phase of its plan to install remotely operated 69 kV switches (in this instance, located in Maryland), four of which affect substations that supply District load.[93] Phase three of the project will include the installation of 18 remotely operated switches in 2014, 10 of which affect substations that supply District load to approximately 6,800 customers.[94] In addition, Pepco completed its installation of network transformer protector remote monitoring system ("RMS") on 41 network transformer protectors in the Buzzard Point network (located in the Southeast portion of the District), installed 104 monitors in the Benning network (located in the Northeast portion of the District) and carried into 2014 its installation of 75 transformer protectors on its Substation 18 Central Network (located in the Southwest portion of the District).[95]

42. Pepco's Outage Management System ("OMS") is the primary tool used to receive customer trouble reports, analyze these reports along with AMI meter statuses, and then determine the common sources of reported problems.[96] Information is passed back through the OMS to Pepco's Call Center, to provide customers with information on non-major outage restoration times and other matters, when customers call in. The OMS database contains the electrical network configuration of each feeder, connecting each transformer to a feeder, and the location of switches, fuses and taps.[97] The OMS analyzes all reported trouble by sorting the reports, and prioritizing and grouping multiple problems to a common source. The analyzed data are then displayed to the system operator for dispatch of crews to investigate and resolve problems.[98]

43. Pepco's customer information system ("CIS") is integrated with AMI meter data so that accounts can be billed using over the air meter data from Pepco's Meter Data Management system.[99] These AMI Activated customer accounts expanded to over 250,000 residential and commercial District customers in 2013.[100] CIS integration with Pepco's AMI

Application for Approval of Triennial Underground Infrastructure Improvement Projects Plan, Order No. 17697, rel. November 12, 2014 ("Order No. 17697")).

92 2014 Consolidated Report at 43.

93 2014 Consolidated Report at 44.

94 2014 Consolidated Report at 44.

95 2014 Consolidated Report at 44.

96 2014 Consolidated Report at 45.

97 2014 Consolidated Report at 45.

98 2014 Consolidated Report at 45.

99 2014 Consolidated Report at 46.

100 2014 Consolidated Report at 46.

system continued to expand in 2013 in preparation for interval billing and dynamic (*i.e.*, time of day) pricing[101]. In 2014, Pepco's primary focus of additional CIS work will be on the design, configuration and testing work to prepare for deployment of a new CIS system. Pepco states that its existing CIS system is over 35 years old and will be replaced with SAP's Customer Relationship Management and Billing System.[102]

44. Pepco began planning an upgrade to its Geographic Information System ("GIS") and Graphical Work Design ("GWD") systems in 2013.[103] The Company signed an agreement with the vendor and started the work associated with going to the latest version for both the GIS and GWD products.[104] This project is expected to continue into 2014 and be deployed in the fourth quarter of 2014. Additionally, in 2013 Pepco began installing additional GIS capabilities allowing for easier access to GIS data throughout the Company and easier integration with other Company information systems.[105] These capabilities are expected to become available during 2014. As of the end of 2013, this project remained on schedule.[106]

45. In 2013, Pepco spent approximately $12,289,000 on various power delivery information system projects, as listed in Table C, below.

Table C: Pepco Expenditures on Power Delivery Information System Projects (2013)

Description	Amount $	Description	Amount $
Customer Systems	251,000	Operations Systems	110,000
CIS Replacement	8,751,000	Energy Management System	0
Smart Grid Systems	1,752	Engineering Systems	394,000
Meter Systems	0	Field Technologies	130,000
Network Operating Center	168.000	Work Management	93,000
Energy Supply Systems	332,000	Planning and Performance	308,000

Source: Pepco Consolidated Report at 48, Table 1.3-A.

b. Equipment Standards and Inspections

46. Pepco has established and maintains guidelines for the design and operation of its four-wire, 13 kV distribution system, and guidelines for the design and operation of its low voltage AC network system located in the District's downtown business district.[107] The Company has been actively involved in standardizing major equipment across the PHI family of utilities, for such items as capacitors, regulators, switches, reclosers and transformers.[108]

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101 2014 Consolidated Report at 46.

102 2014 Consolidated Report at 46.

103 2014 Consolidated Report at 47.

104 2014 Consolidated Report at 47.

105 2014 Consolidated Report at 47.

106 2014 Consolidated Report at 47.

107 2014 Consolidated Report at 48.

108 2014 Consolidated Report at 49.

Consistent construction standards due to this standardization of equipment are intended to support proper installation of equipment throughout the PHI regions.[109]

47. Pepco states that its proactive inspection and monitoring program reduces the possibility of unexpected failures and secondary damage to surrounding units, and increases the opportunities that the Company can plan for the replacement of impending problem equipment.[110] Distribution line equipment such as transformers, cable, and other components are not subject to detailed electrical testing and are replaced only when physical inspection indicates a need for replacement.[111] However, load data from Pepco's AMI system can potentially be used to identify overloaded transformers and allow them to be replaced prior to failure.[112] Other than these inspections, equipment is replaced when it is upgraded, relocated or fails.[113]

48. Table 1.3-B in the 2013 Consolidated Report[114] lists various types of distribution system equipment, describes the types of inspection given to the listed equipment and identifies the frequency of such inspections. For example,[115] this Table shows that substation power transformers are subject to five types of inspections – routine predictive maintenance, oil collection and analysis, routine inspection and test, an LTC filter change, and a routine cooler inspection. Predictive maintenance is undertaken annually, oil collection and analysis may occur as frequently as twice yearly or up to once every two years, based on transformer MVA rating, the filter change occurs as conditions dictate or based on high differential pressure, and the routine cooler inspection occurs at the frequency determined by the results of an ECA.[116]

49. In 2011, Pepco undertook a pilot effort for the inspection of its overhead feeders. Based upon this pilot effort and in consultation with its outside contractor, Pepco refined its time frames for remediating conditions observed during overhead feeder inspections.[117] The new time frames are to synchronize these remediation projects with Pepco's Reliability Enhancement Work Plan planning and construction cycles (typically 6-18 months).[118] In 2012, Pepco initiated its Overhead Feeder Inspection Program, under which it obtains field data and other information to determine a feeder's general condition, compare it to performance data, and strategically

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109 2014 Consolidated Report at 49.

110 2014 Consolidated Report at 49.

111 2014 Consolidated Report at 49-50. Note that underground cables that experience faults may be subjected to Very Low Frequency testing to reveal faults.

112 2014 Consolidated Report at 49.

113 2014 Consolidated Report at 50.

114 2014 Consolidated Report at 50-53.

115 *See* 2014 Consolidated Report at 50.

116 For purposes of this Order, "ECA" is an acronym for Equipment Condition Assessment.

117 2014 Consolidated Report at 55.

118 2014 Consolidated Report at 55.

implement the best solution and/or corrective actions to improve the feeder's overall reliability and to avoid or mitigate future outage impacts.[119] This program sets out four priority classifications that are potentially assignable to observed conditions that require remediation:[120]

> Priority 1: A condition where, upon inspection, a Pepco facility is deemed to represent an imminent safety hazard to utility personnel and/or the public. In this case, steps are to be taken to immediately eliminate the hazard. Inspectors are required to immediately notify Pepco and to stand by until relieved by Pepco personnel.
>
> Priority 2: A condition where, upon inspection, a component of an overhead feeder is observed and confirmed to pose an imminent and significant threat to service reliability, but does not pose a direct public safety threat. Conditions under this category are to be remediated within 90 days.
>
> Priority 3: A condition where damage or degradation exists on a component of an overhead feeder line, does not pose a direct public safety threat, and if left uncorrected, has the potential to affect service reliability under adverse system conditions. Conditions under this category are to be remediated within 18 months.
>
> Priority 4: A condition that poses no threat to safety or reliability, but does not conform to current Pepco standards. Conditions under this category should be corrected when other work presents the opportunity to bring the condition to current standards.

50. Pepco explains that rather than adhering to the aggressive remediation timing it contemplated prior to the initiation of this inspection program, its consultant advised a more comprehensive approach that would coordinate remediation on these feeders with work that is ongoing under Pepco's Reliability Enhancement Plan and with other ongoing work.[121] To do this, Pepco developed its 4-part priority scheme in which remediation is immediate for imminent safety hazards (Priority 1), scheduled to occur within 90 days for conditions that pose an imminent and significant threat to service reliability (Priority 2), within 18 months for conditions that have the potential to affect service reliability under adverse conditions (Priority 3), and as the opportunity presents itself for conditions that pose no threat to safety or reliability, but are not up to Pepco's standards (Priority 4).[122]

51. In 2013, Pepco inspected 26 overhead feeders, covering 5,081 poles, and 479 conditions were identified.[123] The 2013 Consolidated Report includes Table 1-3.D "Overhead Feeder Inspection Program Priorities List" that describes each of the 479 conditions found and

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119 2014 Consolidated Report at 55.

120 2014 Consolidated Report at 56.

121 2014 Consolidated Report at 55.

122 2014 Consolidated Report at 56.

123 2014 Consolidated Report at 57.

ranks them for remediation according to Pepco's 4-part priority scheme, described above. These 479 conditions allocate themselves into 33 different descriptions ranging, alphabetically, from animal guards to woodpecker holes. Of these, 2 conditions were deemed by Pepco to be of sufficient priority (Priority 1) to be repaired immediately (loose or broken risers); 35 conditions required repair within 90 days (Priority 2), 195 within 18 months (Priority 3) and the remaining 247 were of sufficiently low priority (Priority 4) as to be corrected when other scheduled work presents an opportunity to do so.[124] During 2013, all Priority 1 and 33 of the 35 Priority 2 conditions were addressed; five of six lightning arrester issues (Priority 3) were addressed; and of the 75 Priority 2 conditions observed in its 2012 inspection, three were subsequently re-classified as Priority 3 conditions and the remaining 72 (including 55 lightning arrester conditions) were corrected in 2013.[125]

c. **Vegetation Management**[126]

52. Pepco's vegetation management program includes various activities to reduce vegetation-caused outages, including tree pruning, tree removal, clearing of undergrowth and application of herbicides.[127] Pepco's vegetation management activities are said by the Company to be constrained by legal requirements designed to promote an increase in the District's urban tree canopy, and by the value attached by the public to the presence of trees within their communities.[128] Nevertheless, Pepco's vegetation management priorities include achieving and maintaining a high degree of reliability across its entire electric system by targeting areas found to be most susceptible to outages and equipment damage from trees. Pepco also coordinates with local governments and property owners when it performs cyclical pruning and removes hazard trees in close proximity to Pepco's electric lines.[129] In addition, the Company performs emergency tree and limb removal from electric lines.[130]

53. In the District, Pepco's established trim cycle is such that all feeders are to be trimmed at least once every two years.[131] The amount of vegetation cleared is based on the

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124 2014 Consolidated Report at 57, Table 1.3-D: Overhead Feeder Inspection Program Priorities List.

125 2014 Consolidated Report at 58.

126 Pepco's vegetation management program and maintenance practices over the period 2009-2011 were examined as part of Siemen's reliability audit of Pepco and is reported upon in Chapter 4 of the Siemens Audit Report (which Report the Commission incorporates into the record in this proceeding). The Commission's review of Pepco's vegetation management program and practices as reported in the 2014 Consolidated Report and the decisions we make in this Order in response to comments by OPC on these practices will also take into account the findings and recommendations concerning Pepco's vegetation management program and practices contained in the Siemens Audit Report.

127 2014 Consolidated Report at 59, 86-87.

128 2014 Consolidated Report at 59, 60-61 and 85.

129 2014 Consolidated Report at 59.

130 2014 Consolidated Report at 59.

131 2014 Consolidated Report at 59 and 86.

average re-growth rate for the species of the affected tree, so that adequate clearance from conductors can be maintained by re-visiting the same spans on a consistent cycle; there is some variation based upon the characteristics of the vegetation, the construction of the feeder and past regulatory requirements.[132] Vegetation management work is also considered when designing feeder improvement programs for overhead feeders, such as the programs to improve the reliability performance of 2% High Priority Feeders.[133]

54. Pepco's vegetation management work includes removal of vegetation hazards that have the greatest impact on system reliability, such as: removal of hazard trees and weak species trees that threaten overhead distribution feeders, removal of limbs that overhang mainline three-phase distribution lines (where possible), and removal of undergrowth to provide increased access to off-road power poles.[134] Hazard trees are defined by Pepco as trees that are dead, dying, or mechanically damaged, that are within physical reach of Pepco's 34 kV supply lines or mainline three-phase distribution lines, and would cause significant damage to these lines if the hazard tree were to fall.[135] Pepco considers weak species trees to be white pine, tulip poplar, red maple, silver maple, northern red oak, Virginia pine, and black locust.[136]

55. Pepco states that District statute and regulations[137] from decades ago resulted in "legacy trees" that impact the Company's operations today and have historically limited the degree and technique of vegetation cutback from Pepco's power lines, resulting in large trees growing through and in close proximity to overhead conductors.[138] According to Pepco, in many instances issues with these trees cannot be resolved without cutting the entire legacy tree down.[139] However, no standardized practice or agreement exists between Pepco and the District's Urban Forestry Administration ("UFA") to resolve these conflicts; instead, Pepco and UFA work together to resolve these issues on a case-by-case basis and in accordance with the

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132 2014 Consolidated Report at 86.

133 2014 Consolidated Report at 86.

134 2014 Consolidated Report at 86-87.

135 2014 Consolidated Report at 87.

136 2014 Consolidated Report at 88.

137 Pepco supplied the following examples: first, 27 Stat. 324; D.C. Official Code § 22-3310 (1892), reading part "An act for the preservation of the public peace and the protection of property within the District of Columbia….unlawful for any person willfully top, cut down, remove, girdle, break, wound, destroy, or in any manner injure . . any tree not owned by that person….," and second, Trees in Public Space: Washington, DC, June 9, 2060, at p 17: Utility lines must be cleared by the use of directional clearance methods only…the removal of internal branches to permit passage of utility lines through the trees where necessary."

138 2014 Consolidated Report at 61.

139 2014 Consolidated Report at 61.

Company's "Vegetation Management Plan for Utility Tree Pruning – District of Columbia ("2005 Vegetation Management Plan").[140]

56. The final element of Pepco's vegetation management plan is Customer Communications.[141] This includes communicating Pepco's "Right Tree, Right Place" message.[142] Pepco informs its customers as to the minimum distance trees should be planted away from overhead power lines. Pepco identifies trees, by species, as tall, medium or small and recommends for each clearances of 50 feet, 20 feet and "close," respectively.[143] Pepco's customer communication plan also includes the following:[144]

1. Providing information to customers explaining its vegetation management program, along with a schedule of trimming and contact information;

2. Making available a Pepco forestry representative to respond to inquiries as vegetation management work is being scheduled and performed;

3. Ensuring that the Company's planners meet with customers and local officials, or correspond through mail, e-mail, and telephone, as needed;

4. Pepco representatives participate in community meetings; and

5. Use of door hangers to coordinate public awareness of Pepco's vegetation management programs prior to scheduled work.

d. Industry Comparisons

57. In 2013, Pepco participated in the annual Transmission and Distribution System Benchmarking Study conducted nationally by the Institute of Electrical and Electronics Engineers ("IEEE").[145] This study was based on 2012 performance data, excluding major event days. Altogether, 106 utilities participated in the study; 28 utilities participated from the Mid-Atlantic Region, including Pepco. The data submitted to IEEE by Pepco did not separately identify Pepco's performance in the District; consequently, the Company calculated and describes in the 2013 Consolidated Report separate performance values for the District, using

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140 2014 Consolidated Report at 61. The 2005 Vegetation Management Plan was produced as a result of a tree-trimming work group including members from UFA and Pepco's vegetation management team. Pepco filed this plan with the Commission on March 17, 2005, in *Formal Case No. 982*.

141 2014 Consolidated Report at 62-65.

142 2014 Consolidated Report at 62 and 64.

143 2014 Consolidated Report at 64.

144 2014 Consolidated Report at 62.

145 2014 Consolidated Report at 66.

equivalent major event day exclusions.[146] The benchmark results reported by Pepco (District performance only), excluding major event days, are shown in Table D, below:[147]

Table D: Pepco's District Reliability Performance, IEEE Benchmarking Study (2011 and 2012 data)

Performance Index	Ranked Nationally – Quartile Performance (1st Quartile is best)	Ranked Nationally- value (where 1=best)	Ranked Against Mid-Atlantic Participants
SAIDI -2011	Mid 3rd Quartile	161 (61 of 90)	12th among 26
SAIDI -2012	Upper 3rd Quartile	133 (62 of 106)	11th among 28
SAIFI -2011	Upper 3rd Quartile	1.19 (48 of 90)	8th among 26
SAIFI -2012	Mid 2nd Quartile	0.96 (34 of 106)	6th among 28
CAIDI -2011	Upper 4th Quartile	135 (71 of 90)	18th among 26
CAIDI -2012	Upper 4th Quartile	139 (84 of 106)	17th among 28

Source: Pepco 2013 Consolidated Report at 67-69; Pepco 2014 Consolidated Report at 67-70.

58. Pepco also provided its IEEE Benchmarking Performance Value using 2013 data, which demonstrated an improvement in SAIDI and SAIFI, but a slight degradation in CAIDI, when compared to 2012: SAIDI = 124; SAIFI = 0.88; and CAIDI = 141.[148]

e. Best Practices

59. Pepco states that it continues to follow the 20 best practices discussed in its 2013 Consolidated Report, and that the status, maturity/implementation levels, staffing impacts and REP drivers remain unchanged.[149] Regarding its costs to implement these 20 best practices in the District, the Company describes that many of these activities are performed by centralized teams supporting all of PHI's companies or by teams supporting Pepco system-wide; budgets and expenditures of departments that serve all of PHI are not directly attributable to one jurisdiction or another.[150] Further, activities supporting the best practices are only a subset of all work done by these departments and the activities of many of the primary personnel involved in executing and advancing these best practices are allocated to general overhead accounts.[151] Nevertheless, Pepco has attempted to allocate estimated resource hours and associated activity-based costs in these centralized functions to the District of Columbia, where possible.[152] The results are included in Table 1.3-E in the 2014 Consolidated Report.[153]

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146 2014 Consolidated Report at 66.

147 2014 Consolidated Report at 67-70.

148 2014 Consolidated Report at 67-69.

149 2014 Consolidated Report at 72. These best practices are reproduced in Appendix B to this Order.

150 2014 Consolidated Report at 72.

151 2014 Consolidated Report at 72.

152 2014 Consolidated Report at 72.

153 2014 Consolidated Report at 73.

60. In Table 1.3-E of the 2014 Consolidated Report Pepco separately presents approximate man-hours and costs to implement each of 20 best practices, during 2013.[154] According to the data in Table 1.3-E, to implement all 20 of these best practices in 2013, Pepco incurred the identical expenditures as incurred in 2012: approximately 20,967 man hours at a total cost of $2,020,915. Data in this Table demonstrates that approximately 4.5% of the total costs and 4.2% of total man-hours were attributable to the Company's implementation of best practices in vegetation management.

61. Included within its discussion of Best Practices is Pepco's description of its Equipment Condition Assessment ("ECA") work. Pepco has assigned personnel from the following organizational units to serve as members of its ECA team: Substation Design, Substation Maintenance & Construction, District Distribution Planning, Maryland Distribution Planning, Transmission Planning, CPD Reliability, Control Room Operations, Reliability Services, and Corporate Insurance.[155] The ECA team meets quarterly to evaluate potential replacement of large, high-cost, long lead-time primary components within substations.[156] This evaluation usually is based on condition-based criteria, but in the event of some external drivers (such as load, location and system criticality), replacements may also be triggered by historic performance of a component.[157] Pepco states that these projects are heavily driven by the Company's need to manage contingency risk and do not result from cost/benefit analyses.[158] Examples of the types of equipment that have been evaluated in 2013 by the ECA team include substation transformers, load tap changers, breakers, and batteries.[159]

62. During 2013, as a result of the ECA Pepco undertook the following actions in the District:

- Replaced three large power transformers (O Street Substation unit 3, G Street Substation unit 3 and Parklawn unit 1) and is in the process of replacing a fourth (Southwest Substation unit 2);
- Conducted Condition Based Maintenance ("CBM") on two large power transformers (Benning Reactor & Blue Plain R-23106);
- Replaced one LTC (Oliver Street Substation transformer unit 1);
- Conducted CBM on six LTCs (Southwest Substation transformer units 2,3 and 4, Van Ness Substation transformer units 1 and 2, and Oliver Street Substation transformer unit 1);

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154 2014 Consolidated Report at 73, Table 1.3-E, the last four columns.

155 2014 Consolidated Report at 79 and 81.

156 2014 Consolidated Report at 74.

157 2014 Consolidated Report at 75.

158 2014 Consolidated Report at 75.

159 2014 Consolidated Report at 77-83.

- Replaced one circuit breaker (Buzzard Point Substation); and
- Replaced three station battery banks (at the Florida Avenue, L Street, and Station D Substations.[160]

As a further result of the ECA work in 2013, Pepco is scheduled to replace up to 18 large substation circuit breakers in the District, over the 2014-2018 budget periods. The Company also plans to replace three more District transformers in 2014 (Southwest Substation transformer units 3 and 4, and G Street Substation transformer unit 2).[161]

63. Pepco explains that project selection by the ECA team is primarily driven by a need to manage contingency risk through primary and redundant assets, and is not the result of a cost/benefit analysis.[162] Therefore, many projects in the substation reliability category do not directly translate to improvement in outage frequency and duration. This concept of Reliability Centered Maintenance dictates that predictive maintenance activities serve to identify failing assets for repair or replacement prior to catastrophic failure.[163] In a June 2, 2014, supplement to its 2014 Consolidated Report, Pepco updated its 2013 ECA Team quarterly meeting notes to provide the estimated costs of the various capital projects discussed at those meetings.[164] For substation capital projects, Pepco included the feeder identification numbers for feeders powered from the identified substations.[165]

f. Reliability Enhancement Work Plan ("REP")

64. Pepco's REP is a six-part strategy of continuous improvement to achieve the top quartile reliability and outage restoration performance of comparable utilities that are included in applicable Benchmarking Studies.[166] The individual parts of the REP are: vegetation management, feeder improvement, selective undergrounding, Underground Residential Distribution ("URD") cable replacement and enhancement, distribution automation, and managing load growth.[167] Apart from vegetation management, which is primarily an operating expense, the remainder of Pepco's REP consists of capital construction projects; restoration and ongoing operations and maintenance of the distribution system is not part of Pepco's REP.[168]

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160 2014 Consolidated Report at 74.

161 2014 Consolidated Report at 74.

162 2014 Consolidated Report at 75.

163 2014 Consolidated Report at 75.

164 *PEPACR-2014-01, In the Matter of the Commission's Fuel Adjustment Clause Audit and Review Program – Supplement to the 2014 Consolidated Report, dated June 2, 2014* ("2014 Supplement") at 2-12.

165 2014 Supplement at 3-12.

166 2014 Consolidated Report at 85.

167 2014 Consolidated Report at 85.

168 *See* 2013 Consolidated Report at 81: "Best Practice 9 is not part of the REP because it is driven by restoration and the ongoing operations and maintenance of the system."

65. Pepco's specific vegetation management activities undertaken in 2013 are described in Table 2.4-P1 of the 2014 Consolidated Report ("2013 District of Columbia Tree Trimming Data by Feeder and Ward").[169] This Table lists the date that inspection or inspection and pruning was completed on each listed feeder, as well as the Ward(s) that each feeder serves. Altogether, this Table lists tree trimming work as occurring on 117 different feeders. In comparison, Pepco's 2013 Consolidated Report listed tree trimming as occurring on 137 feeders, 26 of which were trimmed again in 2013.[170] This tree trimming work is allocated among Wards as shown in Table E, below:[171]

Table E: Pepco Tree Trimming by Ward - # of Feeders (2012 and 2013)

Ward	1	2	3	4	5	6	7	8
2012	0	5	32	29	10	21	34	30
2013	1	7	35	5	21	8	24	33
Total	1	12	67	34	31	29	58	63

66. Feeder improvement activity under the REP extends beyond the remediation of outage causes on Pepco's 2% High Priority Feeders; it captures a greater number of at-risk feeders and entails a larger array of mitigation and preventative options than what Pepco may deploy in addressing its 2% High Priority Feeders.[172] The first tier of at-risk feeders is identified through an index that blends and weighs each feeder's SAIFI and SAIDI performance; the second tier of at-risk feeders is identified through Pepco's CPI ranking system, which is the methodology used by Pepco prior to 2013 to identify its 2% High Priority Feeders; and the third tier of at-risk feeders is composed of the feeders, or sections of a feeder, which serve customers who have experienced a high number of outages.[173] The purpose of this third tier is to target specific trouble areas that might affect a relatively small number of customers, but cause high levels of customer outages both during storms, as well as during non-storm conditions. Also, feeders with devices that have experienced multiple operational failures over the course of a rolling 12-month period may be referred for investigation and possible remediation under the REP.[174]

67. Remediation tactics used by Pepco to improve performance on at-risk feeders include, without limitation, one or more of the following: installing animal guards; replacing lightning arrestors; replacing poles and cross arms; re-tensioning slack wire/cable spans and installing spacers; replacing insulators; replacing transformers and other distribution equipment; installing new lateral tap fuses; installing sectionalizing devices; vegetation management work; replacing missing or damaged ground and guy wires; checking for and re-sizing fuses; selective

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169 2014 Consolidated Report at 314-316.

170 2013 Consolidated Report, at 382-385, Table 2.4-P1. After eliminating repeat trimming on 26 feeders in 2013, Pepco trimmed along 228 different feeders over the two-year period 2012-13.

171 Because a number of feeders serve multiple Wards, the total allocation by Wards exceeds the number of individual feeder listings.

172 2014 Consolidated Report at 89.

173 2014 Consolidated Report at 90.

174 2014 Consolidated Report at 91.

undergrounding of portions of a feeder; installing tree wire; replacing underground cable; re-routing overhead feeders to avoid potential fault sources; and adding an Automatic Sectionalizing Restoration ("ASR") scheme to a feeder.[175]

68. Pepco describes in its 2014 Consolidated Report the May 2013 recommendation of the Mayor's Power Line Undergrounding Task Force[176] that the Company partner with the District of Columbia Department of Transportation ("DDOT") in order to underground the primary portions of up to 60 overhead feeders that are vulnerable to outages during severe weather events.[177] On March 3, 2014, the Council of the District of Columbia enacted the Electric Company Infrastructure Improvement Financing Act of 2014 ("ECIIFA"), which went into effect following a period for Congressional review, on May 3, 2014.[178] Pursuant to sections 307 and 308 of the ECIFFA, on June 17, 2014, Pepco and DDOT jointly filed an application in Formal Case No. 1116 for approval to underground the primary overhead portions of 21 feeders in the District, for approval of Pepco's annual revenue requirement necessary for the recovery of its share of the costs of this construction, and approval of a customer funding surcharge by which to recover its annual revenue requirement.[179]

69. Pepco reports that Underground Residential Distribution ("URD") cable installation began in the District in the 1960s and that today older URD cables are reaching or have reached their end of useful life and will need to be replaced or enhanced to avoid a heightened risk of cable failure and power outages.[180] Observing an increase in the number of URD cable failures within the District, in 2012 Pepco implemented an engineering strategy for a formal URD cable replacement program.[181] The purpose of this program is to allow Pepco to transition its current URD cable strategy to one of proactive replacement and renewal.[182]

70. Under this strategy, Pepco conducts either spot replacements or Subdivision Primary Replacements. Spot replacements occur for URD cable segments on which three or more failures have been experienced or where deteriorated neutrals have been identified. Subdivision Primary Replacements use established criteria for scoring subdivisions to identify for replacement entire primaries that have experienced three or more failures in the past 12 months.[183] Since URD cable and its associated infrastructure must be protected from

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175 2014 Consolidated Report at 92.

176 *See* Mayor Gray's Executive Order 2012-130 (2012).

177 2014 Consolidated Report at 94; the Final Report of the Task Force was released in October 2013.

178 34 D.C. Code §§ 1311.01, *et seq*. (2014).

179 Joint Application of Potomac Electric Power Company and the District Department of Transportation for Approval of the Triennial Underground Infrastructure Improvement Projects Plan, Formal Case No. 1116, at 3, filed June 17, 2014 ("Joint Application").

180 2014 Consolidated Report at 95.

181 2014 Consolidated Report at 95.

182 2014 Consolidated Report at 95.

183 2014 Consolidated Report at 97.

overvoltage due to lightning strikes, Pepco is also upgrading its lightning arresters to meet new standards.[184]

71. Pepco's approach to Distribution Automation ("DA"), which is one aspect of its comprehensive smart grid strategy, is to install advanced control systems to automatically identify and isolate faults in real time and promptly restore service to customers in the unaffected parts of its system.[185] There are three elements to Pepco's effort: fault identification and isolation, service restoration, and system/data management.[186] The DA devices connect to the overall Pepco network through a wireless mesh network.[187] Pepco has signed a short-term contract with a public wireless provider to obtain broadband services and, in 2013, was engaged in evaluating and testing longer-term solutions for a private broadband network.[188] Pepco also has constructed and continues to expand its fiber optic network, which is used for communicating between substations, and between substations and its control center.[189]

72. Pepco uses power flow and GIS systems to model system loading in an effort to predict and identify overload situations, and to develop recommended mitigation plans, so that single contingencies *(i.e.*, loss of a single substation power transformer and/or its associated supply feeder) will not overload its system.[190] In doing this, Pepco reflects its latest system configuration and projects forward, in conjunction with forecasts of the PJM system operator, up to ten years, for transmission planning purposes.[191] Load growth trends on the overhead distribution system are studied by regions or areas in order to develop individual feeder and substation forecasts.[192] These forecasts are based on load factors and historical trends that were established for that area.[193] Network [*e.g.*, underground] load growth is studied in a similar fashion and trends are identified based on historical load information over the past several years.[194] When load growth is projected to cause a particular network system to exceed the group capacity or individual feeder capacity, load transfers to other area networks are

184 2014 Consolidated Report at 97.

185 2014 Consolidated Report at 98.

186 2014 Consolidated Report at 98.

187 2014 Consolidated Report at 99.

188 2014 Consolidated Report at 99.

189 2014 Consolidated Report at 99.

190 2014 Consolidated Report at 101.

191 2014 Consolidated Report at 100.

192 2014 Consolidated Report at 100.

193 2014 Consolidated Report at 100.

194 2014 Consolidated Report at 100.

examined.[195] Load flow studies are conducted biennially (addressing approximately half of the network system each year) to confirm adequate capacity of cables and transformers.[196]

73. Pepco's 2013 actual and 2014 projected REP budget amounts, categorized by each element of the REP, are shown, below:

Table F: Pepco Reliability Enhancement Work Plan Budgets (2013-2014)

REP Element	2013 Budgeted	2013 Actual	2014 Budgeted
Vegetation Management	$ 2,218.342	$ 2,352,567	$ 2,113,300
Feeder Improvement	$ 37,825,244	$ 34,707,170	$ 38,006,054
Selective Undergrounding	$ 3,104,197	0	0
URD Cable Replace/Enhance	$ 465,004	$ 541,759	$ 471,203
Distribution Automation	$ 10,382,257	$ 5,989,221	$ 9,689,165
Conversions	$ 14,751,658	$ 9,394,129	$ 22,412,777
Load Growth	$ 37,020,814	$ 36,634,850	$ 78,021,448
TOTAL	**$105,767,516**	**$ 89,619,696**	**$150,713,947**

Source: Pepco 2014 Consolidated Report at 107.

74. Pepco planned to undertake the following projects under its REP: three feeder improvement projects,[197] two URD replacement and enhancement projects;[198] 20 distribution automation projects,[199] five conversion projects,[200] and 44 projects characterized as load growth.[201]

75. Pepco uses a number of different metrics to measure reliability improvements through these projects: District-wide SAIFI and SAIDI, miles of feeders over which vegetation management has been performed, number of ASR systems installed, annual number of URD cable failures, and annual tree-related SAIFI/SAIDI performance.[202] Pepco measures these improvements against calendar year 2010 base year performance. Excluding IEEE Major Event Days in the District, Pepco's reliability performance in the District is depicted below.[203]

195 2014 Consolidated Report at 101.

196 2014 Consolidated Report at 101.

197 2014 Consolidated Report at 108-109.

198 2014 Consolidated Report at 108-109.

199 2014 Consolidated Report at 110-113.

200 2014 Consolidated Report at 114-115.

201 2014 Consolidated Report at 116-127.

202 2014 Consolidated Report at 153-154.

203 2013 Consolidated Report at 184, 185 and 187; 2014 Consolidated Report at 156-159.

Table G: Pepco Reliability Improvements (2010-2013)

Description	2010	2011	2012	2013	2014*
SAIFI for 2013's REP Feeders	1.87	2.16	2.13	1.77	
SAIDI for 2013's REP Feeders	264	245	305	203	
Tree-Related SAIFI	0.19	0.18	0.21	0.13	
Tree-Related SAIDI	27	25	34	17	
Number of URD Cable Failures	19	29	30	26	
Number of Substations Operating at 75%-92% of capacity	20	22	22	25	21*
Number of Substations Operating at 93%-100%+ of capacity	3	1	1	1	3*

Sources: 2013 Consolidated Report at 184, 185 and 187; 2014 Consolidated Report at 156-159;
* = projected 2014 performance

76. Pepco's REP includes a load growth component.[204] Pepco uses power flow and GIS systems to model system loading in an effort to predict and identify overload situations and to develop recommendations for their mitigation, so that single contingencies, called N-1 redundancy *(i.e.*, loss of a substation power transformer and/or its associated supply feeder) will not overload its system.[205] A comprehensive engineering process exists for gathering data, developing model inputs, and correcting any load violations generated. This process also includes updating any new loads and system modifications in the model so that the latest system configuration is reflected both presently and up to ten years forward for transmission planning.[206]

77. In 2013, Pepco undertook approximately 25 REP load growth projects in order to maintain its substation operations with design loading criteria.[207] Actual expenditures on these projects totaled $36,634,850.[208] These load growth projects individually included one or more of the following:

- Multiple 13 kV feeder extensions;
- Install over 10 miles of 69 kV cable;
- 4 kV to 13 kV feeder/load conversions;
- Re-arrange load by transferring between feeders and/or substations;
- Replacement of aging infrastructure;
- Retirement of oil-filled breakers;
- Purchase of spare transformer, installation of new transformers;
- Balance phase loading;
- Install 3-way switches;
- Begin engineering for new substation to replace Harrison Substation;

204 2014 Consolidated Report at 85.

205 2014 Consolidated Report at 101.

206 2014 Consolidated Report at 101.

207 2013 Consolidated Report at 141-154.

208 2014 Consolidated Report, REP Workplan Summary at 107.

- Continue engineering for a new substation in the Buzzard Point area;[209]

78. Pepco budgeted 25 REP load growth projects for 2013,[210] totaling $50,637,046:[211] Generally, these load growth projects include one or more of the work descriptions listed above.

g. Emergency Response Incident Plan

79. Pepco's Emergency Response Incident Plan ("ERIP") is the Company's response to a number of major storms occurring in its service territory during 2010 and the early part of 2011.[212] It represents a modification of Pepco's emergency response organization structure to help establish clearer accountability in terms of roles and responsibilities, and to make the PHI organization more consistent with the Federal Emergency Management Agency's incident response framework (known as an Incident Command System).[213] Phase 1 of the ERIP was conducted from December 2010 through July 1, 2011 and concentrated on business and process improvements in Pepco's service territory. Phase 2 of ERIP commenced in July of 2011 and was largely completed in December of 2012.[214] The ERIP programs were designed to be fully integrated into all PHI companies after a two-year period, at which time the reforms became part of PHI's business plan.[215]

80. Pepco's 2012 Consolidated Report contained a complete report on ERIP Phase 1 and its 2013 Consolidated Report contained a complete report on ERIP Phase II.[216] Pepco reports that the reforms enacted and initiatives completed under the ERIP have had a positive effect on improving Pepco's pre-planning and restoration response following major storms. According to Pepco, some of the areas demonstrating the most improvement are:[217]

- Emergency Preparedness, Weather Monitoring and Response Team Activation;
- Coordination with Emergency Management Agencies;
- Updated Emergency Operations Plan, including Pepco's November 6, 2012 Major Service Outage Restoration Plan for the District of Columbia, PHI's Crisis Management Plan, and PHI's Emergency Operations Plan;
- A scalable and flexible Service Center Storm Team structure;

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209 2013 Consolidated Report, Work Breakdown Structure – 2013 Projects, at 142-154.

210 2013 Consolidated Report, Work Breakdown Structure – 2013 Projects, at 142-154.

211 2013 Consolidated Report, REP Workplan Summary at 134.

212 2014 Consolidated Report at 161.

213 2014 Consolidated Report at 161.

214 2014 Consolidated Report at 161.

215 2014 Consolidated Report at 161.

216 2014 Consolidated Report at 162

217 2014 Consolidated Report at 162-164.

- A distributed and de-centralized planning and analysis process at Pepco Service Centers;
- Use of technology to enhance the damage assessment process;
- Relocation of the Crisis Information Center; and
- A refinement of the process used to develop and communicate Estimated Times of Restoration to Pepco's customers.

h. Storm Readiness

81. Pepco's storm readiness refers to the Company's principles that apply to assessing damage across the entire Pepco service area and the restoration guidelines that it applies to its preparedness, pre-storm planning, storm response, communications, and post-storm evaluations.[218] When major storms appear, Pepco's Regional Incident Management Team assigns personnel to a temporary management structure that will match resources to restoration requirements, so as to efficiently restore customer service, allowing restoration activities to be prioritized so that those efforts that restore the largest number of customers will be the efforts that are undertaken first.[219]

82. Pre-storm preparation is the process of preparing for mobilization of material and personnel before storms occur. Pepco begins preparation days in advance of a storm. This preparation includes reviewing its inventory of storm repair materials, notifying vendors of the potential need for material procurements, informing employees of the potential activation of their incident response second role assignments, alerting contractors, and discussing plans for possible aid from utilities within Pepco's mutual assistance groups.[220] In addition, approximately 48 hours in advance of a significant major storm with predicted multi-day outages, Pepco notifies customers who are enrolled in its Emergency Medical Equipment Notification Program so they can prepare to implement their contingency plans in the event of power outages.[221]

83. When a major storm is anticipated, Pepco can activate its High-Volume Call Answering ("HVCA") System.[222] This system is capable of answering more than 100,000 calls per hour, which reduces hold times and incidences of busy signals, and is more efficient at recording outage information in the early stage of the restoration process.[223] Once initial outage reports are in, Pepco disables the automated HVCA system and staffs its call center with additional employees, who are trained to assist the call center representatives in handling the increased volume of calls.[224] All areas in Pepco's Customer Care Group are required to provide

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218 2014 Consolidated Report at 164.

219 2014 Consolidated Report at 165.

220 2013 Consolidated Plan at 166.

221 2014 Consolidated Report at 165.

222 2014 Consolidated Report at 165.

223 2014 Consolidated Report at 165.

224 2014 Consolidated Report at 165.

support to the Call Center in these instances.[225] Pepco identifies in advance and plans for internal and external communications under these conditions, and monitors these communications for effectiveness during storm response.[226]

84. Pepco's advance planning during non-storm conditions includes drills and exercises designed to lead employees through a variety of emergency scenarios.[227] Pepco also works with local emergency management agencies and a cross-section of community, government and business leaders in a collaborative effort to review restoration plans and practices so as to develop more effective ways to improve its storm response.[228] On November 13-14, 2013, Pepco participated in the North American Electric Reliability Corporation's ("NERC") GridEx exercise. This was a North American-wide distributed-play exercise scenario to validate the current readiness of the electricity industry to respond to a security incident, incorporating lessons learned from GridEx 2011.[229] This exercise was designed to identify potential improvements in physical and cyber security plans, programs and responder skills, as well as evaluating senior leadership policy doctrine and trippers.[230] Pepco employees participated as players, controllers and simulators.[231]

85. Pepco also participated in the East Coast "CATEX" Power Restoration 2013 Workshop held on October 28-29, 2013.[232] In addition, Pepco held a Winter Preparedness Tabletop Exercise on December 6, 2013, with more than eighty participants drawn from Pepco and regional Emergency Management Agencies, such as DDOT, HSEMA, the District's Department of Public Works, 911 communication, and fire and police responders.[233]

86. Pepco's storm readiness includes a public education and awareness initiative.[234] Under this initiative, Pepco has prepared a number of written materials and provides information to the public through its website as well. Pepco prepared a brochure entitled "Weathering the Storm" which is available in English and Spanish; a series of fact sheets based on this brochure

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225 2014 Consolidated Report at 165.

226 2014 Consolidated Report a 165.

227 2014 Consolidated Report at 165.

228 2014 Consolidated Report at 165.

229 2014 Consolidated Report at 168.

230 2014 Consolidated Report at 168.

231 2014 Consolidated Report at 168.

232 2014 Consolidated Report at 168. The East Coast CATEX Power Restoration 2013 Workshop was sponsored by the Federal Emergency Management Agency's ("FEMA") Region III states (VA, DC, WV, MD, DE & PA) through FEMA's Regional Catastrophic Preparedness Grant Program. This workshop's National Capital Region Sponsor was the Director of the District's Homeland Security and Emergency Management Agency ("HSEMA").

233 2014 Consolidated Report at 168.

234 2014 Consolidated Report at 166.

are available in English, Spanish, Russian, Italian, Chinese, Korean and Vietnamese.[235] Information about Pepco's Emergency Medical Equipment Notification Program, its tree pruning, and safe operation by the public of portable electric generators is available upon request and through Pepco's website.[236] Pepco reported that a series of videos, including "What to do if the Lights Go Out", "How Power is Restored", and "Tree Management" are also available through its website or upon request.[237] Additional preparedness information, as well as neighborhood outage maps with information regarding each outage event (including Estimated Times for Restoration) **is also made available by Pepco through its website.238**

B-1. Productivity Improvement Plan (Requirements, PIWG and PIP)

87. Part 2 of the Consolidated Report consists of the Productivity Improvement Plan ("PIP"), containing four sections: 1) regulatory origins of the PIP and the Productivity Improvement Working Group ("PIWG"); 2) the PIWG; 3) the PIP; and 4) Pepco's 2013 performance. The first section discusses the origin of the PIWG and identifies Pepco, the Commission Staff, and OPC as providing the representatives which, collectively, make up the PIWG.[239] The discussion also notes that the primary focus of the PIP and PIWG has become Pepco's transmission and distribution operations, performance, and reliability[240] and that of these, reliability has recently become the Commission's designated emphasis of the Annual Consolidated Report.[241]

88. The second section describes the purpose of the PIWG, noting the PIWG is to address issues of interest to the Commission or PIWG members, and issues arising according to directives of the Commission.[242] This section also discusses the procedures applicable to scheduling and conducting PIWG meetings. Section 2.2 concludes by identifying the meeting dates for the six PIWG meetings held in 2013, identifying the dates the minutes for those minutes were filed with the Commission, and with a table (Table 2.2-B) identifying the topics considered at each of these six PIWG meetings.[243]

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235 2014 Consolidated Report at 166.

236 2014 Consolidated Report at 166.

237 2014 Consolidated Report at 166.

238 2014 Consolidated Report at 166.

239 2014 Consolidated Report at 173.

240 2014 Consolidated Report at 173.

241 *Formal Case No. 766; and Formal Case No. 991,* Order No. 16623, rel. November 30, 2011 ("Order No. 16623"), ¶ 8.

242 2014 Consolidated Report at 173.

243 2014 Consolidated Report at 175.

89. Turning to the Productivity Improvement Plan ("PIP") itself, Pepco states that in 2013, the PIP consisted of five projects, all of which strongly emphasize reliability.[244] Each of these projects is considered separately in the discussion that follows:

1. 4 kV Distribution Substation Automation Projects

90. Pepco reports that Digital Remote Terminal Units ("DRTUs") were installed at the Westmoreland Substation 93.[245] Transformer secondary protection and alarm installation work was completed at the 12th Street Substation 126 and communications equipment was installed at Substations 48, 146 and 181, to prepare the substations for fiber optic communications.[246] At the G Street Substation 28, secondary protection and alarm installation work was completed on one transformer, but similar work on another transformer was postponed for completion in 2014. In 2014, Pepco continued this focus on automating transformer secondaries, including installing feeder, bus-tie and transformer breaker protection relays, as well as alarm relays and DRTUs.[247]

2. 4kV to 13 kV Conversion Projects

91. Pepco explains that its 13 kV distribution system is capable of supplying a greater load density and generally produces less electrical losses, when compared with its 4 kV distribution system.[248] Therefore, as load density increases or its distribution system requires more maintenance, replacement becomes the best economic alternative and the 4 kV system facilities are gradually being replaced with 13 kV distribution system facilities.[249] In 2013 Pepco spent approximately $3.4 million less than its budgeted $21.9 million on 4 kV to 13 kV conversion projects.[250] Pepco explains that this deviation was a result of a cost-saving scope of work change, when it discovered usable empty conduits in the field, and permitting and work time restrictions (finding conduit breakdowns) that slowed work.[251]

92. According to Pepco, at present, there are 157 megawatts ("MW") of 4 kV load on Pepco's system, mostly in the District of Columbia.[252] The Company states that over the next ten years, approximately 57 MW (including growth) will be converted to 13 kV service.[253] This

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244 2014 Consolidated Report at 176.

245 2014 Consolidated Report at 178.

246 2014 Consolidated Report at 178.

247 2014 Consolidated Report at 178.

248 2014 Consolidated Report at 179.

249 2014 Consolidated Report at 179.

250 2014 Consolidated Report at 181.

251 2014 Consolidated Report at 181.

252 2014 Consolidated Report at 179.

253 2014 Consolidated Report at 179.

remaining 4 kV load will be located primarily in Wards 3, 7 and 8 where the load is served by substations that have either multiple transformers or are networked together through the feeder primaries.[254] Thus, there remaining 4 kV areas are considered relatively reliable.[255]

93. These 4 kV conversions will require substation transformer work at the eight substations below, over the next ten years. The first seven of these projects fall within the 2013 Productivity Improvement Plan's description of 4 kV-to-13 kV Conversion Projects. Work on the last project (G Street Substation 28) is not expected to begin until 2017. [256] Five of these seven projects were initiated prior to 2013; the Fort Carroll substation project is a new project to accelerate the conversion and retirement of this 4 kV substation so as to avoid the cost of replacing the substation's low-rated switchgear.[257] The project to convert all 4 kV load from the Twenty-third Street Substation 131 and to retire that substation was completed in 2013.[258]

Georgetown Sub. 12	NW	Underground conversion
Harvard Sub. 13	NW	Underground conversion
North Capitol Sub. 40	NE	Overhead conversion
Twelfth Street Sub. 126	SW	Underground conversion
Anacostia Sub. 8	SE	Overhead conversion
Twenty-Third Street Sub. 131	SE	Overhead conversion
Fort Carroll Sub. 130	SE	Overhead conversion
G Street Sub. 28	NE	Underground conversion

94. All of the eight conversion projects above are multi-year projects with multiple phases.[259] Pepco predicts that expenditures on these projects will fluctuate year-to-year to account for project phasing.[260] Total spending on these conversion projects in 2014 is budgeted to be higher than it was in 2013.[261]

95. In addition to the above conversion projects (which will occur downstream of the identified substations) the 2014 PIP includes the retirement of two 4 kV transformers and the retirement of 4kV switchgear at the Harrison Substation.[262] This will convert half the substation's 4 kV load to 13 kV and Pepco will transfer the remaining half of the existing 4 kV

254 2014 Consolidated Report at 179.

255 2014 Consolidated Report at 179.

256 2014 Consolidated Report at 180.

257 2014 Consolidated Report at 180.

258 2014 Consolidated Report at 180.

259 2014 Consolidated Report at 180.

260 2014 Consolidated Report at 180.

261 2014 Consolidated Report at 180.

262 2014 Consolidated Report at 188-189.

load to its Oliver Street Substation. [263] With this, all facilities at the Harrison Substation 38 will be retired.

96. Tables H and I below provide Pepco's estimated cost for all of these PIP projects.

Table H: Pepco's Projected Expenditures, 4 kV-to-13 kV PIP Conversion Projects

Substation	2014 $	2015 $	2016 $	2017 $	2018 $	Total $
Georgetown	4,804,000	4,969,000	4,715,000	5,000,000	0	19,488,000
Harvard	7,426,000	6,184,000	5,477,000	7,165,000	3,207,000	29,459,000
N. Capitol	2,401,000	1,030,000	1,117,000	2,401,000	0	6,949,000
12th Street	4,781,000	6,678,000	6,744,000	4,000,000	0	22,303,000
Anacostia	2,000,000	2,000,000	0	0	0	4,000,000
23rd Street	0	0	0	0	0	0
Harrison	5,234,000	0	0	0	0	5,234,000
Fort Carroll	3,000,000	3,000,000	1,000	0	0	6,001,000
G Street	0	0	0	?	?	?
TOTAL	**29,646,000**	**23,861,000**	**18,054,000**	**18,566,000**	**3,207,000**	**93,334,000**

Source: 2014 Consolidated Report a 182-185, 187-190.

Table I: Year-End 2013 Status of Pepco's 4 kV-to-13 kV PIP Conversion Projects

Substation	Description	2013 Budget Amount	2013 Actual Amount	Target In-Service Date
Georgetown	Trunks of three 13 kV feeders were extended, two half loops have been built; 3 MVA of load has been converted and conduit has been built.	4,100,000	3,529,000	June 2017
Harvard	Extended main trunk of two 13 kV feeders, conduit built, lateral extensions begun, and 3 MVA of load converted	6,019,000	4,196,000	December 2018
N. Capitol	13 kV trunk completed and 2 MVA of load converted	887,000	1,248,000	December 2017
12th Street	Two 13 kV feeders extended	4,627,000	1,669,000	December 2017
Anacostia	1.2 MVA of load converted to 13 kV	495,000	287,000	December 2015
23rd Street	Equipment removal occurred and projected completed	0	237,000	December 2013
Harrison	Feeder extension begun, conduit construction begun	5,715,000	7,373,000	December 2014
Fort Carroll	Construction to begin in 2014, completion targeted for 2014 with some ancillary clean-up work possible in 2016	0	0	December 2015 – early 2016
G Street	Construction to begin in 2017	0	0	
TOTAL		**21,843,000**	**18,539,000**	

Source: 2014 Consolidated Report at 182-190.

[263] 2014 Consolidated Report at 188-189.

3. Distribution Automation ("DA") Projects

97. The PIP DA projects are also included in Pepco's REP DA program.[264] The PIP DA projects address Pepco's implementation of DA technology to improve service reliability.[265] DA is the conversion of a manually operated distribution system characterized by limited remote data collection and system control ability, to a system that not only is fully automated, but also performs operations totally independent of any human intervention[266] Advancements in technologies have made these automation activities practical for the lower voltage systems and will significantly change the way Pepco will respond to outages and restore electric system.[267] All DA ASR projects for 19 feeders funded under the Smart Grid Investment Grant have been completed and plans for ASR installations for an additional nine feeders located in the Anacostia area were terminated with the Commission's approval, in F.C. 1116, of the joint Pepco/DDOT Underground Infrastructure Projects Plan.[268]

4. Selective Undergrounding Projects

98. Selective undergrounding is also an element of Pepco's REP.[269] As explained in our discussion of Pepco's REP above, Pepco temporarily suspended its selective undergrounding program in 2012 and 2013. For 2014, Pepco has also suspended selective undergrounding, in favor of the undergrounding projects described in its joint application with DDOT, for Commission approval of its Underground Infrastructure Projects Plan, subsequently approved by Commission order issued in Formal Case No. 1116.[270]

5. Priority Feeder Projects

99. PIP Priority Feeder Projects are also included in its REP, as part of the Company's Feeder Improvement Program. These projects are discussed extensively in our consideration of Part 4 of the PIP, "Performance" immediately below. Pepco's actual expenditures to implement corrective action plans on its 2013 Priority Feeders totaled $19,230,629, which is $3,378,828 above its budgeted amount.[271]

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264 2014 Consolidated Report at 190.

265 2014 Consolidated Report at 190.

266 2014 Consolidated Report at 190.

267 2014 Consolidated Report at 190.

268 2014 Consolidated Report at 190.

269 2014 Consolidated Report at 190-191.

270 *Formal Case No. 1116, In the Matter of the Application for Approval of Triennial Underground Infrastructure Improvement Projects Plan, Order No. 17697,* rel. November 12, 2014 ("Order No. 17697").

271 2014 Consolidated Report at 191.

B-2. Productivity Improvement Plan (Performance)

100. Section 4 of the PIP (Section 2.4), describes the 2013 performance of Pepco's distribution system. This description is in seven parts, each of which is discussed immediately below:

1. Priority Feeders and Aggressive Initiatives

101. Based upon outage data from the period October 1, 2012 through September 30, 2013,[272] Pepco selected two sets of the least reliable two percent of its District feeders, ("2% High Priority Feeders") using a "New Method" and a "CPI Method", respectively, to rank feeder outage performance.[273] The New Method calculates a value for each feeder that is the sum of 75% of the feeder's SAIFI and 25% of the feeder's SAIDI.[274] The CPI Method is the method historically used by Pepco to identify 2% High Priority Feeders and is a four-part formula that is determined by evaluating, for each feeder: the number of feeder interruptions, number of hours of customer interruptions, SAIFI, and SAIDI.[275] The 16 feeders that were selected as 2013 2% High Priority Feeders under each method are shown in Table J, below:

Table J: Pepco's 2014 2% High Priority Feeders
(Selected by "New Method" and "CPI Method" Using 2013 Outage Data)

Rank-New Method / CPI Method (1=Least Reliable)	Feeder No.	Ward	Neighborhoods	Customer Count	Prior Priority Feeder Designations
Feeders Selected Under Both New Method and CPI Method					
2 / 9	15867	3	Cleveland Park, Forest Hills, Massachusetts Avenue Heights, North Cleveland Park, Rock Creek Park 2, Woodley	634	n/a
3 / 6	15130	7	Fort Dupont Park, Marshall Heights	1,916	n/a
4 / 16	15021	4	Brightwood, Chillum, Petworth, Shepherd Park	2,077	n/a
5 / 14	15009	4	Brightwood, Chillum	1,402	2005, 2009, 2012
6 / 1	15207 R	2	Old City 2	1,424	n/a
7 / 7	15173	8	Randle Heights	519	n/a
8 / 11	212	6	Old City 1	565	n/a
9 / 8	14753	8	Congress Heights, DC Village	801	n/a

[272] The 2014 Consolidated Report erroneously identifies its priority feeder selection as being 2013 priority feeders and that feeder selection was based on 2011-2012 outage data. This erroneous language is a word-for-word repetition of the language in its 2013 Consolidated Report. Accordingly, the Commission is construing this as a typographical error on Pepco's part and assumes that the 2014 Priority Feeders were selected using 2012-2013 outage data, as we state in our discussion. *See* 2013 Consolidated Report at 229-230 in comparison with 2014 Consolidated Report at 193.

[273] 2014 Consolidated Report at 193.

[274] 2014 Consolidated Report at 193.

[275] 2014 Consolidated Report at 193.

10 / 5	14136	3	Cleveland Park, Glover Park, North Cleveland Park, Observatory Circle	1,022	2010, 2012
11 / 4	14031	7	Hillcrest	1,175	n/a
12 / 12	15171	8	Congress Heights, Randle Heights	1,436	n/a
13 / 3	15085	8	Congress Heights, Randle Heights	1,561	`n/a
14 / 13	15199	4	Brightwood, Shepherd Park, Takoma Park	1,969	2001, 2004, 2010, 2012
15 / 2	14717	7	DC Stadium, Deanwood, Lily Ponds	2,023	2001, 2003, 2009, 2012
16 / 10	14758	8	Bolling Air Force Base, Congress Heights, DC Village	2,110	2003, 2012
Feeders Selected Under New Method Only					
1	53	5	Brookland , Columbia Heights	419	n/a
Feeders Selected Under CPI Method Only					
15	177	8	Anacostia	322	N/A

Source: 2014 Consolidated Report at 213, Table 2.4-A.

102. The 2% High Priority Feeder Program is an enhanced initiative that includes not only the reliability work routinely performed, but also includes more aggressive initiatives, including (for overhead feeders) one or more of the following:[276]

a. Installation of tree wire to replace bare wire through heavily treed areas where aggressive tree pruning and standard cross-arm construction would have limited success, or is restricted by ordinance or property owners;

b. Installation of Pre-Assembled Ariel Cable ("PAC") for use as the main trunk of the feeder, with the existing mainline reconfigured as fused laterals;

c. Installation of automatic circuit reclosers ("ACR") in a loop scheme configuration to automatically sectionalize faulted sections of the feeder and provide automatic backup to unfaulted sections; and

d. Installation of remote operated load break switches into the loop scheme configuration with the automatic circuit reclosers.

103. Pepco's aggressive initiatives applicable to high priority underground feeders in the 4kV system are:[277]

a. Perform Very Low Frequency ("VLF") testing and manhole inspections;

b. Install tap-holes (switch points) at key locations to improve the ability to isolate problems, as well as improving the ability to restore customers following an outage event; and

c. Perform a review of the failure history of the area of each failure, and compare failure locations to replacement history, leading to proactive cable replacement of stretches that were not previously replaced in the area.

104. Pepco's aggressive initiatives for the 13kV underground system are:[278]

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[276] 2014 Consolidated Report at 198-199.

[277] 2014 Consolidated Report at 199.

a. Perform Very Low Frequency ("VLF") testing and manhole inspections;

b. Perform a review of the failure history of the area of each failure, and compare failure locations to replacement history, leading to proactive cable replacement of stretches that were not previously replaced in the area; and

c. Replace all problem sections of the underground cable.

2. Reliability Statistics

105. In Section 2.4.2 of its 2013 Consolidated Report, Pepco presents five-year (2009–2013) reliability statistics for, respectively, its combined District and Maryland electric distribution system and also for its electric distribution system in the District alone. To reflect system performance under normal operating conditions, Pepco calculates its reliability indices to exclude power outages associated with significant events.[279] The specific indices used by Pepco for this purpose are:

SAIFI – System Average Interruption Frequency Index – designed to give information about the average frequency of sustained interruptions[280] per customer served in a pre-defined area;

SAIDI – System Average Interruption Duration Index – designed to provide information about the average time (in aggregate) that the customers served in a pre-defined area are interrupted; and

CAIDI – Customer Average Interruption Duration Index – designed to provide information about the average time required to restore service to the average customer experiencing a sustained interruption.

Pepco's District-only, five-year reliability performance under these indices (excluding Major Service Outages) is shown in the series of figures below:[281]

Figure 1:
Pepco's 5-Year SAIFI
(2009-2013)

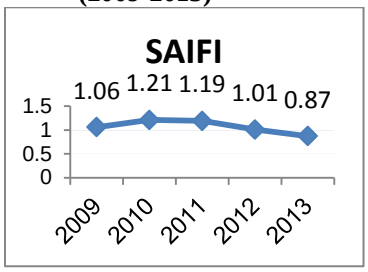


Figure 2:
Pepco's 5-Year SAIDI - hrs
(2009-2013)

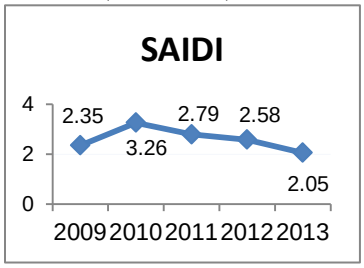
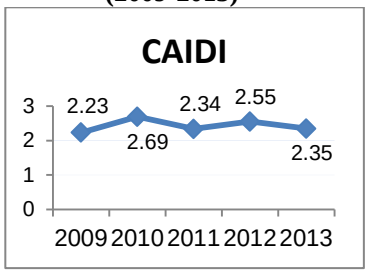


Figure 3:
Pepco's 5-Year CAIDI - hrs
(2009-2013)



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278 2014 Consolidated Report at 200.

279 For purposes of its Annual Consolidated Reports, these excluded significant events would be either District Major Service Outages or District-only Major Event Days.

280 A sustained interruption in electrical service is an interruption of five minutes or longer. *See 15 DCMR § 3699* (2008).

281 2014 Consolidated Report at 277, Table 2.4-F2.

106. Pepco provided SAIFI and SAIDI values for its District system, both including and excluding feeders that extend across the District-Maryland jurisdictional border (*e.g.*, "cross-border feeders").[282] Pepco reported these indices in the alternative, using different exclusions for outages associated with significant events (first, excluding Major Event Days and second, excluding both Major Service Outages and the Maryland Public Service Commission's form of exclusion for significant events – "COMAR MED"). Under both forms of presentation, 2013 SAIFI and SAIDI values improved when cross-border feeders are disregarded in the calculation of these indices (see Table J, below).[283] According to Pepco, there are 81 cross-border feeders on its overall system, 27 of which are underground feeders.[284] Pepco reports that 10 of these 27 underground cross-border feeders are exclusively dedicated to serving the electric load of the Washington Metropolitan Area Transit Authority's subway system.[285]

Table K: Pepco's 2013 SAIFI/SAIDI
Including/Excluding Cross Border Feeders

Excluding Outages on Major Event Days		
All	SAIFI – 0.87	SAIDI – 2.05 hours
Excluding cross-border feeders	SAIFI – 0.83	SAIDI – 2.01 hours
Excluding District MSO & MD-PSC COMAR Major Event Days		
All	SAIFI – 0.87	SAIDI – 2.05 hours
Excluding cross-border feeders	SAIFI – 0.83	SAIDI – 2.01 hours

Source: Pepco 2014 Consolidated Report at 278, Table 2.4-F4.

3. Neighborhood Analysis

107. Beginning with the 2013 Consolidated Report, Pepco re-defined its description of District neighborhoods to conform to the assessment neighborhoods defined by the District's Office of Tax and Revenue's Real Property Tax Administration.[286] Pepco is doing this in order to take advantage of the availability of these neighborhood descriptions, electronically, through a GIS file.[287] In so doing, Pepco has automated the process of assigning neighborhood identifications to outage locations, a process that the Company previously undertook manually.[288] For this reason, certain of the neighborhood descriptions associated with a given feeder are different from what Pepco previously described to the Commission.[289]

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282 2014 Consolidated Report at 278, Table 2.4-F4.

283 2014 Consolidated Report at 278, Table 2.4-F4.

284 2014 Consolidated Report at 279-280, Tables 2.4-F5 and 2.4-F6.

285 2014 Consolidated Report at 279-280, Tables 2.4-F5 and 2.4-F6.

286 2014 Consolidated Report at 281.

287 2014 Consolidated Report at 281.

288 2014 Consolidated Report at 281.

289 2014 Consolidated Report at 281.

108. In Order No. 16623, the Commission approved Pepco's 2011 Annual Consolidated Report, with conditions.[290] Certain of these conditions require Pepco to report infrastructure improvement due to increased load growth and other data on a neighborhood basis.[291] Pepco lists these conditions at pages 282 and 283 of its 2014 Consolidated Report. In addition, Order No. 16975 includes directives that require Pepco to report neighborhood data. Pepco's 2014 Consolidated Report responds to these directives in the following fashions:

a. Pepco identifies the Mt. Vernon Square/Convention Center and NoMa neighborhood, the Washington Navy Yard/Southwest neighborhood, the St. Elizabeths Hospital neighborhood and the Columbia Heights neighborhood, as the four areas where it is undertaking infrastructure improvements due to load growth.[292]

b. Pepco indicates that certain neighborhoods will experience decreased spending in 2014 on 4 kV to 13 kV conversions, when compared against similar spending in 2012 and 2013. The portions of Anacostia and Randle Heights served by Pepco's Substation 8 will see little such spending in 2014 because prior conversion projects are now completed. However, work (feeder extensions) will re-commence for completion in 2015, once the engineering and design work is completed.[293]

c. At Table 2.4-G Pepco lists the feeders that have appeared more than once on its 2% High Priority Feeder list, the years they appeared, and the neighborhoods served by these repeat priority feeders.[294]

109. Pepco concludes its presentation of neighborhood reliability data with two tables and a related analysis that identify a total of 13 feeders associated with the neighborhoods in each Ward of the District that are most susceptible to power outages.[295] In making these neighborhood identifications, Pepco uses two different metrics, as required in Order No. 16975: number of sustained outages (excluding Major Service Outages and excluding planned outages); and customer minutes of interruption (excluding Major Service Outages and including planned outages.)[296] The results are shown in Tables L and M, below:

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290 *Formal Case No. 766; and Formal Case No. 991,* Order No. 16623 (rel. November 30, 2011) ("Order No. 16623").

291 Order No. 16623, ¶¶ 34-35, 46, 55 and 60.

292 2014 Consolidated Report at 284-285.

293 2014 Consolidated Report at 285.

294 2014 Consolidated Report at 286.

295 2014 Consolidated Report at 287-291.

296 Order No. 16975,t ¶ 83.

Table L: Neighborhoods in Each Ward Determined Most Susceptible to Power Outages (Oct. 1, 2012 – Sept. 30, 2013; No. of Feeder Outages/Contribution to SAIFI)

Ward No.	Feeder No.	Neighborhoods	No. of Outages	Feeder SAIFI	% of System SAIFI	UG/ OH
1	14731	Kalorama, Mt. Pleasant, National Zoo, Old City 2	14	1.435	1.70%	UG
2	15204R	Old City 2	5	4.039	1.88%	UG
3	14136	Cleveland Park, Glover Park, N. Cleveland Park, Observatory Circle	9	5.131	2.58%	OH
4	15021	Brightwood, Chillum, Petworth, Shepherd Park	24	2.049	2.09%	OH
5	14014	Brookland, Woodridge	27	3.43	3.53%	OH
6	14787	Brentwood, Capitol Hill, Old City 1, Old City 2	9	1.434	1.02%	UG
7	15710	DC Stadium, Deanwood, Fort DuPont Park, Lily Ponds	21	5.057	5.06%	OH
8	15174	Randle Heights	22	4.039	4.51%	OH

Source: 2014 Consolidated Report at 289, Table 2.4-H1.

Table M: Neighborhoods in Each Ward Determined Most Susceptible to Power Outages (Oct. 1, 2012 – Sept. 30, 2013; Customer Minutes of Interruption/Contribution to SAIDI)

Ward No.	Feeder No.	Neighborhoods	No. of Outages	Feeder SAIDI	% of System SAIDI	UG/ OH
1	15207R	Old City 2	16	1260.67	5.21%	UG
2	15204R	Old City 2Old city 2	6	805.48	2.22%	UG
3	15801	Foxhall, Georgetown, Kent, Palisades	54	439.96	1.27%	OH
4	15199	Brightwood, Shepherd Park, Takoma Park	29	174.78	1.00%	OH
5	14014	Brookland, Woodridge	76	554.93	3.25%	OH
6	14713	DC Stadium, Old City 1, Trinidad	43	200.06	1.89%	UG
7	15710	DC Stadium, Deanwood, Fort DuPont Park, Lily Ponds	30	609.87	3.60%	OH
8	15085	Congress Heights, Randle Heights	27	443.35	2.01%	OH

Source: 2014 Consolidated Report at 290, Table 2.4-H2.

110. Pepco states that all 13 of the above feeders are also selected and reported through other evaluation methods and are included for remediation as part of either its 2014 Equipment Failure Analysis initiative, the REP Feeder Improvement program, the 2014 Priority Feeder program, PILC Replacement Strategy, the Georgetown conversion project or the 2014 REP Feeder Improvement program.[297]

4. Equipment Failure Rates

111. The 2014 Consolidated Report provides an analysis of the top three 2013 equipment failure causes, when measured according the number of customers losing power from these outages.[298] These are, in descending order, 281 cable failures (affecting 33,643 customers in total), 158 connections failures (affecting 15,113 customers in total) and 106 transformer failures (affecting 9,075 customers in total).[299] Pepco's analysis of these 281 cable failures revealed that 60% of the customers affected by cable failures were fed by 11 feeders.[300] Eight of

297 2014 Consolidated Report at 291.

298 2014 Consolidated Report at 295-303.

299 2014 Consolidated Report at 295, Table 2.4-I2.

300 2014 Consolidated Report at 296.

these feeders are being addressed through the REP program (priority feeder work) and for the remaining feeders, Pepco concluded that no further [remedial] action is required.[301]

112. Pepco's analysis of the 158 connection failures revealed that 80% of the customers impacted by connection failures can be attributed to seven events on the main trunks of seven feeders.[302] Four of these seven events were attributed to breaker operation, two events were attributed to load breaker switch operation, where faulty connections were found to be the root cause, and one event was attributed to a connection failure while crews were working on the feeder.[303] Five of these seven feeders either had recent reliability work performed or are scheduled for work under Pepco's 2014 REP.[304]

113. Pepco states that there were 106 transformer failure events during the reporting period.[305] 80% of the customers impacted by these failures were, collectively, served by 12 feeders on which, collectively, 13 events occurred.[306]

114. Overall, most of the issues that contributed to the top three equipment failure modes during the evaluation period have been or are scheduled to be addressed under various elements of the REP.[307] Pepco states that from equipment-related SAIFI decreased each year, beginning in 2012 (2011 – 0.504, 2012 – 0.42 and 2013 – 0.367).[308]

5. Outage Causes

115. The Consolidated Report lists eight (8) main outage causes from Pepco's Outage Management System: (1) Animal (outages caused by contact between birds or small animals and the distribution system); (2) Equipment Failure; (3) Equipment Hit (*e.g.*, cable cuts and motor vehicle hits); (4) Other (*e.g.*, employee error, fire, loss of power source, and vandalism); (5) Overload; (6) Tree (includes outside ROW – Limb, Outside ROW – Down, Inside ROW – Limb, and Inside ROW – Down; (7) Unknown (the field responder did not know the cause of the outage); and (8) Weather (*e.g.*, flood, ice, lightning, and wind).[309]

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301 2014 Consolidated Report at 296.

302 2014 Consolidated Report at 298.

303 2014 Consolidated Report at 298.

304 2014 Consolidated Report at 299.

305 2014 Consolidated Report at 300.

306 2014 Consolidated Report at 300.

307 2014 Consolidated Report at 302.

308 2014 Consolidated Report at 302, Figure 2.4-B.

309 2014 Consolidated Report at 308, Table 2.4-N1.

116. Pepco's Tables 2.4-N1 analyzes its District power outages occurring in 2013, by these eight causes.[310] Table 2.4-N2 analyzes all of Pepco's equipment-related outages occurring in the District in 2013, according to equipment type and differentiating between outages on its primary and secondary distribution systems.[311] These analyses show that during 2013, 1,966 outage events occurred in the District (a reduction from 2012's 2,712 outage events); of these, 944 were equipment-related outages. The greatest number of equipment-related outages were caused by primary cable failures (156), followed by secondary cable failures (151), loose connections on secondary equipment (136), primary transformer failures (113), and secondary meter failures (100).[312]

117. The 2014 Consolidated Report displays the outage cause options from which Pepco's field crews select, when entering data into Pepco's Advantex Mobile application, at the time of restoration.[313] Crews have the ability to enter the event restoration information through drop-down menus, as well as any additional information through a free form text field.[314] The outage cause selections are later classified into categories for reporting purposes.[315] Pepco states that "[t]he most common causes of power outages are equipment failures and vegetation-related."[316] High winds, heavy rain, snow, and ice, for example, can cause trees or branches to topple on power lines which can cause short circuits and blown fuses.[317]

118. Pepco notes that there are several different equipment types that fall under the "Equipment Failure" category; one being fuse-related outages. If the fuse blows, it is not an equipment failure, but rather the fuse is performing its designed function. Thus, "there are fewer actual 'Equipment Failures' than are captured by the Company's Outage Management System "OMS")."[318]

119. In further explaining the "Unknown" category, Pepco states that besides indicating that the field responder did not know the cause of the outage, the designation "is used most frequently where a service interruption results from the operation of a protective device such as a fuse or recloser."[319] These devices protect the distribution system from damage by

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310 2014 Consolidated Report at 308, Table N2.4-N1. Since no Major Service Outages occurred in 2013, Pepco found it unnecessary to report this information both including and excluding Major Service Outages.

311 2014 Consolidated Report at 309.

312 2014 Consolidated Report at 309, Table 2.4-N2.

313 2014 Consolidated Report at 304 and 305, Table 2.4-M.

314 2014 Consolidated Report at 304.

315 2014 Consolidated Report at 304.

316 2014 Consolidated Report at 307.

317 2014 Consolidated Report at 307.

318 2014 Consolidated Report at 307.

319 2014 Consolidated Report at 307.

sensing a fault current and activating a break in the flow of the current. If the device holds (no fault current is detected), the field responder may report "Equipment Failure" or "Unknown" as a cause and move on to the next trouble call assigned. However, the operation of these protective devices is not considered "equipment failures" because they are operating correctly.[320]

6. Vegetation Management Budget and Pruning, and Tree-Related Outages

120. Pepco submitted Table 2.4-P1 to list each feeder pruned in 2013, the associated Ward(s), and the dates that pruning was completed on the respective listed feeders.[321] Altogether, Pepco pruned along 117 feeders in 2013.[322] Pepco's tree-related outages in 2013 are listed in Table 2.4-P2.[323] This table lists 258 tree-related outages occurring both within and outside of Pepco's overhead power line right-of-way and on its primary and secondary distribution systems facilities.

121. Table N, below, presents Pepco's budgeted and actual VM operating and maintenance ("O&M") expenses for the period 2006-2013, and budgeted VM O&M expenses with a projected reduction when comparing the 2014-2016 annual budgets with Pepco's 2013 vegetation management budget.[324]

Table N: Pepco's District O&M Expenses for Vegetation Management (2006-2016)

Description	2006 ($)	2007 ($)	2008 ($)	2009 ($)	2010 ($)	2011 ($)	2012 ($)
Budgeted	1,577,896	1,352,987	1,163,390	1,264,608	1,145,246	1,668,154	2,218,154
Actual	1,017,779	931,453	993,124	1,022,366	1,197,382	1,585,406	1,981,233
Variance	560,117	421,534	170,266	242,242	(52,136)	82,748	236,921
	2013	**2014**	**2015**	**2016**			
Budgeted	2,218,342	2,113,300	2,155,566	2,198,677			
Actual	2.352,567						
Variance	(134,225)						
Note: ( ) denotes over-spending budgeted amount.							

Source: 2014 Consolidated Report at 312, Table 2.4-01.

122. Pepco explains that from 2006 to 2010, the Company mainly removed the minimal vegetation that was required to represent the equivalent of two years' growth.[325] Pepco further indicates that the "two-year trim cycle of approximately 330 overhead line miles annually was able to be achieved at an average annual spend of $1,033,000 during this period. From 2006

320 2014 Consolidated Report at 307.

321 2014 Consolidated Report at 314-316.

322 This number is found by summing the number of feeders listed in Table 2.4-P1.

323 2014 Consolidated Report at 317-322.

324 2014 Consolidated Report at 312.

325 2014 Consolidated Report at 310.

to 2010 the budget was slowly reduced to better reflect the actual rate of expenditures required to complete the work."[326]

123. The Company explains that beginning in late 2010 and 2011 it recognized that it needed to substantially increase the amount of vegetation that was removed, including targeting hazard trees and overhanging tree limbs, as part of the annual trim cycle in order to improve both blue-sky as well as storm reliability.[327] In response to this realization, "both the budget and the spending increased in 2011," with "the amount spent in 2011 at $1,585,406, while short of the budget, was a 50% increase in what had been spent annually over the previous five years."[328] Pepco attributes the shortfall in the budgeted amount in 2011 to "the ramp-up time required to bring acquire and train additional contract arborist planners and contract tree-trimming personnel to achieve the new higher level of vegetation removal."[329]

124. Pepco asserts that, in 2012, actual O&M VM expenditures increased an additional 25% over 2011 and 90% over the average annual spending over the period of 2006-2010, and that while Pepco spent 10% less "than its full O&M maintenance trim budget, primarily due to the increase in capital reliability overhead line rebuilding work that occurred in 2012," the total budget (including capital spending on tree pruning) was under-spent by less than 0.3%.[330]

7. Electricity Quality of Service Standards ("EQSS")

125. Chapter 36 of the Commission's Rules contains Electrical Quality of Service Standards ("EQSS") to which Pepco is subject.[331] These rules impose reliability performance standards in outage restoration and other activities associated with the reliability of Pepco's electric distribution service in the District; they also impose reporting requirements with respect to various incidents and outages. In its 2014 Consolidated Report, Pepco includes a table that lists each of these rules, describes the standard imposed by the rule, indicates the number of events in 2013 that invoked the applicable rule, measures its compliance with the rule (up to 100% compliant) and describes its corrective actions following any failure to meet the applicable standard.[332] Specifically, the EQSS standards address:

a. Reporting Requirements for Service Outages, Incidents and Power Quality;

b. Complaints (15 D.C.M.R. §§ 3601.2-3601.23);

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326 2014 Consolidated Report at 311.

327 2014 Consolidated Report at 311.

328 2014 Consolidated Report at 311.

329 2014 Consolidated Report at 311.

330 2014 Consolidated Report at 311. Pepco also explains that its "VM program includes increased trimming above all three-phase and single-phase lines. For three-phase it also includes the removal (with permission) of any limbs identified by our Arborist planners that have a probability of breaking and falling into the conductors."

331 *15 DCMR §§ 3601.2-3604.7* (2008).

332 2014 Consolidated Report at 325-329.

c. Customer Service Standards (15 D.C.M.R. §§ 3602.1-3602.22);

d. Reliability Standards (15 D.C.M.R. §§ 3603.1-3603.17); and

e. Billing Error Notification (15 D.C.M.R. §§ 3604.1-3604.7).

126. In 2011, Pepco achieved 95% compliance with the standard applicable to completing installation of new residential service requests: "The utility shall complete installation of new residential service requests within ten (10) business days of the start date for the new installation."[333] As a consequence, Pepco was required to adopt and report on a corrective action plan to improve performance under this standard.[334] However, for each quarter of 2013, Pepco achieved 100% compliance for this standard.[335]

127. Under the Commission's EQSS standards, Pepco is required to restore power within 24 hours for power outages that constitute non-major service outages.[336] It is also required to report in its Annual Consolidated Report the number and percentages of outages that extended beyond this 24 standard, and the causes for the extended outages.[337] In 2013, Pepco exceeded this 24-hour restoration period in regards to 5 of 365 Non-Major Service Outages.[338] Pepco states that these 5 events were associated with "Super-storm Sandy's" arrival in the District; despite the severity of that storm, it failed to qualify as a Major Service Outage.[339] Pepco's rate of compliance with this EQSS standard (99%) is presented in Table 2.4-R[340] and its detailed description is presented in Table 2.4-S.[341]

C. Manhole Event Report and Underground Failure Analysis

128. The third section of Pepco's 2014 Consolidated Report consists of two parts: first, the Company's Manhole Event Report; and second, Pepco's Underground Failure Analysis.[342]

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333 *15 DCMR § 3602.14* (2008).

334 2014 Consolidated Report at 330.

335 2014 Consolidated Report at 330, Table 2.4-Q.

336 *15 DCMR § 3603.7* (2012).

337 *15 DCMR § 3603.8* (2012).

338 2014 Consolidated Report at 331.

339 2014 Consolidated Report at 331.

340 2014 Consolidated Report at 331.

341 2014 Consolidated Report at 332.

342 The original Failure Analysis Study was completed in January 2004, and updated in May 2006, for the purpose of determining the cause of underground failure rates experienced in 2003 and thereafter. On July 23, 2012, Pepco filed its update to the Failure Analysis Study, prepared by its consultant, O'Neil Management Consulting LLC. Pepco's 2012 update identified two key findings: (1) that Primary Paper Insulated Lead Covered (PILC) cable and joints are sensitive to load and rain, especially when load rises rapidly in the presence of rain; and (2) that secondary cable of all types is sensitive to rain, snow melt, and interaction with load, especially at temperatures below 35 degrees Fahrenheit, when salt is likely to be applied heavily. Order No. 16975, ¶ 66.

For these purposes, a manhole event is defined as a smoking manhole, a manhole explosion or a manhole fire.[343] Pepco's 2013 manhole events are summarized in the following table:[344]

Table O: Pepco Manhole Events – 2013

Description	All	13 kV	4 kV	34 kV	69 kV	Primary	Secondary	Non-Pepco
Smoking Manholes	37	34	3			8	26	
Explosions	19	13	4	1	1	17	2	
TOTAL	56	47	7	1	1	25	28	3

Source 2014 Consolidated Report at 342, Figure 3.5 and Appendix 3A at 370-372, Table 3A

129. As in previous years, most smoking manhole Reportable Events ("RE") occurred on the secondary system, while most manhole explosions occurred on primary equipment.[345] The causes of these events are shown in Pepco's Underground Failure analysis, and fall into one of three categories: equipment failures, outages, or reportable events (*i.e.*, an explosion, fire, or smoke in a manhole).[346] Not all equipment failures result in customer outages due to redundancy, especially on secondary networks. Each secondary network is fed by multiple primary feeders and each customer can be fed from multiple transformers and secondary mains.[347]

130. Pepco states that it is currently in the process of analyzing available data of the underground electric system faults in the District over the ten-year period from December 2003 through December 2013.[348] Feeders with at least 5 faults within 10 years were identified for further analysis. From that list of feeders, those that are already being addressed as part of Pepco's REP and/or other strategies or programs were removed to avoid duplication of effort. Through this process, in 2013 Pepco identified 13 feeders as potential candidates for targeted replacement. Of these, four feeders were selected as part of Pepco's PILC replacement program.[349] These four feeders together yielded a total of 22,700 feet of PILC for possible replacement.[350] Pepco reports that of this total, 17,037 feet (or 75%), were replaced in 2013.[351]

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343 2014 Consolidated Report at 335.

344 2014 Consolidated Report at 335. A detailed description of the 50 manhole events that occurred in the District in 2013 is provided in Appendix 3A to the 2014 Consolidated Report. Appendix 3B describes Pepco's manhole inspection procedures and where they were applied in the District, in 2013. Appendix 3C contained Pepco's Network Accuracy Procedure Report. This Report describes Pepco's modeling and analysis to determine correct underground cable sizing and the implementation status of any corrective actions determined by this analysis.

345 2014 Consolidated Report at 342.

346 2014 Consolidated Report at 339.

347 2014 Consolidated Report at 339.

348 2014 Consolidated Report at 337.

349 2014 Consolidated Report at 337.

350 2014 Consolidated Report at 337.

131. Although Pepco "cannot provide an estimate of the number of miles of PILC that will be replaced by EPR for the ten year period from 2012 to 2021," Pepco asserts it "can show progress in the actualization of its PILC replacement strategy" and presented a table indicating its annual replacement of PILC footage from 2001 to 2013, with a total of 226,836 feet replaced.[352] Going forward, Pepco indicates that it will seek to implement an opportunistic replacement strategy, based on conditions it finds, which it expects to be a more cost-effective replacement strategy than a commitment to replacing a fixed number of miles of PILC each year."[353]

132. Pepco summarizes the trend in year-to- year Reportable Events ("REs"), indicating that they "decreased significantly in 2008 (69) as compared to 2007 (96), increased in 2009 (82), increased even more in 2010 (111), and in 2011 returned to a number similar to 2009 (84). For 2012 there was a marked decrease in REs from 84 in 2011 to 50. For 2013, the number of REs increased to 56 (a 12% increase above what occurred in 2012.) The number of total failures, however, has continued to decline overall (from 284 in 2008 to 196 in 2013, a 31% decrease.)[354] Pepco states that "[t]he Failure Analysis Section will continue to perform failure analysis for all manhole incidents in the District in order to determine trends and remediation activities."[355]

133. Pepco indicates that in 2013 underground cable failures decreased by a significant amount compared to 2011 and 2010" falling from 275 in 2010, to 196 in 2013.[356] Pepco states that it conducted an "analysis of underground failures for the months of January through December for the years 2009 through 2013 respectively for the 4 kV and 13 kV primary and secondary systems."[357] Pepco explains that "failures were grouped into six types - primary cable failures in the manhole, primary cable failures in duct, primary splice failures, secondary single phase and secondary three phase cable and splice failures, and underground equipment failures."[358] In discussing the use of slotted manhole covers, Pepco indicated that from 2008 through 2013, most of the reportable events occurring in manholes equipped with a slotted cover involved secondary equipment and were manhole smoking events.[359]

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351 2014 Consolidated Report at 338.

352 2014 Consolidated Report at 338.

353 2014 Consolidated Report at 337.

354 2014 Consolidated Report at 354.

355 2014 Consolidated Report at 354.

356 2014 Consolidated Report at 355.

357 2014 Consolidated Report at 355.

358 2014 Consolidated Report at 355.

359 2014 Consolidated Report at 358.

134. Pepco explains that secondary cable is not shielded and has less physical protection than primary cable and thus is "more likely to fail due to a breach in the insulation."[360] Pepco also indicated that "[s]ince 2009, the leading cause of manhole reportable events in the District is insulation-related, such as insulation deterioration" and provided charts for each year indicating the causes of manhole related events.[361] In looking at the type of insulation, Pepco indicates that "[t]he type of insulation related to cable and joint failures resulting in a reportable event for secondary equipment does not provide a discernible trend in reportable events caused by Rubber Lead (RL), Rubber Neoprene (RN), or other insulation types."[362]

135. Additionally, Pepco states that Rubber Lead insulation is "an outdated technology and . . . [i]t is not possible to trend future reportable events associated with this cable type."[363] Pepco also indicates that "most primary cable reportable events involve PILC cable" but this is because "PILC is the predominant primary cable on the Pepco underground system."[364] Pepco similarly indicates that the "majority of reportable events involving primary equipment occur on 13 kV feeders . . . and the majority of Pepco's underground system is 13 kV."[365]

136. Pepco also states that "moisture plays a major role in the deterioration of both primary and secondary cable insulation" because "[w]hen a significant amount of precipitation is received in the District, moisture and contaminants from the street . . . enter into the manholes and affect cable insulation."[366] Pepco explains that "[w]hile moisture affects all cable insulation, since secondary cable is not as robust or of the same design as primary cable, secondary cable is inherently more likely to fail under adverse weather conditions."[367] Next, Pepco presents two tables "[a] comparison of [which] suggests that total moisture accumulation affects the number of reportable events."[368] Pepco points to large amounts of rain in June of 2013 and correlates that with a significant increase in the number of REs in that month.[369]

137. Pepco indicates that in 2013 it installed 32 slotted manhole covers primarily in the Northwest quadrant of the District.[370] The Company states that it realizes that the openings in these covers, while allowing gases to vent, also allow rain, snow, dirt, debris and chemicals into

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360 2014 Consolidated Report at 344.

361 2014 Consolidated Report at 344.

362 2014 Consolidated Report at 350.

363 2014 Consolidated Report at 350.

364 2014 Consolidated Report at 351.

365 2014 Consolidated Report at 352.

366 2014 Consolidated Report at 352.

367 2014 Consolidated Report at 352.

368 2014 Consolidated Report at 353.

369 2014 Consolidated Report at 354.

370 2014 Consolidated Report at 357, Figure 3.19.

manholes.[371] As a result, Pepco continues to monitor debris accumulation in manholes with slotted covers.[372]

D. References

138. The fourth and final part of Pepco's 2014 Consolidated Report is entitled References and includes a section listing abbreviations and acronyms used in the Report, a section that defines certain of the technical terms used in the Report, including illustrative photos and diagrams, a section describing, by subject matter, prior Commission Orders and Directives applicable to the content of Pepco's Annual Consolidated Reports, and a final section that describes the Composite Performance Index ("CPI") formerly used by Pepco to identify 2% High Priority Feeders and, through a flow chart, illustrates the process for calculating the CPI for a feeder.

IV. DISCUSSION

139. The Commission takes note that its reliability performance standards that went into effect beginning in 2013 require that Pepco's reliability performance meet certain SAIFI and SAIDI standards, excluding OMS data associated with Major Service Outages.[373] Pepco states in the 2014 Consolidated Report that, in 2013, it achieved a SAIFI of 0.88 and SAIDI of 2.07.[374] Under the Commission's regulations, the 2013 SAIFI reliability performance standard is 1.13 and the SAIDI reliability performance standard is 2.68.[375] This is the second consecutive year in which Pepco's EQSS performance has bettered the 2013 standards. This is a significant achievement and we congratulate Pepco for the progress that it has made, and continues to make, in this regard.

A. Pepco's 2013 Annual Consolidated Report – Carry-Over Issues

140. As noted earlier, we are addressing in this order matters that were previously deferred until the Siemens Reliability Audit Report was completed (see Appendix A to this Order for a listing of these deferred matters).[376] To the extent these same matters are placed at issue again in OPC's Comments (or are touched upon in the Staff recommendations) concerning

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371 2014 Consolidated Report at 358.

372 2014 Consolidated Report at 358.

373 SAIFI refers to System Average Interruption Frequency Index, which is designed to give information about the average frequency of sustained interruptions per customer served in a pre-defined area, in this case, the District of Columbia. SAIDI refers to System Average Interruption Duration Index, which is the designed to provide information about the average time (in aggregate) that the customers in the pre-defined area are interrupted. See 2014 Consolidated Report at 374.

374 2014 Consolidated Report at 277, Table 2.4-F2.

375 15 DCMR § 3603.11(a) (2012).

376 See Appendix A to this Order for a listing of these deferred matters.

Pepco's 2014 Consolidated Report, we will discuss these additional comments and recommendations in this Section A.[377]

VEGETATION MANAGEMENT

2013 Consolidated Report (Carry-Over Issues) –

Is Pepco adequately budgeting for vegetation management expenses and is the amount it expends on vegetation management appropriate?[378]

Is Pepco implementing best practices in its vegetation management program and practices?[379]

Is Pepco's hazard tree removal and pruning work adequate or do improvements in tree-SAIFI/SAIDI reflect instead the effects of 2012's four severe weather events?[380]

OPC Recommendations re 2014 Consolidated Report –

Recommendation #5: Pepco should continue to report on the success of its hazard tree removal program, clarify whether Enhanced Integrated Vegetation Management ("EIVM") is still a defined Pepco program, and should continue to track the non-major tree-related sustained outages for further evidence of improvement in reliability attributable to the EIVM program;[381] *and*

Recommendation #6: OPC recommends continued observation of the impact of Pepco's vegetation management program on sustained outages.[382]

Conclusions and Recommendations in Siemens Audit Report[383] –

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377 The Commission notes that the Siemens and Liberty Audit Reports make a number of findings concerning Pepco's equipment-related outages and offer recommendations, including the installation of distribution automation devices, increased feeder segmentation and potential adoption of a Distribution Management System, to remediate the number and impact of these outages. Although these findings and recommendations overlap, in-part, several of the carry-over issues addressed below, the Commission will be addressing these matters in its future follow-up order(s) on these Audit Reports, where they can be discussed in a broader context than what is afforded through Pepco's Annual Consolidated Reports.

378 Order No. 17455 at ¶¶ 160-165.

379 Order No. 17455 at ¶¶ 238-242.

380 Order No. 17455 at ¶¶ 259, 263-264.

381 OPC Comments at 5, 8, 19-20 and 38-39.

382 OPC Comments at 6, 31-32.

383 The scope of the audit performed by Liberty did not include Pepco's hazard tree replacement program or tree pruning/trimming practices. However, when discussing Pepco's maintenance of its overhead distribution assets, Liberty's Audit Report described that PHI's Vegetation Management Group manages Pepco's pole inspection program (page IV-31) and that Pepco's Staff Forester re-inspects about three percent of the pole inspection work completed on Pepco's system by the company's contractor (page IV-32).

Develop a Comprehensive Plan for managing the risks associated with the District's population of large aging street trees, engaging a broad group of stakeholders in developing such a plan;[384]

Develop a Formal Vegetation Management Plan that would provide a cohesive and holistic frame of reference for planning, managing and evaluating Pepco's vegetation management;[385]

Revise tree-conductor clearance specifications, recognizing in the specifications differences in voltage, infrastructure type and work location within the circuit;[386]

Formally pursue a targeted risk mitigation program using consensus risk assessment criteria arrived at by Pepco in coordination with the District's Urban Forestry Administration ("UFA");[387]

Formalize a means of including vegetation management considerations in Pepco's identification and planning of new construction, its maintenance programs, and in its reliability initiatives (vegetation management requirements should be included and/or specifically referenced in engineering design standards and considered in overhead infrastructure inspections);[388]

Implement and/or revise the hazard tree removal program and the pruning program to reduce tree-related outages during major storms;[389]

Consistently employ a post-interruption site assessment for significant tree-caused interruptions;[390] *and*

Consider adopting more granular performance metrics (listing nine possible metrics to be considered).[391]

141. Commission Decision: The carry-over issues from the 2013 Consolidated Report questioned whether the budget for vegetation management was adequate, whether best practices for vegetation management were being employed and whether Pepco's hazard tree removal and pruning work was adequate. We deferred our discussion of these issues until we received the Siemens Audit Report and the more comprehensive discussion of Pepco's vegetation management program that it would contain. In the interim, the D.C. Council enacted the Electric

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384 Siemens Audit Report at 4-37, item 1.

385 Siemens Audit Report at 4-37, item 2.

386 Siemens Audit Report at 4-37, item 3.

387 Siemens Audit Report at 4-37, item 4.

388 Siemens Audit Report at 4-37, item 5.

389 Siemens Audit Report at 1-5, Recommendation 3.2.

390 Siemens Audit Report at 4-37, item 6.

391 Siemens Audit Report at 4-38, item 7 and table.

Company Infrastructure Improvement Financing Act ("ECIIFA") that provides for the undergrounding of the least reliable portions of Pepco's overhead distribution system. Pursuant to the ECIIFA, Pepco and the District Department of Transportation filed an application for approval of an undergrounding plan and we take administrative notice of it here. As part of the pre-filed testimony accompanying that application, William M. Gausman states that: "Once these lines are placed underground 100% of the outages associated with the overhead primary lines will be eliminated. These outages on average account for over 95% of the interruptions that occur on the overhead system."[392] Moreover, this pre-filed testimony states that Pepco's forecasting model predicts that the customer minutes of interruption previously occurring on the overhead primary mainline and overhead lateral portions of the feeders scheduled to be placed underground will be completely eliminated once undergrounding occurs.[393] While some may disagree with the accuracy of Gausman's testimony, undergrounding clearly relieves pressure on vegetation management budgets, inasmuch as tree growth in the areas where power lines have been relocated underground no longer creates interference between trees and energized mainline and lateral line primary overhead distribution equipment, thereby reducing cyclical and hot-spot pruning requirements. We recognize that the advent of undergrounding will impact how vegetation management issues, including budgeting and vegetation management plans, will be addressed in the future. These impacts are important issues to resolve; but they are not before us at this time.

142. With respect to Pepco's vegetation management practices and the adequacy of its hazard tree removal and pruning work, the Siemens Report provided the Commission with information that can inform our decision making. Of special note is the observation in the Siemen's Audit Report that "[t]here is no single document that would be considered a formal vegetation management plan."[394] Instead, according to this Audit Report, Pepco's vegetation management program embraces a number of documents, listed below:[395]

- Technical specification for vegetation maintenance work;
- Procurement contracts for work planning and line clearance services;
- PHI system-wide vegetation reference manual;
- O&M Procedures for the Transmission and Distribution System;
- Pepco's 2013 Vegetation Management Work Plan (Formal Case No. 766);
- Section 4.1 of Pepco's Comprehensive Reliability Plan;
- Section 1.1.3 of Pepco's Comprehensive Plan, as contained in its Annual Consolidated Report;
- Section 2.4.6 of Pepco's Productivity Improvement Plan, as contained in its Annual Consolidated Report; and

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392 *Formal Case No. 1116*, Joint Application, Exhibit Pepco (A) at 9.

393 *Formal Case No. 1116*, Joint Application, Exhibit Pepco (A) at 9.

394 Siemens Audit Report at 4-9.

395 Siemens Audit Report at 4-9.

- *Vegetation Management Plan for Utility Tree Pruning*, March 16, 2005 (a Memorandum of Understanding between Pepco and UFA).

143. Given the importance of vegetation management, we agree that the absence of a single, publicly available, comprehensive document that distills and encapsulates all of Pepco's vegetation management practices makes it more difficult for the Commission, the stakeholders and the public to get a complete picture of the actions that Pepco has taken or plans to take with respect to vegetation management. Consequently, as a follow-up to the Siemens Audit, the Commission will direct Pepco, in a future order to be issued as a follow-up to the Siemens Reliability Audit Report, to develop and file for the Commission's approval a comprehensive vegetation management plan consistent with our decisions, in that order, of the specific Siemens recommendations outlined above.

144. Until a new comprehensive plan is approved, Pepco will continue to report on its vegetation management activities in the annual ACR under its current Vegetation Management Plan. Pepco explained, in response to an inquiry from OPC, that this program has incorporated its former EIVM/

145. As noted previously, OPC has recommended that Pepco begin using a GIS mapping system to collect information on the location, condition, and other useful information on hazard trees located near power line rights-of-way. According to OPC, this data can be used to identify mature trees and trees in decline, and to identify problem trees that cause multiple outages.[396] The Commission concludes that such an effort by Pepco would be redundant of mapping and other data tools already maintained, separately, by UFA, Casey Trees[397] and the District's Office of the Chief Technology Officer ("OCTO").[398] Given this, it would be an inefficient use of ratepayer-generated revenue to direct Pepco to create the recommended GIS data set on street trees located in public spaces proximate to Pepco's overhead utility lines. The Commission will not adopt this OPC recommendation.

LOAD GROWTH FORECASTS

2013 Consolidated Report (Carry-Over Issues) –

Pepco provide the basis for continually implementing aggressive load projections[399] and

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396 OPC Response to Order No. 16830 at 6.

397 See, for example, Holli Howard, *Understanding Washington DC's Urban Forest Through GIS*, Casey Tree Foundation http://actrees.org/files/Newsroom/dc_gis.pdf (access January 21, 2015): "The UFA has since taken this data and converted it to fit their own GIS system and data collection methods. By maintaining an inventory of the city's trees, both Casey Trees and UFA have an efficient management system that helps to coordinate activities between their organizations and other city agencies. With a reliable, comprehensive data set, the analyses that can be performed are extensive." See, also http://caseytrees.org/resources/maps/dc-street-trees/ (accessed January 21, 2015) for a GIS-enabled map of the District's street trees.

398 See http://opendata.dc.gov/datasets/d6364e8d068e4e558c82040569f5d33a_23 (accessed January 21, 2015).

399 Order No. 17455 at ¶¶ 329 and 377.

Pepco analyze the cost effectiveness of load management systems, the use of which is now possible with the installation of the AMI system, and include in its analysis the impact of such load management systems on Pepco's projected load growth - including how that impact is reflected in the construction budgets for the projected new substations.[400]

OPC Recommendations re 2014 Consolidated Report –

OPC Recommendation #1: Pepco utilizes unreasonably aggressive load projections to justify four substation projects (a fourth transformer at the Florida Avenue Substation, a fourth transformer at the Northeast Substation, the L Street Substation, and the new Mt. Vernon Square Substation) and those projects should be delayed.[401]

Conclusions and Recommendations in Siemens Reliability Audit Report –

Pepco's load forecasting is adequate for a mature system and incorporates some level of spatial [locational] load forecasting [relative to] new customers).[402]

Pepco is effective in planning its capital expenditures for substation and feeder investments to attend load growth.[403]

Pepco's practice of maintaining individual substation firm capacity, while conservative, may not be optimum.[404]

Pepco appears to have adequate lead times for the required investments in substations considering the [District] load growth rates.[405]

Pepco should i*mprove its method to allocate load to system transformers for modeling and simulation purposes, through the incorporation of AMI measurements taken along the feeders. This is due to the fact that even though the modeling of loads in the system is fairly typical, it may lead to inaccurate estimation of loading at transformers and/or along the feeders.* [406]

Conclusions and Recommendations in Liberty Audit Report –

Pepco's methods for conducting load studies and load forecasting for planning construction for load growth conforms to good utility practice.[407]

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400 Order No. 17455 at ¶¶ 329 and 377.

401 OPC Comments at 3 and 8-15.

402 Siemens Reliability Audit Report at p. 5-21, Section 5.11.1.

403 Siemens Reliability Audit Report at p. 5-21, Section 5.11.1.

404 Siemens Reliability Audit Report at 5-22, Section 5.11.1.

405 Siemens Reliability Audit Report at 5.22, Section 5.11.1.

406 Siemens Reliability Audit Report at 5.22-5.23, Section 5.11.2.

407 Liberty Audit Report at IV-13.

Pepco has the means to monitor appropriately its distribution loads and to mitigate overload conditions; Pepco's distribution planning practice is consistent with good utility practice.[408]

The Company also generally performs and uses load forecasting appropriately to address its infrastructure requirements.[409]

146. 2014 Consolidated Report: Pepco explains in its 2014 Consolidated Report that it develops short-term summer-peak load forecasts for three years, to allow adequate time to complete routine 4 kV-to- 13 kV (conversion) construction work; long range load forecasting (four to ten years) is used to develop: (a) advance plans for large 4 kV and 13 kV construction projects that require more than two or three to complete; (b) routine and advance plans for 34.5 kV- to-230 kV (conversion) construction work; and (c) to identify future capital projects in the Construction Budget Forecast process.[410]

147. Pepco tracks and projects load by substation.[411] It does so by examining the summer historical loads for each feeder and substation, on a two-year cycle.[412] New customer additions are considered, but changes in the number of customers do not necessarily correspond to a similar change in load.[413] Moreover, existing customers may change load profiles, resulting in load increases without a change in customer count.[414] Since forecasting growth in customer count has little impact on electric system planning, Pepco focuses on forecasting system load growth.[415] Pepco's six-year historical and 10-year projected loads, and associated load growth rates are shown in the table below:[416]

408 Liberty Audit Report at IV-13.

409 Liberty Audit Report at ES-5.

410 2014 Consolidated Report at 12.

411 2014 Consolidated Report at 13.

412 2014 Consolidated Report at 12.

413 2014 Consolidated Report at 13.

414 2014 Consolidated Report at 13.

415 2014 Consolidated Report at 13.

416 Data in this table are extracted from Tables 1.2-B and 1.2-C, 2014 Consolidated Report at 17-8.

Table P: Pepco District Load Growth – Actual and Projected (2008 – 2023)

Historical Load Growth (Mega-Volt Amperes)		Projected Load Growth (Mega-Volt Amperes)	
2008	2399.7	2014	2,660.60
2009	2328.3	2015	2741.2
2010	2422.9	2016	2787.7
2011	2491.6	2017	2812.6
2012	2394.5	2018	2859.8
2013	2409.9	2019	2891.4
Avg. annual growth rate = .08%		2020	2933.3
		2021	2969
		2022	2999.4
		2023	3030.2
		Avg. annual growth rate = 1.46%	

148. Pepco describes its plans to enhance or install eight substations in the District, with projected in-service dates ranging from June 2014 through June 2021.[417] The company plans to add a 4th transformer to the Florida Avenue Substation and a 4th transformer to the Northeast Substation, both to relieve a predicted substation overload. The capacity improvement at the Florida Avenue Substation, it states, is to serve new load in the Mt Vernon Triangle/Convention Center and NoMa[418] areas.[419] Initially (2014), approximately 33 Mega-Volt Amperes ("MVA") of load will be transferred from the 12th and Irving Substation to relieve a predicted overload of that substation; the remainder of the new capacity will be used to serve load in the Shaw, Convention Center and Mt. Vernon Triangle areas.[420] Pepco forecasts an average annual substation load increase of 2.32 MVA (1.8%), above the 2013 base load of 126.6 MVA.[421]

149. The new transformer at the Northeast Substation is to be paired with the extension of a new 69 kV feeder from the Benning Substation which is needed in order to supply this new transformer.[422] The new firm capacity at the Northeast Substation will enable the extension of a new Low Voltage Alternating Current ("LVAC") network group to the Penn Quarter area[423] in order to relieve a predicted overload on the Tenth Street Substation.[424] Pepco states that without this additional supply and transformer, the new Mt. Vernon Substation would have to be

417 2014 Consolidated Report at 23, Table 1.2-G.

418 The term "NoMa" indicates the neighborhood and business district located immediately north of Massachusetts Avenue, just north of the U.S. Capitol and Union Station.

419 2014 Consolidated Report at 23.

420 2014 Consolidated Report at 24.

421 2014 Consolidated Report at 24.

422 2014 Consolidated Report at 25.

423 The phrase "Penn Quarter Area" indicates an area of central downtown D.C., near the Verizon Center, that encompasses the neighborhood that runs north of Pennsylvania Avenue, south of Mount Vernon Square, and between the White House and I-395.

424 2014 Consolidated Report at 25.

advanced in time, to supply the added capacity requirement.[425] In addition, if the Tenth Street substation load were to be transferred to the Northeast Substation without this capacity, it would result in an 8% firm capacity overload.[426] Pepco forecasts an average annual substation load increase of 4.22 MVA (2.3%), above the 2013 base load of 186.6 MVA.[427]

150. The capacity improvements to the L Street Substation are recommended by Pepco to retire aging infrastructure and to serve new load in the West End and Georgetown areas.[428] Specifically, Pepco will extend four new double-legged 34 kV feeders from the Buzzard Point Substation B to the L Street substation and build structures within the latter substation to accept the double-legged feeders.[429] These will replace the existing single-legged 34 kV feeders that were installed in 1940.[430] Upon completion, this project will combine with other projects to enable the retirement of the 34 kV substation at Buzzard Point and eliminate the need to otherwise rebuild that facility, due to its age and condition.[431]

151. Pepco states that the new substation at Mt. Vernon Square is needed to provide capacity to the redeveloping Mt. Vernon Triangle and Shaw areas.[432] Pepco projects approximately 140 MVA of long-term growth coming into service in the Mt. Vernon Triangle and NoMa neighborhoods over the next ten years.[433] In addition to serving this load, the new substation will provide relief to the 10th Street substation, which has experienced a peak loading of 90% or more of capacity since 2005.[434] In addition, the Northeast Substation Southwest LVAC Network Group is expected to exceed its firm capacity in 2020, requiring the transfer of approximately 30 MVA of load to the new Mt. Vernon Square Substation.[435]

152. OPC Comments: OPC claims that Pepco's forecasting method is flawed, and supports this by comparing past load projections to actual demands; however, OPC does not dispute that Pepco's 90/10 load prediction methodology is appropriate.[436] OPC objects to what it

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425 2014 Consolidated Report at 25.

426 2014 Consolidated Report at 25.

427 2014 Consolidated Report at 25.

428 2014 Consolidated Report at 23-24.

429 2014 Consolidated Report at 31.

430 2014 Consolidated Report at 31.

431 2014 Consolidated Report at 31-32.

432 2014 Consolidated Report at 24.

433 2014 Consolidated Report at 33.

434 2014 Consolidated Report at 33.

435 2014 Consolidated Report at 33.

436 OPC Comments at 9. The "90/10" load projection methodology is one in which Pepco uses the hottest summer in ten years as the baseline for its load predictions (*See* OPC Comments at 9, footnote 9).

claims is Pepco's continued projection of large increases in system demand with very aggressive growth rates on top of projected, but unrealized increases.[437] Consequently, OPC claims that Pepco's unreasonably aggressive load projections will result in substantial investment in new capacity well before it is needed or prudent.[438]

153. Of the eight substation addition and enhancement projects described by Pepco in its 2014 Consolidated Report, OPC opposes four, discussed as follows:

- 4th Transformer at the Florida Avenue Substation: OPC states that this project is predicated on load increases at the 12th and Irving Street Substation 133 reaching 140.1 Megavolt Ampere ("MVA") [and thus requiring a load transfer to the Florida Avenue Substation] in 2014.[439] The 2014 Consolidated Report, however, projects that load at Substation 133 will not reach 140.1 MVA until 2017.[440] Based upon these load projections, OPC concludes that Pepco has artificially and unnecessarily accelerated investment by at least two or more years.[441]
- 4th Transformer at the Northeast Substation: According to OPC, this project is premised on load growth projections that have not occurred and are overly aggressive, considering that 2011 was the hottest year in more than four decades.[442] For the overloaded condition to occur in June 2016, as now projected by Pepco, more than 30 MVA of load will need to be added at the 10th Street Substation, OPC claims.[443] Therefore, OPC recommends that the addition of a 4th transformer at the Northeast Substation be postponed until such time as Pepco can demonstrate the need for this additional capacity.[444]
- New L Street Substation: OPC states that the justification for this project is that the 34.5 kV cables from Buzzard Point to L Street (installed in 1940) need replacing and that the loading of Pepco's Georgetown Substation is predicted to be at 98% of firm capacity, in 2023.[445] According to OPC, in its 2013 Consolidated Report Pepco stated that a study was underway to investigate alternatives to this project as part of a long range study for supplying District load growth and in its 2014 Consolidated Report, Pepco indicates that the alternate planning for his project is not complete.[446] For

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437 OPC Comments at 10.

438 OPC Comments at 10.

439 OPC Comments at 11.

440 OPC Comments at 11, referencing the 2014 Consolidated Report at 24.

441 OPC Comments at 12.

442 OPC Comments at 12.

443 OPC Comments at 13.

444 OPC Comments at 13.

445 OPC Comments at 13, referencing the 2014 Consolidated Report at 32.

446 OPC Comments at 13-14, referencing the 2014 Consolidated Report at 32.

these reasons, OPC recommends that no funding for this project be permitted until such time as the referenced planning study is completed and vetted by concerned parties.

- New Mt. Vernon Square Area Substation: OPC states that Pepco's 2014 expenditures include approximately $30.5 million to purchase land to be used as the site for the new Mt. Vernon Square Substation.[447] According to OPC, the overly-aggressive load growth projection for the 10th Street Substation is also driving an artificial need for the new Mt. Vernon Square Area Substation.[448] OPC concludes that expenditures at this time for land for this new substation would not be prudent.[449]

154. Pepco Response: Pepco states that its base load represents the load from the hottest summer in the past 10 years and to this is added probable load growth, to produce the overall forecast; in doing this, Pepco states that it develops load forecasts for each substation and feeder based upon known future [development] projects in particular areas of the District.[450] According to Pepco, it is from these localized substation forecasts that Pepco's capital projects are planned and scheduled, and this construction to accommodate load must stay ahead of probable economic growth (at the neighborhood level) because of the long construction times required for load growth projects.[451] Pepco concludes that the risk to customers is that load growth may be underestimated as the economy recovers, rather than overestimating load growth based on forecasts linked to economic activity experienced during a recession.[452] Moreover, Pepco must have the ability to supply capacity under peak conditions and not based on annual averages.[453] For these reasons, Pepco concludes that OPC's analysis of Pepco's load forecasting is flawed, based on irrelevant data, and demonstrates a fundamental misunderstanding of the nature of forecasting.[454]

155. Pepco also explains that its planning process is designed to identify the need for new substations and enhancements up to ten years in advance of the date that the new facilities are required.[455] This process allows Pepco time to track each project's need, over time, and to adjust plans as load forecasts may change. If a firm overload is identified, Pepco states, a project must move forward due to the long lead times required to manufacture substations equipment and supply cables.[456] These timeframes can be as long as two years, and once commitments are

447 OPC Comments at 14.

448 OPC Comments at 15.

449 OPC Comments at 15.

450 Pepco Response at 1.

451 Pepco Response at 1-2.

452 Pepco Response at 2.

453 Pepco Response at 1.

454 Pepco Response at 1.

455 Pepco Response at 3.

456 Pepco Response at 3.

made, any change orders can be costly.[457] According to Pepco changing in-service dates for major development projects cannot be done and waiting until the load has developed poses a high risk to system reliability.[458]

156. Staff Report and Staff Recommendation #6: The Staff Report compares Pepco's projected 10-year District average load growth rate shown in the 2014 Consolidated Report (1.46%)[459] with Pepco's 10-year District average load growth rates of 1.71% and 1.66%, respectively, projected in the 2013 and 2012 Annual Consolidated Reports. The Staff Report concludes that Pepco's load forecasting process attempts to balance the possibility of incurring investment costs in new capacity before the capacity is needed, against the risk to customers and danger to distribution system reliability by underestimating load growth as the economy recovers. To address OPC's concerns, *the Staff Report recommends that Pepco be directed to include data in its discussion of load growth in its future Annual Consolidated Reports showing the most recent five historical years' load forecasts, versus actual loads experienced, and a discussion of variance and trends in the accuracy of these forecasts*.[460]

157. Siemens Reliability Audit Report: The Siemens Reliability Audit Report addresses and arrives at conclusions regarding the appropriateness of Pepco's load forecasts for purposes of planning capital investment in infrastructure improvements. Siemens concludes that Pepco's approach to system modeling and evaluation, including load growth, is one that is fairly standard in the industry and allows the simultaneous consideration of all substations serving an area, when assessing the best ways to supply new load.[461] When simulating feeder load, Pepco allocates the load proportionally among connected distribution transformers, based on installed capacity of the transformers.[462] Siemens is of the opinion that this allocation practice is one that is commonly accepted, but it could lead to underestimating or overestimating loading on sections of feeders.[463] According to Siemens, Pepco also conducts a 10-year horizon analysis, using 10-yer load projections obtained from the Pennsylvania-New Jersey-Maryland Interconnection ("PJM"), which Pepco uses for trending.[464]

158. Siemens concludes that Pepco's load forecasting is adequate for a mature system, incorporates some level of new customer forecasting, and that Pepco is effective in planning its capital expenditures for substation and feeder investments to attend load growth.[465] However,

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457 Pepco Response at 3.

458 Pepco Response at 3.

459 2014 Consolidated Report at 18, Table 1.2-C.

460 Staff Report at 82, Recommendation 6.

461 Siemens Reliability Audit Report at 5-2, Section 5.2.1.

462 Siemens Reliability Audit Report at 5-2, Section 5.2.1.

463 Siemens Reliability Audit Report at 5-2, Section 5.2.1.

464 Siemens Reliability Audit Report at 5-2, Section 5.2.1.

465 Siemens Reliability Audit Report at 5-21, Section 5.11.1 at conclusions 1. and 2.

Siemens recommends that better methodologies to allocate load to the transformers should be implemented, including incorporating data from metering along the feeders and AMI measurements.[466] In this regard, Siemens generally agrees with Pepco's procedure for selecting substation investments and the timing of those investments.[467] Siemens notes, however, that while Pepco has a practice of maintaining individual substation firm capacity, some utilities do not require this, but instead, firm capacity is maintained at the Planning Area level.[468] Pepco's procedure, Siemens concludes, is conservative but may not be optimum.[469]

159. The Siemens Reliability Audit Report evaluated two of the four substation projects which OPC questions (install a 4th transformer at the Florida Avenue substation and install a 4th transformer at the Northeast Avenue substation). Siemens considers Pepco's approach to load management, as reflected by these projects, to be reasonable.[470] The remaining two projects questioned by OPC (the L Street substation project and the new Mt. Vernon Square substation) were not evaluated since Siemens characterized these projects as long term (2019 and 2020 in-service dates, respectively) and under revision by Pepco.[471]

160. Liberty Audit Report: The Liberty Audit Report states that Pepco models distribution primary and secondary radial and network systems using equipment data loaded into its Geographic Information System ("GIS") system.[472] Its load flow and voltage drop studies consider historical summer loads (considering worst ambient temperatures in the immediate prior ten years, expected load growth from new businesses, and takes into account 4 kVto-13 kV conversions.[473] The Company studies half of its distribution system each year, developing short-term (three years) and long-term (four to ten years) summer load forecasts.[474] Pepco plans feeder load relief projects when forecasted feeder loading exceeds 100 percent of capacity under normal configurations and 100 percent of emergency capacity under N-1 (loss of one equipment unit) configurations.[475] Load growth studies of Pepco's networks uses GIS data under modeling

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466 Siemens Reliability Audit Report at 5.4, Sub-Section 5.2.4(1.) and 5-22 at recommendation 1.

467 Siemens Reliability Audit Report at 5-5, Section 5.3.1.2 and 5-22, Section 5.11.1 at conclusion 5.

468 Siemens Reliability Audit Report at 5-5, Section 5.3.1.2: "Thus, in the case of a transformer outage in a given substation there are procedures, which can be automatic, to transfer load to other substations and relieve the expected overload on the remaining transformer at the affected substations, beyond the 24 hours emergency rating."

469 Siemens Reliability Audit Report at 5-22, Section 5.11.1 at conclusion 4.

470 Siemens Reliability Audit Report at 5-7, Section 5.3.2.2.

471 Siemens Reliability Audit Report at 5-8.

472 Liberty Audit Report at IV-9.

473 Liberty Audit Report at IV-9.

474 Liberty Audit Report at IV-9 through IV-10.

475 Liberty Audit Report at IV-10.

driven by an industry-accepted software provider and Pepco uses a different industry-accepted software program to conduct similar loading studies on its radial feeders.[476]

161. The Liberty Audit Report states that, according to Pepco, the District has generally shown little overall load growth for the period 2006-2011, but a few areas present 3%-5% annual load growth for the last five years.[477] The Report states that Pepco has the means to appropriately monitor its distribution loads and to mitigate overload conditions, that its distribution planning practice is consistent with good utility practice, and that Pepco appropriately uses GIS data and computerized modeling programs to analyze load flows under normal and contingency conditions for the purpose of mitigating emergent feeder issues and to forecast loads.[478] The Liberty Audit Report does not recommend any changes in Pepco's load forecasting methodology.

162. Commission Decision: As noted above, the Siemens Reliability Audit Report concludes that Pepco is effective in planning its capital expenditures for substation and feeder investments to attend load growth while Liberty finds Pepco's distribution planning practice to be consistent with good utility practice. Both Audit Reports generally conclude that Pepco's load forecasting methodology is appropriate. OPC, on the other hand argues here, as it did in *Formal Case No. 1103*, that Pepco's load forecasting is faulty and too aggressive. For reasons set out in greater detail below, we are not accepting OPC's argument. Furthermore, OPC recommends that four substation projects (a fourth transformer at the Florida Avenue Substation, a fourth transformer at the Northeast Substation, the L Street Substation, and the new Mt. Vernon Square Substation) be delayed. For the reasons set out below, we accept the findings of the two Audit Reports and decline to accept OPC's recommendation to delay the construction for the four substation projects based on a problem with Pepco's load forecasting. No further information is needed for the two substations projects that were reviewed as part of the Siemens Audit Report; however we are directing Pepco to provide additional information in the 2015 ACR about the substation projects for the L Street Substation and the new Mt. Vernon Square Substation. Finally, we note that neither the Audit Reports nor OPC raised a question about the planned new Waterfront substation project so we have not addressed that substation in this Order; however, the Waterfront project is the subject of a separate investigation by the Commission

163. In *Formal Case No. 1103*, the Commission addressed OPC's challenges to Pepco's load forecasting methodology and rejected OPC's premise that short-term, modest emergency overload conditions should be allowed so as to avoid the cost of load relief projects. In this regard, the Siemens Reliability Audit Report describes that the most common practice in the electric distribution industry is to load feeders up to two thirds (67%) of their normal operating rating, whereas Pepco's operating philosophy is to load feeders up to 80% of their normal operating rating.[479] Siemens concludes that this is acceptable, but speculates that at this rating, the higher

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476 Liberty Audit Report at IV-10.

477 Liberty Audit Report at IV-11.

478 Liberty Audit Report at IV-11.

479 Siemens Reliability Audit Report at 2-7, Section 2.2.4.

number of switching operations needed to transfer load between feeders in the event of an outage leads to longer restoration times and may have a negative impact on Pepco's reliability indices (*i.e*., CAIDI and SAIDI).[480]

164. By adopting this higher load rating, the need for the load relief projects Pepco does propose is more credible. Moreover, by creating a higher threshold for planning load relief projects, the number of these projects is minimized and the cost to be borne by ratepayers in connection with load relief projects is reduced. We expect that with the increased use of Distribution Automation, and in particular the installation of automated switching capability, the trade-off in achieved cost savings from fewer new load relief projects in exchange for slightly extended outage durations would become of lesser significance, as outage durations shorten.

165. The Siemens Reliability Audit Report determined that the 2012 summer peak conditions on the five feeders described in Table R below meant that these feeders would be loaded at or beyond their 24 hour emergency rating. Four of these five feeders are to be relocated underground; one (Feeder 476) before the close of 2017 and the remaining three thereafter. The fifth feeder (No. 147) was designated as a 2% high priority feeder in 2013. Pepco's corrective action plan for Feeder No. 147 involved placing the feeder in its 2013 4 kV-to-13 kV conversion program.[481] Since these actions will relieve potential overload conditions, it is not necessary for Pepco to implement specific load relief projects for the five feeders set forth in the table below.

Table Q: Pepco Overloaded Feeders (Summer 2012 Peak Load)

Feeder #	OH, UG or OH/UG	Ward	Years 2% High Priority Feeder	Years MSN Feeder	Proposed for Undergrounding (FC1116)? Ranked (# out of 70)	Cross-Border Feeder? - Substation Location
64	OH	3			Yes – Ranked 62	No
144	OH	3			Yes – Ranked 23	No
147	UG	1,5	2008, 2013		No	No
476	OH	3			Yes – Ranked 6	Yes - DC
15943	OH / UG	2,3	2008, 2010, 2012	2010	Yes – Ranked 31	No

Sources: Pepco 2014 Consolidated Report at 279, Table 2.4-F5; at 286, Table 2.4-G; F.C. 1116, Joint Application at Appendix B; F.C. 766, *et al*., *Response of Potomac Electric Power Company in Response to Order No. 16347* at Appendix A, pages 2 of 14 and 3 of 14.

166. The Siemens Reliability Audit Report concludes that Pepco's load forecasting is adequate and that installation of fourth transformers at both the Florida Avenue and Northeast substations is reasonable. Moreover, the Liberty Audit Report concludes that both Pepco's load studies and its load forecasting for planning construction for load growth conform to good utility practice. OPC has not offered any studies or authoritative sources that rebut these conclusions. Therefore, the Commission will not direct Pepco to defer or eliminate these transformer additions and will not adopt OPC Recommendation #1.

167. However, the Commission concludes it is premature at this time to evaluate whether the changes being considered by Pepco with respect to its L Street substation or its design of a new substation for installation in the Mt. Vernon Square area are appropriate. As Siemens notes in its Reliability Audit Report, both of those projects have distant proposed in-service dates and the

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480 Siemens Reliability Audit Report at 2-7 through 2-8, Section 2.2.4 and 5-22, Section 5.11.1, Conclusion 3.

481 Pepco 2013 Consolidated Report at 320.

configurations for, and extent of, these changes are not yet finalized (a matter that appears to be confirmed in the year-to-year variances in their estimated project costs that appear in Pepco's Annual Consolidated Reports.) Therefore, in its 2015 Consolidated Report, Pepco is directed to clarify whether project descriptions, cost estimates, projected in-service dates and related data for the L Street and Mt. Vernon Square substation projects are final or subject to change. In its clarification, Pepco is to provide a showing that these projects are needed to ensure reliable electric distribution service, including a description of any aging infrastructure to be replaced and the load projections upon which additional capacity requirements are predicated. In describing these load projections, Pepco is to indicate how AMI data and/or Smart Meter data have been incorporated into the projections.

168. Staff recommends that Pepco be directed to include in its discussion of load growth in its future Annual Consolidated Reports data showing the most recent five historical years' load forecasts, versus actual loads experienced, and a discussion of variance and trends in the accuracy of these forecasts for the L Street and Mt. Vernon Square substation projects. The Commission agrees that it will be helpful to obtain this information to substantiate the extent to which the incorporation of AMI and Smart Meter data into Pepco's load forecasting is narrowing the gap between projected load growth and the load growth that actually materializes subsequent to Pepco's projections.

169. If, as we expect, the predictive accuracy of these projections is enhanced by these new data inputs, it will be unnecessary to impose in the long term greater transparency beyond what Pepco is currently providing. For this reason, the Commission will not adopt the forward-looking five-year reporting period recommended by Staff. For now, Pepco is directed to provide in its 2015 Annual Consolidated Report the five-year historical data and a discussion of variance and trends in the accuracy of these forecasts, called for in this Staff recommendation.

170. The Siemens Report recommends that Pepco incorporate the use of AMI measurements in its method of allocating load to system transformers for modeling and simulation purposes. In Order No. 17424, the Commission directed that Pepco have a Load Research Plan ("LPR") and, under that Plan, begin using AMI data in this and other fashions. Pepco's quarterly updates to its LPR show that this directive is being implemented by Pepco at the present time and that more widespread use within the Company of AMI data will take place as its database of AMI data becomes fully functional by the end of 2015. Accordingly, it is not necessary for the Commission to take any further action in the present Order on Siemens' recommendation regarding the use of AMI data in capital asset planning.

171. OPC argues here, as it did in *Formal Case No. 1103*, that Pepco's load projections are being made without appropriate consideration of the Company's demand response measures.[482] In *Formal Case No. 1103*, the Commission agreed with OPC's argument and directed "Pepco to explain in its next Construction Program Report how the Company's Demand Response Program for the District is factored into the load forecasts used by Pepco to determine the need and timing for

[482] Order No. 17424 at ¶ 538.

certain construction projects".[483] We will look for that explanation when we review Pepco's next Construction Program Report.

FEEDER RELIABILITY IMPROVEMENTS

2013 Consolidated Report (Carry-Over Issues) –

Is the pattern of repeated re-designations as a 2% high priority feeder evidence of a program failure? What changes are needed to the 2% high priority feeder program?[484]

Did Pepco's remediation tactics applicable to 2% high priority feeders change between 2012 and 2013?[485]

Is Pepco devoting enough man hours to analyze outages and choose outage remediation methods with respect to 2% high priority feeders and feeders associated with most susceptible neighborhoods ("MSN feeders")?[486]

Are Pepco's metrics used to identify 2% high priority feeders capable of identifying under-performing feeders serving smaller numbers of customers?[487]

What plan(s) and schedule(s) should Pepco follow to remediate outage conditions on MSN feeders?[488]

OPC Recommendations re 2014 Consolidated Report –

OPC Recommendation #8: OPC recommends that Pepco report planned [infrastructure] improvements for feeders associated with susceptible neighborhoods in a fashion similar to the [reporting for the 2% High] Priority Feeder program.[489]

Conclusions and Recommendations in Siemens Reliability Audit Report[490] –

Feeder performance above the threshold for selecting 2% High Priority Feeders can still be substandard in terms of customers' legitimate reliability expectations;[491] *the*

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483 Order No. 17424 at ¶ 538.

484 Order No. 17455 at ¶ 201.

485 Order No. 17455 at ¶¶ 345-347.

486 Order No. 17455 at ¶¶ 338-341.

487 Order No. 17455 at ¶¶ 342-344.

488 Order No. 17455 at ¶ 303.

489 OPC Comments at pp. 7 and 32-33.

490 The scope of the Liberty Audit did not include Pepco's 2% High Priority Feeder reliability performance or the reliability performance of feeders associated with the neighborhood(s) in each Ward of the district that are most susceptible to power outages ("MSN Feeders"). Therefore, the Liberty Audit Report did not address these feeders, other than including a passing reference when discussing Pepco's past overhead feeder inspections and repair practices (Liberty Audit Report at IV-33).

491 Siemens Reliability Audit Report at 1.5, Section 3, Recommendation 3.1.

point is that 2% High Priority Feeders might not represent the complete target population [for remediation] because some other feeders face different problems and/or are under the radar of the 2% High Priority Feeder selection criteria.[492]

The 'Worst Performing Feeder" approach is an industry standard that has been expanded to include other feeders for remedial action, on a base-by-case basis.[493]

When selecting 2% High Priority Feeders, take into account the feeder design [network or radial] in order to identify deterioration from "built in" [inherent] reliability performance.[494]

Implement a priority feeder outage remediation effort that considers not only the criteria applicable to 2% High Priority Feeders, but other criteria as well.[495]

172. 2014 Consolidated Report: In its 2014 Consolidated Report, Pepco provides a schedule listing each of the 16 priority feeders it identified in its 2013 Consolidated Report that comprise the bottom 2% of its District feeders, in terms of their 2012 reliability performance.[496] The schedule describes the corrective actions proposed by Pepco in its 2013 Consolidated Report for each of these feeders, the corrective actions undertaken in 2013 and remaining to be completed, and the reason(s) for any variances encountered between Pepco's proposed and actual corrective actions.

173. In its 2014 Consolidated Report, Pepco also identified 16 feeders as 2% high priority feeders, based upon their 2013 outage performance and provided a detailed proposed corrective action plan for each designated feeder.[497] The Company noted that in Order No. 16975, the Commission required that Pepco provide certain specified historic outage data for each year, beginning with the year the feeder first appeared on the Priority Feeder list.[498] Pepco concluded, however that reporting all historic information for priority feeders in a given year could become burdensome, and potentially less useful, particularly in the future. Therefore, beginning with its 2014 Consolidated Report, Pepco stated, it will provide only a ten-year history of the required data, unless directed otherwise by the Commission.

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492 Siemens Reliability Audit Report at 1.5, Section 3.

493 Siemens Reliability Audit Report at 1.5, Section 3.

494 Siemens Reliability Audit Report at 1-9, Section 5, Recommendation 5.6 and 1-26, Table 1-2, Recommendation 2.

495 Siemens Reliability Audit Report at 1-5, Section 3, Recommendation 3.1 and 1-26, Table 1-2, Recommendation 3.

496 2014 Consolidated Report at 202-210.

497 2014 Consolidated Report at 215-261.

498 Order No. 16975, ¶ 59.

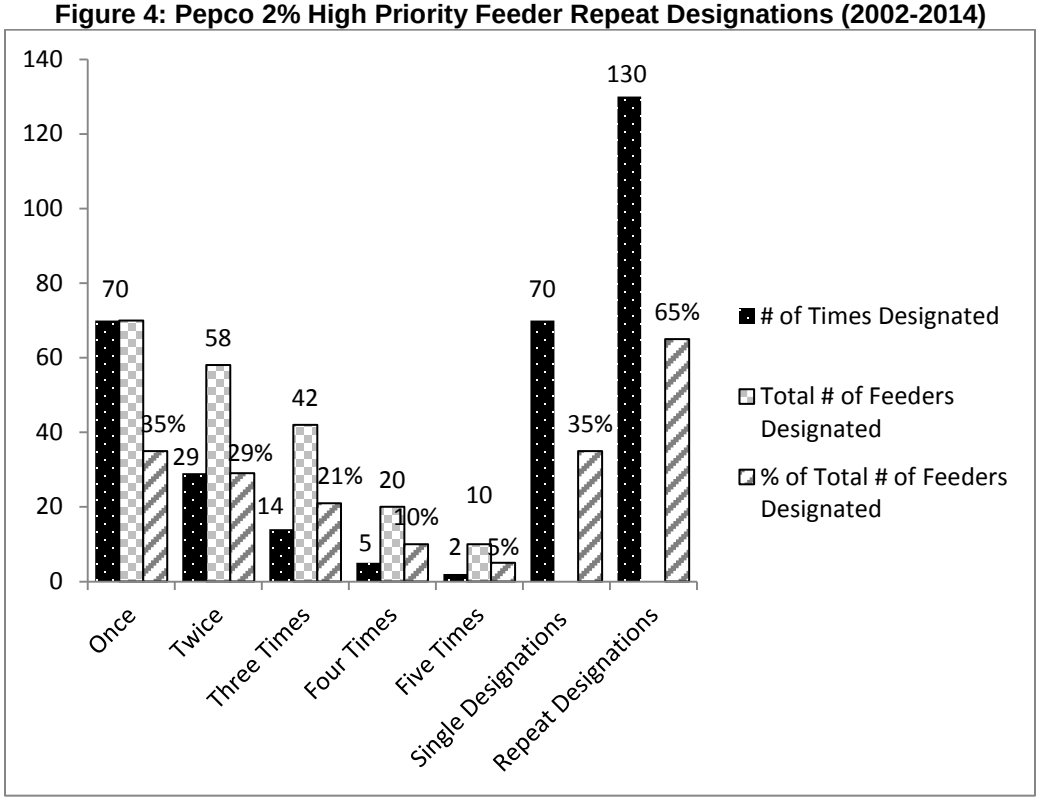
174. Pepco's 2013 and 2014 ACRs reported 2% High Priority Feeders identified in Table R, below and Figure 4 which follows, depict the number of repeat designations among the 200 2% High Priority Feeders designated as such over the life of the program:

Table R: Pepco 2% High Priority Feeders (Reported 2013/2014)
(Ranked in Ascending Order of Performance)

2013 2% Priority Feeder #	Ward	Prior Designations	MSN Feeder	2014 2% Priority Feeder #	Ward	Prior Designations	MSN Feeder
15705	7	2003, 2009, 2011	2008, 2011, 2012	53	1, 5	n/a	n/a
15707	7	2007, 2010	2009, 2010, 2013	15867	3	n/a	n/a
15174	8	2010	2013	15130	7	n/a	n/a
15710	7	n /a	n/a	15021	4	n/a	2014
14786	6	2007	2009, 2013	15009	4	2005, 2009, 2012	n/a
14014	5	2004, 2006	2013	15207R	1,2 6	n/a	2014
15166	8	2010	n/a	15173	8	n/a	n/a
15801	3	2002, 2005. 2008, 2010	2008, 2009, 2013	212	6	n/a	n/a
14006	5	2002	2009	14753	8	n/a	n/a
14788	6	2007	n/a	14136	3	2010, 2012	2014
15945	3, 4	2011	n/a	14031	7	n/a	n/a
14900	4	2002, 2007, 2009, 2011	n/a	15171	8	n/a	n/a
14200	5	2009, 2011	n/a	15085	8	n/a	2014
14787	5, 6	2005, 2008	2010, 2013	15199	4	2001, 2004, 2010, 2012	2009, 2011, 2012, 2014
14009	1, 5	n/a	n/a	14717	7	2001, 2003, 2009, 2012,	2013
14001	1, 5	2011	n/a	14758	8	2003,2012	2011, 2012, 2013

Sources: Formal Case Nos. 766, *et al.*, Pepco 2012 Annual Consolidated Report at 231; Pepco 2013 Annual Consolidated Report at 246, Figure 2.4-A2, 247, Table 2.4-A and 354; Pepco 2014 Annual Consolidated Report at 212, Figure 2.4-A2, 213, Table 2.4-A and 291; Formal Case Nos. 766, *et al*., Pepco Response to Order No. 16347 at Appendix A, pp. 2-4 (May 20, 2011).

Figure 4: Pepco 2% High Priority Feeder Repeat Designations (2002-2014)



Source: Pepco 2014 Annual Consolidated Report at 286, Table 2.4-G.

175. For those feeders associated with the neighborhoods in each Ward of the District that are receiving the least reliable electric service ("Most Susceptible Neighborhood Feeder" or "MSN Feeder"), Pepco reported:

- Feeder number;
- Associated neighborhood(s);
- Number of customers served by the feeder;
- Whether it is a cross-border feeder also providing power to customers in Maryland;
- Whether it is an overhead, underground or combined overhead/ underground feeder;
- Number of power outages occurring during the year;
- Values under specified reliability indices;
- Years, if any, the feeder was previously designed as a 2% high priority feeder; and
- The years, if any, the feeder was previously designated a MSN feeder.

176. OPC Comments: OPC commented that with regard to these MSN feeders, Pepco notes that ten of the 13 affected feeders will see corrective action through the Priority Feeder Program and the remaining three feeders are part of Pepco's 2014 Reliability Enhancement Feeder Improvement Program.[499] Nevertheless, OPC recommends that Pepco report its planned

499 OPC Comments at 33.

improvements for these susceptible neighborhood feeders in a fashion similar to the reporting required under the Priority Feeder Program.[500]

177. Pepco Response: Pepco did not respond to OPC's recommendation.

178. Staff Report: The Staff Report did not address this topic and offered no recommendation on OPC's suggested new reporting format for these feeders.

179. Commission Decision: The Siemens Audit Report recognizes that a Priority Feeder Program is standard within the industry; but it also reports that 2% High Priority Feeders might not represent the complete target population for remediation because some other feeders face different problems and/or are under the radar of the 2% High Priority Feeder selection criteria. Both the Commission and Pepco recognized the need for multiple programs to focus on problem feeders; as a result there presently exists Pepco's 2014 Reliability Enhancement Feeder Improvement Program as well as the Most Susceptible Neighborhood feeder program which focuses on poorly performing feeders in neighborhoods that do not concurrently appear on the 2% High Priority Feeder list.

180. By a separate order, as a follow-up to the Siemens Reliability Audit Report, the Commission will be seeking comments from Pepco and interested persons concerning the potential adoption of a local feeder improvement program that would blend together both the 2% High Priority and the Most Susceptible Neighborhood feeder programs, with the goal that each Ward of the District will be represented in an effort by Pepco to steadily improve the reliability performance of participating priority feeders until customers served from these feeders have their legitimate reliability expectations met. OPC is welcome to reassert its Recommendation #8 to be considered in response to that order. With respect to the 2015 ACR, Pepco seeks to produce only 10 years' worth of historic data on its 2% High Priority Feeders as part of its report unless ordered to do otherwise by the Commission. The Commission will allow Pepco to include only 10 years of data in its report provided that it retains all of the historical data and makes it available as needed as the local feeder improvement programs are being reviewed.

OVERHEAD FEEDER AND POLE INSPECTIONS

2013 Consolidated Report (Carry-Over Issues) –

Pepco has failed to report on its replacement of faulty of lightning arresters as was directed by the Commission.[501] *The Commission will weigh the adequacy of Pepco's overvoltage protection scheme, with particular attention to Pepco's criteria for lightning arrester inspections and replacements.*[502]

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500 OPC Comments at 33.

501 Order No. 17455 at ¶¶ 212 and 215.

502 Order No 17455 at ¶ 358.

Review the Overhead Feeder Inspection priority assignments and repair schedules with Commission Staff for possible priority reassignments and shorter repair time schedules.[503]

Pepco report to the Commission regarding the quality of the feeder inspection used to identify distribution equipment in need of replacement or repair.[504]

Weigh the adequacy of Pepco's scheme (ASR, fuses and other sectionalizing equipment) for isolating upstream customers from downstream power outages.[505]

The Commission will examine AMI meter failure information reported in Pepco's 2014 Consolidated Report and based on our findings, will determine whether corrective action by Pepco is warranted.[506]

OPC Recommendations re 2014 Consolidated Report –

OPC Recommendation #3: Pepco should be directed to provide information comparing the Company's equipment-based approach for inspections to the feeder-based approach; in this information, Pepco should include an explanation for the discrepancy among the pole reject rates from Pepco's three different inspection programs (Pole Inspection, Overhead Feeder Inspection, and Priority Feeder remedies). Pepco should include its feeder inspection program in Table 1.3-B.[507]

Conclusions and Recommendations in Siemens Reliability Audit Report –

There are not significant key Performance Indicators ("KPIs") to measure and track progress of Pepco's inspection and maintenance programs, as well as their impact on reliability performance.[508]

Several important overhead maintenance work projects have been delayed, although Pepco is working on the implementation of new maintenance program (for example the overhead feeder inspection program) while definition of the maintenance priorities has not yet been clearly established.[509]

Incorporate overhead distribution equipment into the ECA process.[510]

Increase the frequency of inspections and testing for the overhead feeder inspection program and pole inspection and remediation program.[511]

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503 Order No. 17455 at ¶¶ 297, 299 and 302.

504 Order No. 17455 at ¶ 335.

505 Order No. 17455 at ¶ 357.

506 Order No. 17455 at ¶ 360.

507 OPC Comments at 4, 16-17.

508 Siemens Reliability Audit Report at 6-8.

509 Siemens Reliability Audit Report at 6-8.

510 Siemens Reliability Audit Report at 6-8, recommendation 1.

Develop key performance indicators to monitor the effectiveness of inspections and maintenance programs, including how programs affect reliability.[512]

Establish procedures for defining maintenance priorities (Pepco Asset Management Group and Pepco Maintenance and Construction Group).[513]

The number of Customer Minutes of Interruption demonstrate that Pepco's overhead feeders are in fair condition, on average, but display room for improvement.[514]

The practice is to replace wood poles based on age or condition, but Pepco has been performing pole replacements based on age and condition.[515]

Conclusions and Recommendations in Liberty Audit Report -

Pepco's new annual and four-year overhead feeder inspection programs, implemented in 2011, conform to best utility practices and appropriately support the District's overhead feeders.[516]

Create and implement formal policy documents applicable to inspection, maintenance and repair of infrastructure, including expected maintenance, inspection and repair job completion targets.[517]

Continue current pole, overhead feeder and overhead device inspection, maintenance and repair programs, particularly the annual and four-year overhead feeder inspection program.[518]

181. 2014 Consolidated Report: The 2014 Consolidated Report includes a table listing the types and periodicities of the various types of inspections the Company performs on its distribution equipment.[519] These were developed, it states, by weighing factors such as criticality, duty cycle, varying manufacturer's recommendations, and technological differences.[520] Distribution line equipment, such as transformers, cable and other components are not subject to detailed electrical testing and are replaced only when physical inspection

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511 Siemens Reliability Audit Report at 6-9, recommendation 2.

512 Siemens Reliability Audit Report at 6-9, recommendation 5.

513 Siemens Reliability Audit Report at 6-9, Recommendation 6.

514 Liberty Audit Report at IV-30.

515 Siemens Reliability Audit Report at 6-4.

516 Liberty Audit Report at IV-38.

517 Liberty Audit Report at ES A-6, IV-27 and IV-28.

518 Liberty Audit Report at ES A-6 and IV-.

519 2014 Consolidated Report at 50-53, Table 1.3-B.

520 2014 Consolidated Report at 49.

indicates a need for replacement.[521] Otherwise, equipment is replaced when it is upgraded, relocated or fails.[522] However, as increased technologies are installed, actual operational data will be available to better analyze the loading and performance of equipment, Pepco states.[523] It provides as an example, load data from the AMI system. This data, the Company states, can potentially be used to identify overloaded transformers and allow them to be replaced prior to failure.[524]

182. In its 2013 overhead feeder inspections, Pepco inspected 26 feeders, covering 5,081 poles.[525] In this inspection, 479 conditions were identified and prioritized for remediation.[526] These conditions ranged in importance from missing animal guards[527] to loose or broken risers.[528] In 2013, Pepco correct all 55 lightning arrester conditions that were identified in 2012 and reported in its 2013 Consolidated Report, as well as correcting 5 of 6 lightning arrester conditions found in its 2013 Overhead feeder inspections.[529]

183. OPC Comments: According to OPC, Pepco stated in its 2012 Consolidated Report that its overhead feeder inspection program would be reviewed to compare the equipment-based approach for inspections to the feeder-based approach, yet, Pepco has not provided this information.[530] In addition, OPC is concerned with apparent discrepancy between the number of poles found to require replacement, depending upon which of its three inspection programs (pole inspection, overhead feeder inspection and priority feeder inspection and remedies) is being applied to poles.[531] OPC notes that although Pepco described a range of feeder inspections in Table 1.3-B (Equipment Inspections), it has not included the [Overhead] Feeder Inspection [Program].[532] OPC also states its belief that the volume of required corrections found during Pepco's overhead feeder inspections has overwhelmed Pepco's resources, which is why

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521 2014 Consolidated Report at 49-50.

522 2014 Consolidated Report at 50.

523 2014 Consolidated Report at 49.

524 2014 Consolidated Report at 49.

525 2014 Consolidated Report at 57.

526 2014 Consolidated Report at 57.

527 145 conditions were found and are rated priority 4, to be corrected when other work being performed presents the opportunity to bring the condition to current Pepco standards.

528 Two conditions were found and are rated priority 1. For Priority 1 faults, inspectors stay on site until relieved by Pepco personnel, who then immediately eliminate the hazard to utility personnel and/or the public. *See* 2014 Consolidated Report at 56-57.

529 2014 Consolidated Report at 58.

530 OPC Comments at 16.

531 OPC Comments at 17.

532 OPC Comments at 17.

corrections are being triaged until repairs can be made to all identified deficiencies.[533] In light of these considerations, OPC is recommending the actions described in OPC Recommendation #3, above.

184. Pepco Response: Pepco disagrees with OPC that a comparison of the two inspection methods (equipment-based/feeder-based) was ever mentioned, but notes that its feeder-based Overhead Feeder Inspection Program was described in its 2013 Consolidated Report.[534] Pepco also disagrees with OPC's characterization of Pepco's work prioritization and organization process for feeder remediation (*i.e.* its allegation that the volume of required corrections found has overwhelmed Pepco resources). Pepco contends that its work is prioritized according to safety and reliability needs and referenced corrective actions are combined with other capital programs so that there is no duplication of efforts or replacements in the near term that would be replaced later, under another infrastructure replacement program.[535] Pepco did not respond to OPC's recommendation that Table 1.3-B include information describing the equipment inspected under the Company's Overhead Feeder Inspection Program.

185. As to its power poles, Pepco responds that OPC's criticisms evidence its confusion with the goals of the three different programs under which poles are replaced. The Overhead Feeder Inspection process is associated with pole tops [crossarms] or general external pole conditions that can be viewed at the above-ground level.[536] The Priority Feeder program is a more aggressive program in which, based on performance selection criteria, infrastructure replacements (including poles) are made to prevent further outages. The reasons for replacing these poles on priority feeders can range from feeder hardening tactics by upgrading pole class, to remediating insufficient [vegetation] clearances requiring taller poles.[537] Finally, the cycle-based Ground Line Pole Inspection program maintains the viability of pole's footing. In this program, a Pepco contractor inspects the individual poles at and below the ground level for internal and external conditions that may affect the pole's structural integrity and load carrying capability.[538] The differences in program goals and strategies reflect the different rates of pole replacements associated with the three programs.

186. Staff Report: The Staff Report concludes that Pepco appropriately responded to the directive in Order No. 16975 regarding its Overhead Feeder Inspection Program and agrees with Pepco that because of the different goals of its two inspection programs and Priority Feeder Program, there is no *prima facie* discrepancy among the rates by which pole replacements occur under the respective programs. The Staff Report makes no recommendation regarding OPC's concerns on this topic.

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533 OPC Comments at 17.

534 Pepco Response at 4.

535 Pepco Response at 5.

536 Pepco Response at 5.

537 Pepco Response at 5.

538 Pepco Response at 5.

187. Siemens Reliability Audit Report: The Siemens Reliability Audit Report addresses Pepco's Overhead Feeder Inspection Program as part of its overall review of Pepco's maintenance practices. The Program was implemented in 2011 and consists of visual inspection and thermal scanning of cross-arms, braces, insulators, transformers and switches, and inspection and treatment of wood poles.[539] The first annual cycle of inspections occurred over the 2011-12 period and examined 59 different feeders, revealing 905 deficiencies, 67 of which were identified as critical.[540] Of these 67, 27 remained unresolved at the time the Audit Report was prepared.[541] Pepco's 2013 Overhead Feeder Inspections included 30 feeders that were not previously inspected.

188. In addition to the Overhead Feeder Inspection, Pepco implements a Pole Inspection and Remediation Program ("IR Program"). The IR Program is a 10-year cyclical inspection of wood structures that support overhead electric distribution equipment.[542] The inspection calculates the percentage loss of a pole's original strength and considers replacement or restoration when any pole has lost 33% or more of its original strength; any pole that has lost 50% or more of its strength is considered a high priority for replacement.[543] In the District, there are 40,233 Pepco-owned wood poles; 70% are older than 35 years and 35% are older than 55 years. According to Siemens, as part of Pepco's practices, wood poles 55 years or older are supposed to be replaced, regardless of condition; however, some have not been replaced.[544] Siemens reported that the number of poles in deteriorated condition during its field assessment was relatively low, leading to its assumption that poles in bad condition, including old poles, are being effectively replaced.[545]

189. Siemens found that several important overhead maintenance work projects have been delayed and that the definition of maintenance priorities has not yet been clearly established between Pepco's Asset Management Group and the Maintenance and Construction Group.[546]

190. The Siemens Reliability Audit Report recommends the following with respect to overhead feeder inspections:

- Overhead distribution equipment be incorporated into Pepco's ECA [team evaluation] process;[547]

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539 Siemens Reliability Audit Report at 6-4.

540 Siemens Reliability Audit Report at 6-4.

541 Siemens Reliability Audit Report at 6-4.

542 Siemens Reliability Audit Report at 6-4.

543 Siemens Reliability Audit Report at 6-4.

544 Siemens Reliability Audit Report at 6-4.

545 Siemens Reliability Audit Report at 6-7.

546 Siemens Reliability Audit Report at 6-8.

- Increase the frequency of inspections and testing in the Overhead Feeder Inspection Program and the IR [pole inspection] Program;[548]
- Develop and implement a detailed plan for feeder inspections after a major storm to address any temporary or unfinished work from the storm restoration process, possible hidden issues such as broken insulators and loose connections, and any remaining vegetation management issues;[549]
- Develop and implement key performance indicators ("KPIs") to measure and track progress in the inspection and maintenance programs;[550] and
- Establish the procedures to be followed by the Asset Management Group and Maintenance and Construction Group to use in defining maintenance priorities.[551]

191. Liberty Audit Report: Liberty states that good utility practice calls for the conduct of walking inspection patrols of the utility's entire overhead system, including laterals, at least once every four years.[552] For an inspection program to be effective defects found must undergo timely repair, with prioritization of repair work determined largely by the consequences should the repair not be timely completed.[553] Liberty examined Pepco's overhead feeder inspection and repair activities addressing overhead lines, insulators, cross-arms and devices (such as non-remote controlled capacitors, automatic circuit reclosers and voltage regulators).[554]

192. Liberty reports that Pepco's Overhead Feeder Inspection Program has two components: 1) an annual drive-by visual and infrared inspection of mainline feeders (conducted before summer loading); and 2) a thorough walking inspection of complete overhead mainline feeders and lateral feeders, based on a four-year inspection cycle.[555] Liberty found that Pepco does not have formal written policy documents related to overhead feeder inspections and repairs; however, it has maintenance protocols for overhead feeder devices that describe maintenance activities/cycles with respect to pad-mounted transformers, capacitor banks, voltage

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547 Siemens Reliability Audit Report at 6-8.

548 Siemens Reliability Audit Report at 6-9.

549 Siemens Reliability Audit Report at 6-9.

550 Siemens Reliability Audit Report at 6-9.

551 Siemens Reliability Audit Report at 6-9.

552 Liberty Audit Report at IV-29.

553 Liberty Audit Report at IV-29.

554 Liberty Audit Report at IV-29 through IV-30.

555 Liberty Audit Report at IV-33.

regulators and automatic circuit reclosers.[556] Liberty found that Pepco considers the following schedule as the program document for its overhead feeder inspection documentation:[557]

Annual Overhead Inspection (from Vehicle)

- Visual inspection of main lines; and
- Infrared scan of main lines.

Four-Year Feeder-Based Comprehensive Inspection (mainline and lateral lines)

- Walking visual inspection of pole attachments, including all equipment;
- Infrared scan for overheated splices, switches and fuses;
- Compliance to PHI construction standards
- Basic Impulse Levels (phase spacing)
- Joint-use audit; and
- Contact-voltage test.

193. In 2012, Pepco inspected 31 overhead feeders under this program (16% of all overhead feeders in the District), covering 12,668 poles (31% of the total number of poles in the District).[558] This inspection yielded zero Priority 1 conditions, 75 Priority 2 conditions, 621 Priority 3 conditions and 217 Priority 4 conditions.[559] No repair jobs were overdue at the time Pepco demonstrated its logging of "repair by" dates in its Work Management Information System program database.[560]

194. Liberty states that "blue-sky" customer minutes of interruption ("CMI") is indicative of the condition of Pepco's overhead equipment and of the sufficiency of Pepco's overhead feeder maintenance practices.[561] Based upon Pepco's 2010 and 2012 "blue sky" CMI, Liberty concludes that Pepco's overhead feeders are in fair condition, on average, but display room for improvement.[562] Liberty conducted field inspections of four old overhead feeders on which Pepco had not yet conducted reliability work and for which it had no reliability work planned.[563] Liberty found that all poles appeared to be in good condition, and cross-arms, hardware and conductors generally appeared to be in fair to good condition.[564] Liberty observed,

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556 Liberty Audit Report at IV-36 through IV-37.

557 Liberty Audit Report at IV-34.

558 Liberty Audit Report at IV-34.

559 Liberty Audit Report at IV-35. To illustrate, a broken or cracked cross-arm is a Priority 2 condition; a missing or defective animal guard is a priority 3 condition; and missing or defective Down Guy Wire or Overhead guy wire can be either a Priority 3 or Priority 4 condition.

560 Liberty Audit Report at IV-34.

561 Liberty Audit Report at IV-30.

562 Liberty Audit Report at IV-30.

563 Liberty Audit Report at IV-30 (Feeder Nos. 349, 380, 15010 and 15016).

564 Liberty Audit Report at IV-30.

however, two broken cross-arms on feeder 15010 which, in Liberty's opinion, reinforces the need for Pepco to continue with its new Overhead Feeder Inspection Program.[565]

195. According to the Liberty Audit Report, Pepco does not have formal written policy documents relating to the method, quality control, goals, tracking and responsibility for pole inspections.[566] Instead, it relies upon a PHI document entitled, "Detailed Specifications for Inspection and Remedial Treatment of Wood Utility Poles on the PHI System" as its program document, consistent with PHI's Vegetation Management Group providing management of Pepco's pole inspections in the District.[567]

196. A total of 9,592 District poles underwent inspection in 2011, with Pepco's contractor tagging 62 for replacement and 46 for reinforcement; slightly more than one percent of the poles inspected did not meet the minimum strength requirements.[568] These results fell well within the three percent limit that Liberty uses as a benchmark for pole conditions.[569] Pepco reduced its pole inspection cycle to 10 years, with the goal of maintaining a pole rejection rate well below 1%.[570] Liberty found that Pepco's and PHI's digital job tracking methods for pole inspections and remediation were convenient and effective, with no pole replacement jobs being overdue at the time.[571]

197. Commission Decision: The Commission commends Pepco for correcting all 55 of the faulty lightning arrestors found in its 2012 inspection and correcting 5 of the 6 faulty lightening arresters identified in its 2013 inspection. In Order No.17455, we discussed in detail the safety concerns potentially implicated in faulty lightning arresters.[572] We are heartened that Pepco responded timely and completely to our concerns.

198. Significantly, Siemens reported that the number of poles in deteriorated condition during its field assessment was relatively low. In addition, Liberty found Pepco's pole rejection rates to be slightly more than one percent, which is well below the 3% pole reject rate that Liberty considers to be the benchmark. Therefore, even though Pepco's different inspections employed different methodologies, this did not have a negative impact on the state of Pepco's power poles. In response to OPC's concerns about the discrepancies between the results reported about pole inspections, Pepco explained in further detail the three types of inspections

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565 Liberty Audit Report at IV-30.

566 Liberty Audit Report at IV-30.

567 Liberty Audit Report at IV-30 through IV-31.

568 Liberty Audit Report at IV-32.

569 Liberty Audit Report at IV-32.

570 Liberty Audit Report at IV-32.

571 Liberty Audit Report at IV-33.

572 Order No. 17455 at ¶¶ 211-215.

that it conducts on its poles. The Audit findings and the additional explanation provided by Pepco provide ample information about Pepco's pole inspection programs; therefore the Commission will not adopt OPC's Recommendation #3.

Quality of Overhead Feeder Inspections, In General

199. In Order No. 16975 on the 2012 Consolidated Report, the Commission decided in favor of a recommendation by its Staff, concurred in by OPC, that Pepco provide in its 2013 Consolidated Report a discussion of the findings and results of its Overhead Feeder Inspection Program (as well as a review of the OH and UG switch maintenance program, replacement of oil filled switches in the 4 kV underground system, and other initiatives designed to reduce equipment failure rates.)[573] In Order No. 17455, the Commission agreed with a recommendation of both Staff and OPC that the quality of Pepco's Overhead Feeder Inspection Program should be reviewed, but deferred that review until after the Commission has examined the Siemens Reliability Audit Report and the comments from interested persons on that Report.[574] The Commission now has the benefit of the findings of both the Liberty and the Siemens Audit Reports; consequently we are now able to review the prior ACR recommendations that address the quality of Pepco's Overhead Feeder Inspection Program and we do so in the discussion that follows.

200. The Liberty Audit Report concludes that Pepco's annual and four-year overhead feeder inspection programs, implemented in 2011, conform to best utility practices and appropriately support the District's overhead feeders, although the Report recommends that key performance indicators be developed that would signal the effectiveness of these inspections and their effect on reliability.[575] The Siemens Reliability Audit Report describes the overhead inspection process and states that this process triggers inspection and maintenance best practices within Pepco's overhead system.[576] The Commission accepts the Liberty and Siemens Audit Reports' general conclusions that Pepco's Overhead Feeder Inspection Program currently operates consistent with best practices. Despite this general conclusion, the Siemens Audit also identified several ways that Pepco's overhead inspection and maintenance programs can be improved. We address these recommendations below.

Key Performance Indicators for Overhead Inspections

201. The Siemens Audit recommends that Pepco develop and implement key performance indicators ("KPIs") to measure and track progress in the inspection and maintenance programs. This recommendation is supported by OPC and the Commission Staff, both in response to the Siemens Audit and in response to the 2014 Consolidated Report. In the absence of indicators that signify when performance is being met with respect to key inspection criteria, it would be difficult to objectively evaluate the need for future enhancements to Pepco's

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573 Order No. 16975, ¶¶ 63-64.

574 Order No. 17455, ¶¶ 297-299, 302.

575 Liberty Audit Report at IV-38.

576 Siemens Reliability Audit Report at 6-4.

current overhead inspections. Therefore, the Commission agrees that Pepco should develop and adopt KPIs for its overhead inspection and maintenance programs.

202. In this context, the performance indicators should assist Pepco to timely and accurately identify overhead infrastructure that either has failed or is deteriorating to the point that premature failure of the equipment is foreseeable. In addition, the performance indicators should assist Pepco to manage the inspection program in such a way that observations of failed and failing equipment are accurately and timely recorded, communicated to the appropriate responsible party or parties, and acted upon in such a way as to relieve or forestall these overhead equipment failures. The Commission will include the directive to Pepco to develop a listing and weighting of KPIs it believes appropriate to measure the quality of its Overhead Feeder Inspection Program in the separate order it will issue detailing follow-up actions from the Siemens Audit.

Post-Completion Inspection of Repairs In Response To Major Service Outages

203. The Siemens Reliability Audit Report speculates that there may be a deficiency in Pepco's major service outage restoration performance that requires additional follow-up feeder inspections. Siemens states that several related outage events have occurred on "blue sky" days timed within weeks following 2011 and 2012 Major Service Outages.[577] This suggests to Siemens that some equipment outage conditions have not been properly solved during restoration work.[578] Therefore, Siemens recommends that Pepco develop and implement a plan for follow-up feeder inspections to occur after all customers have been restored, following a Major Service Outage.[579] The inspection may uncover possible hidden issues such as broken insulators and loose connections, any temporary or unfinished repair work, and unaddressed vegetation management issues.[580]

204. This recommendation, however, has been superseded by the Commission's adoption of Rules requiring Pepco to implement a Major Service Outage Restoration Plan ("MSO Restoration Plan") and prescribing the minimum content of the Plan.[581] Specifically, Rule 3603.20, in paragraphs (f) and (o) respectively, requires that Pepco include in its Major Service Outage Restoration Plan a description of its damage assessment, and a description its post-event inspection and reporting.[582] In addition, paragraph (p) of Rule 3603.20 requires Pepco to file a report with the Commission within 60 days following its completion of its post-MSO restoration work that evaluates and reports upon each of the criteria within its

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577 Siemens Reliability Audit Report at 6-8.

578 Siemens Reliability Audit Report at 6-8.

579 Siemens Reliability Audit Report at 6-9.

580 Siemens Reliability Audit Report at 6-9.

581 15 DCMR § 3603.20 (July 27, 2012).

582 15 DCMR § 3603.20(o) (July 27, 2012).

Commission-accepted MSO Restoration Plan.[583] Given Pepco's MSO Restoration Plan that satisfies the Commission's Rules and the reporting required regarding that Plan, this recommendation has already been addressed.

Frequency of Inspections

205. Pepco's Overhead Feeder Inspection Program which began implementation in 2012 uses a four-year inspection cycle which the Liberty Audit Report describes as both appropriate and a best practice.[584] The Siemens Reliability Audit Report recommends that the frequency of Pepco's overhead feeder inspections be increased.[585] Because the first four-year cycle has yet to be completed, the Commission concludes that the Siemens recommendation with regard to the overhead feeder inspections is unsupported and premature. In the absence of any contrary facts, the Commission will presume that the industry best practice of maintaining a four year inspection cycle for overhead feeders is appropriate for Pepco's use in the District.

206. Siemens has raised the further concern that under its present schedule, Pepco will inspect the entire overhead system in about five years, not four years.[586] If such is the case, this discrepancy could create slippage in the frequency of overhead inspections and lead to undetected actual or incipit fault conditions on overhead wires and other equipment. Accordingly, the Commission directs Pepco to clarify in its 2015 Consolidated Report whether all of its overhead feeders will be inspected over a four-year period. In addition, to allow the Commission to determine whether there has been any slippage in the schedule, Pepco is directed to provide in its 2015 Consolidated Report a table listing by year the overhead feeders that have been inspected from the commencement of the Program through December 31, 2014, and, if known, the feeder numbers of the overhead feeders scheduled to be inspected by Pepco in 2015.

Unaddressed Priority 2 Repairs on Overhead Feeders

207. Another concern raised in the Siemens Report dealt with unaddressed Priority 2 repairs on overhead feeders at the time of its audit. Siemens reported that Pepco's 2012 overhead feeder inspection yielded 67 deficiencies that were critical or with high priority work required and 40% of those deficiencies had not been resolved,[587] however the Liberty Audit Report states that 41 Priority 2 deficiencies had already been repaired and the remaining 26

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583 See *Formal Case No. 766, In The Matter Of The Commission's Fuel Adjustment Clause Audit and Review Program; Formal Case No. 982, In The Matter Of An investigation Into Potomac Electric Power Company Regarding Interruption To Electric Energy Service; Formal Case No. 991, An Investigation Into Explosions Occurring In Or Around The Underground Distribution System Of The Potomac Electric Power Company; and Formal Case No. 1002, In The Matter Of The Joint Application Of Pepco And The New RC, Inc. For Authorization And Approval Of Merger Transaction, Order No. 17146* (May 30, 2014), First Revised MSO Plan, Order No. 17558 (July 25, 2014) and Second Revised MSO Plan, Order No. 17683 (October 27, 2014).

584 Liberty Audit Report at IV-38.

585 Siemens Reliability Audit report at 6-9, recommendations 2a and 2c.

586 Siemens Reliability Audit Report at 6-4.

587 Siemens Reliability Audit Report at 6-4.

deficiencies were then in a planning and design phase.[588] Thus, no repair jobs associated with Pepco's 2012 overhead feeder inspections were overdue at the time Pepco demonstrated its WMIS program to Liberty.[589] Consequently, the Commission decides that no action needs to be taken to address the Priority 2 deficiencies from the 2012 inspection that Siemens identified as outstanding and Liberty reports as being in the design and planning stage.

Pole Inspection Program

208. There was a discrepancy between the Siemens Audit Report and the Liberty Audit Report with respect to Pepco's pole inspection program. The Liberty Audit Report found that after 2012, Pepco shortened its pole inspection frequency from 12-18 years to 10 years.[590] It further reports that for the five-year period 2008-2012, Pepco inspected two thirds of its poles in the District, which exceeds the pole inspection program's cycle requirements.[591] More importantly, Liberty reports that of the 9,592 poles Pepco inspected in the District in 2011, only slightly more than one percent did not meet minimum strength requirements.[592] This result falls well within the three percent pole reject rate that Liberty uses as a benchmark for pole conditions[593] and demonstrates there is no need to increase the frequency of pole inspection to less than 10 years, as recommended by Siemens.

Assessing Maintenance Priorities for Overhead Feeders

209. In response to Pepco's 2013 Consolidated Report, Staff recommended that Pepco be directed to review with Staff the Company's overhead feeder inspection priority schedules and repair priorities, for possible reassignments of inspections and shorter repair time schedules.[594] The Commission deferred action on this recommendation until the Siemens Reliability Audit Report was reviewed. According to the Siemens Report, PHI's Asset Performance and Reliability Unit collects information generated from various Pepco inspections, including information on maintenance needs;[595] however, maintenance priorities are initially determined jointly by Pepco's Asset Management Group and its Maintenance and Construction Group.[596] Once determined, these maintenance needs are communicated to Pepco's work center, where engineering and planning personnel evaluate the information, define an estimated time to

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588 Liberty Audit Report at IV-36.

589 Liberty Audit Report at IV-34.

590 Liberty Audit Report at IV-31.

591 Liberty Audit Report at IV-31.

592 Liberty Audit Report at IV-32.

593 Liberty Audit Report at IV-32.

594 Staff Report on Pepco's 2013 Annual Consolidated Report, Staff Recommendations Nos. 8 and 9.

595 Siemens Reliability Audit Report at 6-5.

596 Siemens Reliability Audit Report at 6-6 and 6-8.

completion for each maintenance task and on occasion change its associated priority.[597] Accordingly, Siemens recommends that procedures be established by which these Groups will cooperate in defining maintenance priorities.[598]

210. The Liberty Audit Report concludes that PHI's Asset Management Group and Pepco's senior management do not have direct oversight over some of Pepco's inspection, maintenance and repair programs.[599] Liberty observed that Pepco's Substation maintenance organization assigns equipment repair priorities in a different manner from the Overhead and Underground Maintenance organizations, with overhead maintenance work being completed consistent with its program requirements.[600] Liberty states that Pepco does not routinely complete maintenance work on a timely basis for some substation repairs, for circuit breaker maintenance tasks, and for network transformer inspections.[601] It concludes that a lack of structured oversight allows maintenance organizations to conduct some maintenance work consistent with their own internal sense of priorities, affecting timeliness of repairs.[602] Thus, Liberty recommends that formal policy documents be created and implemented for inspections, maintenance and repairs.[603]

211. The Liberty Audit Report recommends that Pepco assign maintenance priority to radial underground cables, when compared with underground cables that are networked and, having N-1 redundancy, are less likely to have outage events from failed equipment.[604] Pepco states that repair of damaged radial feeders already receives special attention in that it handles all situations that indicate imminent failure (cables and joints smoking, insulation damage exposing conductors, etc.) with urgency, regardless of feeder configuration.[605] The corrective actions have an allowed response period of five days, but as a practical matter, Pepco typically addresses them during the next fully staffed shift after the condition is found.[606] The Commission agrees that Pepco's equal prioritization of radial versus non-radial underground cables is consistent with a

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597 Siemens Reliability Audit Report at 6-6.

598 Siemens Reliability Audit Report at 6-9.

599 Liberty Audit Report at ES A-5

600 Liberty Audit Report at IV-26.

601 Liberty Audit Report at IV-26.

602 Liberty Audit Report at IV-26 through IV-27.

603 Liberty Audit Report at ES A-6 and IV-27.

604 Liberty Audit Report Recommendation V-B-3.

605 Pepco Response to Liberty Audit Report at 28 (filed October 14, 2014).

606 Pepco Response to Liberty Audit Report at 28 (filed October 14, 2014).

Conditions-Based Maintenance process, which is a utility best practice.[607] For this reason, the Commission will not adopt this specific Liberty recommendation.

212. Both audits support Staff's observation that there needs to be more structure for the procedures by which maintenance priorities for the overhead system are defined and implemented and how repair priorities are established, implemented and changed. In the separate order the Commission will issue detailing follow-up actions from the Siemens and Liberty Audit, we will include a directive to Pepco to develop and make available to the Commission formal policy documents detailing the procedures for setting and implementing maintenance priorities for each division for inspections, maintenance and repairs.

Maintenance - Expansion of the ECA Process to Include Distribution Equipment

213. The Siemens Reliability Audit Report recommends that underground and overhead distribution equipment be incorporated into Pepco's Equipment Condition Assessment ("ECA") process.[608] We note as a preliminary matter that there is a major discrepancy between the ECA process as described in the Siemens Reliability Audit Report and as described by Pepco in its 2013 and 2014 Consolidated Reports. In the former, the ECA process is described by Siemens as one by which Pepco identifies maintenance tasks and prioritizes available maintenance resources to ensure that equipment receives required maintenance when needed.[609] Also, according to Siemens, "the ECA process uses technologies such as chemical analysis, electrical testing, NDT tools, and breaker operation to provide input for prioritization and to determine further routine inspection or maintenance." In contrast, in the 2013 and 2014 Consolidated Reports, Pepco describes the ECA process as one to identify potential replacements of large, high cost, long lead time primary components within substations as a means of managing contingency risk (*i.e.*, maintaining N-1 redundancy). Inasmuch as Siemen's recommendation appears to be premised on its faulty understanding of the ECA process, we attach little weight to that recommendation. Instead, the Commission concludes that the time and resource-intensive ECA process described in the 2014 Consolidated Report does not lend itself to routine maintenance of distribution equipment and for this reason, the Commission will not adopt this recommendation.

UNDERGROUND PILC REPLACEMENT

2013 Consolidated Report (Carry-Over Issues) –

The Siemens Reliability Audit is reviewing policies and operational issues related to PILC replacement activity; therefore, the Commission will not act at this time on Staff's concerns regarding the efficacy of Pepco's opportunistic PILC replacement strategy and associated reporting.[610]

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607 Pepco Response to Liberty Audit Report at 28 (filed October 14, 2014).

608 Siemens Reliability Audit Report at 6-8.

609 Siemens Reliability Audit Report at 6.

610 Order No. 17455 at ¶ 277.

Revisit the opportunistic PILC Replacement Strategy and provide an estimate of how many of the approximately 1,100 miles of PILC in the underground system are replaceable.[611]

OPC Comments on 2014 Consolidated Report –

OPC offered no recommendations in its Comments concerning Pepco's PILC replacement strategy and associated reporting.

Conclusions and Recommendations in Siemens Reliability Audit Report –

Pepco create a database of PILC and hybrid cable types for comparative purposes and diagnostics.[612]

Using testing standards specified in Section 9 of the Siemens Reliability Audit Report, Pepco evaluate PILC cables to determine which cables are apt to stay in service and which should be replaced.[613]

Conclusions and Recommendations in Liberty Audit Report -

Pepco's existing underground cable database has important gaps and that the Company has not made concerted efforts to populate its GIS with information on existing cables.[614]

Liberty recommends that Pepco develop a plan to close the gaps in its underground cable database with data on cable insulation type and age.[615]

214. 2014 Consolidated Report: In 2013 Pepco identified 13 5-in-10 feeders as potential candidates for targeted PILC replacement and of these, selected four to be upgraded as part of Pepco's PILC replacement program.[616] These four feeders together yielded a total of 22,700 feet of PILC for possible replacement.[617] Pepco reports that of this total, 17,037 feet (or 75%), were replaced in 2013.[618]

215. Although Pepco "cannot provide an estimate of the number of miles of PILC that will be replaced by EPR for the ten year period from 2012 to 2021," Pepco asserts it "can show progress in the actualization of its PILC replacement strategy" and presented a table indicating

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611 Order No. 17455 at ¶¶ 307-309.

612 Siemens Reliability Audit Report at 9-3.

613 Siemens Reliability Audit Report at 9-3.

614 Liberty Audit Report at V-2.

615 Liberty Audit Report at V2.

616 2014 Consolidated Report at 337.

617 2014 Consolidated Report at 337.

618 2014 Consolidated Report at 338.

its annual replacement of PILC footage from 2001 to 2013, with a total of 226,836 feet replaced.[619] Going forward, Pepco indicates that it will seek to implement an opportunistic replacement strategy, based on conditions it finds, which it expects to be a more cost-effective replacement strategy than a commitment to replacing a fixed number of miles of PILC each year."[620]

216. OPC Comments: OPC did not address Pepco's PILC replacement in its Comments on the 2014 Consolidated Report. However, in Comments responding to the Staff Report on Pepco's 2013 Consolidated Report, OPC supported a Staff Recommendation that Pepco revisit its opportunistic PILC Replacement Strategy and provide an estimate of how many of the approximately 1,100 miles of PILC in the underground system are replaceable; OPC suggested that this estimate be broken down according to operating voltage.[621]

217. Pepco Response: Pepco responded to the above Staff Recommendation, as modified by OPC stating, "At this point, Pepco cannot accurately estimate how many non-replaceable PILC miles are on its system. The PILC replacement strategy was designed as an ongoing opportunistic approach that specifically targets portions of PILC cable experiencing repeated failures meeting the Company's 5-in-10 criteria."[622] In Order No. 17455, the Commission observed that the Siemens Reliability Audit was, at that time, reviewing policies and operational issues related to PILC replacement activity and, therefore, deferred action on this Staff recommendation.

218. Staff Report: The Staff Report concluded that although it is clear that a wholesale replacement of PILC is cost prohibitive, Staff anticipates that Pepco's opportunistic PILC replacement strategy, along with the installation of additional slotted manhole covers, will reduce the number of severe manhole events on the primary system.[623] The Staff Report has no recommendations regarding Pepco's PILC replacement strategy and associated reporting, or Pepco's recording of PILC cable data in its GIS.

219. Siemens Reliability Audit Report: The Siemens Reliability Audit Report provides a narrow look at this topic, making no findings regarding the quantity, location, or condition of the PILC on Pepco's underground distribution system, or Pepco's recordkeeping associated with PILC. Instead, the Report describes various testing standards (typically to determine insulation thickness) within the industry that are accepted for purposes of assessing the condition of PILC. Siemens recommends that Pepco create a database of PILC and hybrid cable types for comparative purposes and diagnostics.[624] Pepco noted in its Response to the Siemens Reliability

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619 2014 Consolidated Report at 338.

620 2014 Consolidated Report at 337.

621 OPC Comments on Staff Report at 9.

622 Pepco Response to Staff Report on 2013 Consolidated Report at 22.

623 Staff Report on 2014 Consolidated Report at 81.

624 Siemens Reliability Audit Report at 9-3.

Audit Report that it is already recording cable failures and is in the process of updating its GIS to include information on cable replacements.

220. Liberty Audit Report: The Liberty Audit Report determined that as of the end of 2011, there were approximately 1,106 miles of primary PILC on Pepco's underground distribution system and that many of these PILC cables are approaching the end of their scheduled service lives.[625] The Liberty Audit Report also found that Pepco's GIS has been collecting underground cable insulation types for the past several years: describing that only one of these recorded feeders has PILC for insulation, 219 have Ethylene Propylene Rubber ("EPR") insulation and the remaining 1,472 are of unknown insulation types.[626] Significantly, the Report states that an accurate underground cable database is a recognized industry best practice in asset cable management.[627] Nevertheless, Liberty concludes that Pepco's existing underground cable database has important gaps and that the Company has not made concerted efforts to populate its GIS with information on existing cables.[628] The Report recommends that Pepco develop a plan to close the gaps in its underground cable database with data on cable insulation type and age.[629]

221. Siemens Technical Audit Reports and Commission Order No. 17711: In 2003, the Commission retained Siemens as a technical consultant to annually assess, monitor, and report on Pepco's progress in remediating problems on its system that give rise to manhole incidents, such as fires, smoke and explosions.[630] As part of this assessment, Siemens reports on the progress of Pepco's PILC replacement and related matters involving PILC. In its Sixth Year Technical Audit Report Siemens presented a table, using data provide by Pepco, listing manhole events occurring in 2011, by insulation type.[631] This table identified 101 events involving seven cable insulation types. Of these, 23 events occurred on primary PILC.

222. In Order No. 17711, the Commission reviewed and decided upon the recommendations given in Siemens Eighth Year Technical Audit Report in *Formal Case No. 991*.[632] In the Eighth Year Audit Report, Siemens expressed concern that Pepco's new [opportunistic] PILC replacement strategy will not increase its PILC replacement rate, stating its

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625 Liberty Audit Report at V-1.

626 Liberty Audit Report at V-1.

627 Liberty Audit Report at V2.

628 Liberty Audit Report at V-2.

629 Liberty Audit Report at V2.

630 See *Formal Case No. 991, In the Matter of the Investigation into Explosions Occurring in or Around the Underground Distribution Systems of the Potomac Electric Power Company, Order No. 12735* ("F.C. 991, Order No 12735")(rel. May 16, 2003.)

631 See F.C. 991, Order No. 16654 ,Attachment "Investigation of the Manhole Incidents and Explosions Occurring In and Around the Underground Distribution Systems of the Potomac Electric Power Company in Formal Case No. 991: Sixth Year Technical Audit Report at p. xiv (September 1, 2011).

632 Formal Case No. 991, Order No. 17711 (rel. November 24, 2014).

expectation that PILC replacements in 2013 will be about half that achieved during 2012.[633] Siemens also stated its preference for a planned annual program of PIOLC replacement that would incorporate the opportunistic elements of Pepco's existent PILC replacement strategy.[634]

223. Consequently, Siemens recommended that Pepco develop and provide in its future Annual Consolidated Reports an annual and five-year PILC replacement plan, including an estimate of annual feet of PILC to be replaced, actual versus estimated annual replacement footage, and reasons for variations.[635] We deferred ruling upon this recommendation in Order No. 17711, until the recommendation could be coordinated with similar directives resulting from Siemens' recommendations on underground cable and PILC replacement in the Siemens Reliability Audit, and with the Commission's final decisions in our upcoming rulemaking in *Formal Case No. RM5-2014-01-E* (to address the content and review procedures for Pepco's future Annual Consolidated Reports).[636]

224. Commission Decision: As described above, in 2011, Pepco identified for Siemens 23 different underground events involving PILC. Notwithstanding the availability of this information, Pepco apparently has recorded only one underground PILC feeder in its GIS to date. This fact further substantiates Liberty's conclusion that Pepco has not made concerted efforts to populate the GIS with information on existing cables. The Commission is concerned that Pepco's recording of PILC data in its GIS is not yet consistent with industry standards, particularly in light of Liberty's representation that common industry practices include field surveys, inspections, and maintenance activities to feed the GIS system, and incorporate a feedback process in place for populating with collected information data fields that are specified as "unknown".

225. For the foregoing reasons, the Commission directs Pepco to include in its 2015 Consolidated Report, an update on its inclusion of the location of PILC on its system into its GIS. In addition, in its follow-up order to the Siemens Reliability Audit, the Commission will be directing Pepco to submit a plan, including a timeline, under which it will: i) incorporate into the GIS information that Company has already collected that identifies the location of PILC on its system in the District; ii) systematically coordinates newly acquired field data with its ongoing efforts to populate its GIS with feeder location and identification data, including feeder insulation type; iii) re-state the GIS data currently identifying feeder insulation type as unknown, with the actual insulation type; and iv) describe quality control/quality assurance measures to ensure the accuracy of GIS data of these natures.

226. The Commission's remaining concerns at this time regarding Pepco's PILC replacement strategy and associated reporting is that the opportunistic strategy for such replacements may not be sufficiently defined to link future replacements with demonstrated

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633 Order No. 17711 at ¶ 28.

634 Order No. 17711 at ¶ 28.

635 Order No. 17711 at ¶ 30.

636 Order No. 17711 at ¶ 31.

reliability needs on the underground system or to allow Pepco to maintain or improve upon the pace of its PILC replacement. For instance, it is not clear whether Pepco will routinely evaluate corridors for new undergrounding projects to determine the proximity, if any, of PILC and whether PILC replacement would be economically viable, in light of the upcoming undergrounding activity. The same concern holds true when Pepco is engaging in other forms of underground capital improvements or maintenance. For this reason, in its follow-up order to the Siemens Reliability Audit, the Commission will also be directing Pepco to submit a description of the criteria under its opportunistic PILC replacement strategy (above and beyond its 5-events-in-10-years criterion) that, when present, will lead to a positive decision by Pepco to replace PILC at specific locations.

B. Pepco's Compliance with Prior Commission Directives

227. In Order No. 17455 (approving Pepco's 2013 Consolidated Report), the Commission issued 11 directives that described additional information to be included by Pepco in its 2014 Consolidated Report.[637] These directives, along with related discussions contained, variously, in the 2014 Consolidated Report, OPC Comments on the 2014 Consolidated Report and in Pepco's Response to those Comments, are discussed individually below.

> **Directive 1 (Order No. 17455 at ¶ 380): Pepco is to provide in a supplement to its 2014 Annual Consolidated Report, cost and location information about equipment recommended for the District by its Equipment Condition Assessment Team, consistent with paragraph 157 of Order No. 17455.**

228. Consolidated Report: To comply with paragraphs 157 and 380 of Order No. 17455, Pepco included in its Supplement revised ECA Team Meeting Minutes for each of the Team Meetings held in 2013. The revised minutes now include information reflecting costs of the replacements or maintenance performed, the locations of the substations, and the identification of the affected feeders located downstream from each substation.[638]

229. OPC Comments: OPC did not comment upon Pepco's compliance with this directive.

230. Staff Report and Staff Recommendation #1: The Staff Report concludes that Pepco complied with this directive, but found that the information in the ECA Team Meeting Minutes is not summarized nor presented in a manner which facilitates analysis. The Staff Report also concludes that it is not clear from the minutes whether the reported upon 2013 Capital Work items were completed, deferred or are still ongoing.[639] The Staff Report recommends that, in addition to information currently provided, the minutes provide a summary,

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637 Order No. 17455, ¶¶ 380 – 390.

638 Supplement at 2-12.

639 Staff Report at 78.

by category, of the individual projects described in the minutes and indicate for each project whether the project was deferred, is completed, or is ongoing.[640]

231. Commission Decision: The Commission finds that Pepco has supplemented its 2014 Consolidated Report to include cost and location information about equipment recommended for the District by the ECA Team and concludes that Pepco has fully satisfied this directive. The Staff seeks to have Pepco add additional information about each project to the minutes as well as a status of each project. The addition of more detailed project summaries for the projects that are included in the minutes would, we think, impose an unnecessary burden on the ECA process and we decline to accept that recommendation from the Staff. We will, however, adopt the recommendation to include a brief description of the project status *(i.e.*, whether it is deferred, completed or ongoing). A brief program status will provide useful information to the Commission and other parties that monitor Pepco's work while not adding materially to the length of the minutes nor imposing an undue burden upon Pepco. The Commission observes that the first quarter 2013 ECA Team Meeting Minutes includes a parenthetical status report -- "(Complete)" -- for the Blue Plains 23106 Reactor electric maintenance action item. This suggests, but does not confirm, that when status is not reported as "complete" the status of an action item is ongoing. We therefore direct Pepco to clarify the status of the action items listed in future ECA Team Minutes.

> **Directive 2 (Order No. 17455 at ¶ 381): Pepco is to provide in a supplement to its 2014 Annual Consolidated Report a District-Wide Priority Feeder Service Area Map depicting and identifying the neighborhoods associated with the Company's 2014 Priority Feeders, and a District-Wide Priority Feeder Service Area Map differentiating between overhead and underground 2014 Priority Feeders, which maps shall clearly indicate Ward boundaries, Ward numbers, and the feeder numbers for the priority feeders identified on each map, consistent with paragraph 199 of Order No. 17455.**

232. Consolidated Report: Pepco included two priority feeder maps in its Supplement; the first depicts and identifies the neighborhoods in each Ward associated with the Company's 2014 priority feeders[641] and the second shows the locations of these priority feeders relative to Ward boundaries, and differentiating between overhead and underground feeders.[642]

233. OPC Comments: OPC did not comment upon Pepco's compliance with this directive.

234. Staff Report and Staff Recommendation #2: The Staff Report concludes that priority feeder service area maps presented by Pepco contain the information called for under this directive. However, the Staff Report finds that the legibility of some of the information

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640 Staff Report at 78 and 82, Recommendation 1.

641 Supplement at 14.

642 Supplement at 15.

presented is less than desirable and recommends (Staff Recommendation No. 2) that the legibility be improved.[643]

235. Commission Decision: The Commission finds that Pepco has supplemented its 2014 Consolidated Report to include the required map data and concludes that Pepco has fully satisfied this directive. The Commission agrees with the Staff Report, finding that the legibility of these maps needs to be improved in future Annual Consolidated Reports and we direct Pepco to improve the legibility of these maps in its 2015 and future Annual Consolidated Reports.

Directive 3 (Order No. 17455 at ¶ 382): Pepco is to recommend in a supplement to its 2014 Consolidated Report a method for comparing reliability statistics among different time periods when feeder designations are shifted between jurisdictions during those time periods, consistent with paragraph 207 of Order No. 17455.

236. Consolidated Report: Pepco recommends that it maintain and report in future Annual Consolidated Reports a table listing the cross jurisdictional feeders that are currently or have at some point since 2011 been assigned to the District, for jurisdictional reporting purposes.[644]

237. OPC Comments: OPC did not comment upon Pepco's compliance with this directive.

238. Staff Report: The Staff Report concludes that while it is acceptable to include in future Annual Consolidated Reports a table listing cross jurisdictional feeders, it is not clear that Pepco's recommended table will include comparative reliability statistics resulting from jurisdictional shifts [as between Maryland and the District] for the time periods in question.[645]

239. Commission Decision: The Commission concludes that Pepco has not fully complied with this directive. Pepco offers to provide a table that lists the cross- jurisdictional feeders but offers no further explanation about how its proposed table will allow the reliability performance of individual cross-jurisdictional feeders to be compared over time, should their classification as either a Maryland or District feeder change during the comparison period.

240. Data in the 2014 Consolidated Report demonstrates that as a whole, the reliability of cross jurisdictional feeders is below Pepco's system average.[646] In addition, under the District's new Electric Company Infrastructure Improvement Financing Act of 2014 ("ECIIFA") Pepco is to identify and prioritize for undergrounding the primary voltage portions of its least reliable overhead feeders. Therefore, it is important for Pepco to develop transparent and uniform metrics that will allow it to monitor and report on the reliability of its electric

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643 Staff Report at 78 and 82, Recommendation 2.

644 Supplement at 16.

645 Staff Report at 78.

646 2014 Consolidated Report at 278, Table 2.4-F4.

distribution service to District ratepayers served from cross-jurisdictional feeders, regardless of whether the feeder is identified as a Maryland or District feeder.[647]

241. Pepco is again directed to include in its 2015 Annual Consolidated Report[648] an explanation of the metric or metrics it will use to report upon the reliability performance of its cross-jurisdictional feeders. This explanation is also to describe how Pepco's chosen metric(s) will allow reliability performance to be compared from year-to-year, when the jurisdictional status of a feeder changes between Maryland and the District.

> **Directive 4 (Order No. 17455 at ¶ 383): Pepco is to provide in a supplement to its 2014 Consolidated Report a table listing each distribution equipment type for which it applies a run-to-failure maintenance model, consistent with paragraph 244 of Order No. 17455.**

242. Consolidated Report: Pepco's response lacked the required table. Instead, Pepco offered a description in which it states that "run-to-failure" is a term of art in the electric industry indicating that equipment is installed for its full useful life, and is not replaced on a fixed interval. According to Pepco, its equipment is replaced for many different reasons, one of which is failure. Replacement needs are determined by appropriate inspection and maintenance for specific asset groups, based on factors such as equipment criticality, observed condition, condition trending, past performance, environment, duty cycle, application, common failure modes, and the cost and benefits of replacement versus maintenance costs.[649] Based upon these factors, Pepco employs various levels of inspection and testing to determine replacement strategies. Pepco did not provide a table listing these specific asset groups or otherwise describe the inspection and maintenance intervals for each specific asset group.

243. OPC Comments: As set out in more detail in the discussion of OPC Recommendation #3, below, OPC recommends that Pepco be ordered again to provide the previously-directed table listing each distribution equipment type for which it applies a run-to-failure maintenance model, as directed in Order No. 17455.[650] OPC opines that Pepco has an adequate maintenance model for substation equipment and a detailed inspection model for the underground network, but Pepco's overhead and underground radial distribution systems have limited inspections and fewer diagnostic tests.[651] According to OPC, it is essential that the

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647 The Commission expects that the integration of AMI Smart Meter outage reports or other automated operating data into Pepco's OMS data will allow the Company to distinguish between Maryland and District customers when assessing outages on a cross-jurisdictional feeder.

648 The Commission is limiting this data reporting to Pepco's 2015 Annual Consolidated Report in deference to its ongoing actions to re-tailor the content and review procedures applicable to future Annual Consolidated Reports. Whether this reporting requirement should be continued indefinitely is a matter to be addressed in the future rulemaking that will occur as part of these actions.

649 Supplement at 17.

650 OPC Comments at 4.

651 OPC Comments at 18.

Commission and OPC understand Pepco's maintenance and inspection programs, and how these programs affect system reliability.[652]

244. Staff Report and Staff Recommendation #3: The Staff Report observes that an asset management practice that does not routinely replace equipment on a time interval basis places increased burden on Pepco to assure that all distribution equipment inspection and maintenance schedules fully meet industry standards and manufacturers' recommendations.[653] Consequently, the Staff Report recommends that Pepco be directed to design and develop a set of Key Performance Indicators to measure and track the progress of the Company's inspection and maintenance programs for its distribution equipment and facilities.[654]

245. Commission Decision: The Commission concludes that Pepco has not complied with this directive. The Commission notes that Table 1.3-B in Pepco's 2014 Consolidated Report depicts that Pepco practices preventive maintenance with respect to some equipment types, predictive maintenance with respect to others and does not attribute any specific type of maintenance to others.[655] However, in its Response, Pepco states that it employs "appropriate inspection and maintenance for specific asset groups."[656] We also note that the Siemen's Reliability Audit Report indicates that Pepco uses a run-to-fail maintenance methodology for underground cables.[657]

246. To address OPC's concerns regarding its inability to understand from Pepco's 2014 Consolidated Report the Company's maintenance and inspection programs for radial overhead and underground distribution system equipment, Pepco is to include additional information in Table 1.3-B of its Annual Consolidated reports, on a going-forward basis, that describes for each listed equipment type or asset group whether its maintenance methodology is reactive, preventive, predictive, and/or reliability-centered. To remove possible ambiguity regarding these terms, Pepco is to observe the following definitions in reporting upon its maintenance methodologies in Table 1.3-B (sourced from the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy), unless or until Pepco presents alternative definitions that are accepted by the Commission:[658]

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652 OPC Comments at 18.

653 Staff Report at 78.

654 Staff Report at 82, Recommendation 3.

655 2014 Consolidated Report at 50-53.

656 Pepco Response at 6.

657 Siemens Reliability Audit Report at 6-7.

658 U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Operations & Maintenance Best Practices, A Guide to Achieving Operational Efficiency, Release 3.0 (August 2010).

> Reactive Maintenance – A "run it till it breaks" or "run-to-fail" maintenance model; in this mode, no actions or efforts are taken to maintain the equipment to ensure that design life is reached.[659]
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> Preventive Maintenance - This entails the scheduling of maintenance activities at predetermined time intervals, where damaged equipment is repaired or replaced before obvious problems occur.[660]
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> Predictive Maintenance - This consists of scheduling maintenance activities only if and when mechanical or operational conditions warrant-by periodically monitoring the machinery for excessive vibration, temperature and/or lubrication degradation, or by observing any other unhealthy trends that occur over time. When the condition gets to a predetermined unacceptable level, the equipment is shut down to repair or replace damaged components so as to prevent a more costly failure from occurring.[661]
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> Reliability-Centered Maintenance - This philosophy utilizes all of the previously discussed predictive/preventive maintenance techniques, in concert with root cause failure analysis. This not only detects and pinpoints precise problems that occur, but ensures that advanced installation and repair techniques are performed, including potential equipment redesign or modification, thus helping to avoid problems or keep them from occurring.[662]

247. The Staff's concerns regarding the development of Key Performance Indicators applicable to Pepco's overhead feeder inspections are addressed in the Commission's discussion of Pepco's Overhead Feeder Inspection Program, above.

> **Directive 5 (Order No. 17455 at ¶ 384): Pepco is to include in a supplement to its 2014 Consolidated Report a description of the improvements that it made in its procedures during 2012 and 2013 to maintain data quality and the analysis by which it evaluates ways to improve data quality; any decisions made with regard to new procedures, software or training and the timeline for implementing these changes; and the costs (either actual or projected) of implementing data quality assurance improvements, consistent with paragraph 257 of Order No. 17455.**

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659 U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Operations & Maintenance Best Practices, A Guide to Achieving Operational Efficiency, Release 3.0 (August 2010) at 5.2 and 5.6.

660 U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Operations & Maintenance Best Practices, A Guide to Achieving Operational Efficiency, Release 3.0 (August 2010) at 5.3.

661 U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Operations & Maintenance Best Practices, A Guide to Achieving Operational Efficiency, Release 3.0 (August 2010) at 5.4-5.5.

662 U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Operations & Maintenance Best Practices, A Guide to Achieving Operational Efficiency, Release 3.0 (August 2010) at 6 5.5.

248. Consolidated Report: In response to this directive, Pepco included a list of nine improvements in its data procedures during 2012 and 2013, to improve the quality of its outage data:

- Additional training has been given to dispatchers to create secondary outages, enabling better predictions of customers affected;
- OMS training and refresher courses were given to the employees designated to complete trouble tickets and who assist with storm duties as their second roles;
- A Transmission and Distribution IT Solutions website was added to provide access to multiple reports for reliability purposes.
- Modeling of additional interrupting devices into OMS occurred, such as SR schemes, SF6 switches, and reclosers, thus improving accuracy of outage predations;
- Post-event reviews and validations of Distribution System Operations reports and Transmission System Operation reports now occur, confirmed with PI Historic (an operation data collection application), which helps to more accurately reflect the impacts of switching operations;
- Ward information used for reporting to the Commission has been updated;
- Load transfers are now logged and periodically checked for OMS changes;
- Advanced Meter Infrastructure (AMI) meters have been added to the system, providing more accurate indication of outages and the ability to remotely confirm OMS predictions; and
- Outage data validation is performed on a daily basis to accurately reflect outage impacts, such as customer counts and restoration times.

249. OPC Comments: OPC's Comments did not address Pepco's compliance with this directive.

250. Staff Report and Staff Recommendation #4: The Staff Report notes that Pepco did not include information describing actual or projected costs of implementing data quality assurance improvements, as directed.[663] The Staff Report recommends that Pepco be required to provide a description of actual and/or projected costs incurred to improve outage data quality, together with a description of actions taken and/or under consideration.[664]

251. Commission Decision: The Commission concludes that Pepco has complied, in part, with this directive. The Company provided a description of the improvements that it made in its procedures during 2012 and 2013 to maintain data quality, but did not provide a description of the analysis by which it evaluates procedures to improve data quality. Nor did Pepco provide

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663 Staff Report at 78.

664 Staff Report at 82, Recommendation 4.

a description of any actual or planned acquisition of new software or current or future implementation of training in software use, and the timeline and costs for implementing these. Pepco provided no explanation for the missing data. Pepco has made and reports that it will continue to make significant investments in new software to improve its data quality; so it is both reasonable and appropriate for the Commission to require that Pepco report on the costs of actual or planned investments, including the cost of training the personnel who will be using that new data. Similarly, the Commission and all stakeholders benefit from having a timeline for when those costs are being or will be incurred and when the required training is or will be done.

252. The Commission recognizes the data quality improvement obtained by Pepco through validating its outage data on a daily basis. It appears, however, that Pepco has not been incorporating the validated outage data into the monthly outage reporting it files with the Commission pursuant to Order Nos. 15131 and 15360, either when each monthly report is filed with the Commission, or as a correction to previously-submitted monthly outage data. The accuracy of reported outage data directly impacts the Commission's ability to validate Pepco's EQSS compliance, as well as its selection and prioritization of overhead feeders or overhead portions of combined overhead/underground feeders to be relocated underground, pursuant to section 308 of the ECIIFA.

253. Therefore, the Commission directs Pepco to incorporate its validated OMS data into its monthly outage reporting, above, beginning with outages for the month of April 2015. The Commission understands that it might be difficult to provide succinct explanations of the analysis by which it evaluates procedures to improve data quality and so will not require that Pepco provide more information about its 2012-2013 decision making concerning its data quality improvements. However, as suggested by Staff Recommendation #4, we direct Pepco to provide in its 2015 Consolidated Report information depicting the costs it incurred during 2012-2014 to improve its data quality, including its costs for new software, hardware, training and implementation, and a timeline that indicates when these costs were or will be incurred and when training was or will be performed.

> **Directive 6 (Order No. 17455 at ¶ 385): Pepco is to provide in a supplement to its 2014 Consolidated Report information for each substation load growth project shown in its 2013 and 2014 Consolidated Reports, indicating whether there will be any incremental annual revenue associated with the project and if so, providing a forecast of the expected incremental annual revenue, consistent with paragraph 280 of Order No. 17455.**

254. Consolidated Report: Pepco states that it will not see incremental revenue growth from the substation additions and enhancements shown in Section 1.2.3 of its 2013 and 2014 Consolidated Reports.[665] The Company explains that under its Bill Stabilization Adjustment ("BSA"), incremental revenue growth only occurs through increased customer count and not through increases in either sales or load.[666] To the extent increased sales or load might increase

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665 Supplement at 19.

666 Supplement at 19.

revenue recovered through volumetric charges, the BSA operates to negate that increase through a periodic true-up mechanism that levelizes revenue.[667]

255. OPC Comments: OPC's Comments did not address Pepco's compliance with this directive.

256. Staff Report: The Staff Report did not address or make a recommendation regarding Pepco's compliance with this directive.

257. Commission Decision: The Commission finds that Pepco has not fully responded to this directive. Pepco's language suggests that incremental gross revenue will attend these substation load growth projects, but due to the BSA, its net revenue remains unchanged. This does not, however, address the Commission's directive. The Commission asked whether there will be any incremental annual revenue associated with the project and if so, it directed Pepco to provide a forecast of the expected incremental annual revenue. To be clear, the request is for the incremental gross revenue growth attending these projects (described in its 2013 through 2015 Consolidated Reports), before the BSA adjustment is made. Therefore, the Commission again directs Pepco to report in its 2015 Consolidated Report whether there will be any incremental annual revenue associated with these substation projects and if so, it directs Pepco to provide a forecast of the expected incremental annual revenue.

> **Directive 7 (Order No. 17455 at ¶ 386): Pepco is to address in a supplement to its 2014 Annual Consolidated Report the status of the Company's statistical modeling program and any changes to that model, and to provide a chart or table comparing predicted and actual reliability results attributable to REP projects that were placed into service in 2012 and 2013, consistent with paragraph 295 of Order No. 17455.**

258. Consolidated Report: The Supplement states that "[t]here have been no changes to the fundamentals to Pepco's statistical modeling program."[668] In addition, in the Supplement Pepco provides two tables which compare the Company's forecast and actual 2013 SAIFI and SAIDI both with each other and with the Commission's EQSS requirements (through 2016).[669] These tables demonstrate that Pepco's actual 2013 SAIFI was approximately 10% better than what the model forecast and its actual 2013 SAIDI was approximately 9% better than what the model forecast. Pepco did not explain whether these variances were within or exceeded the tolerances built into its model or make any qualitative assessment of the model based on these variances.

259. OPC Comments: Comments did not address Pepco's compliance with this directive.

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667 Supplement at 19.

668 Supplement at 20.

669 Supplement at 20, Table 1 and 21, at Table 2.

260. Staff Report: The Staff Report observed that Pepco's statistical modeling program predicts that Pepco's SAIDI performance will not meet its EQSS target applicable to 2016's reliability performance, but offered no assessment as to the quality of Pepco's statistical modeling program. The Staff Report made no recommendation regarding Pepco's compliance with this directive.

261. Commission Decision: The Commission views Pepco as being slightly remiss in its compliance with this directive, inasmuch as it did not respond to our interest, announced in Order No. 17455, in obtaining Pepco's evaluation of the accuracy of its statistical modeling program.[670] However, Pepco did report on the status of its statistical modeling program and provided the required comparison between predicted and actual results. Under these circumstances, we view Pepco's response to this directive as sufficient enough not to warrant additional reporting, at this time.

> **Directive 8 (Order No. 17455 at ¶ 387): Pepco is to provide in a supplement to its 2014 Consolidated Report a map depicting current and prospective locations for slotted manhole covers, comparable to that found at page 449, Figure 3.19 of its 2013 Consolidated Report, that is updated to clearly identify, at a minimum, the District's Wards and, for those areas shown on the map that identify locations for current and prospective slotted manhole cover installations, the names of the affected neighborhoods, consistent with paragraph 315 of Order No. 17455.**

262. Consolidated Report: In its Supplement, Pepco provided an updated map (figure 3.19) that depicts Ward boundaries and names the Wards and neighborhoods in the District where slotted manhole covers were installed.[671]

263. OPC Comments: OPC's Comments did not address Pepco's compliance with this directive.

264. Staff Report: The Staff Report did not comment upon or offer a recommendation regarding Pepco's compliance with this directive.

265. Commission Decision: The Commission finds that Pepco has complied with this directive. However, in order to better correlate the map and table, both of which describe slotted manhole cover installation locations, Pepco is directed to include in the above-described table the Wards and District neighborhoods associated with each newly reported slotted manhole cover installation.

> **Directive 9 (Order No. 17455 at ¶ 388): Pepco is to comment in a supplement to its 2014 Consolidated Report on the potential use of cathodic protection devices to inhibit corrosion on its electric distribution equipment located in**

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670 Order No. 17455, ¶ 295.

671 Supplement at 23.

underground electrical vaults and manholes, consistent with paragraph 319 of Order No. 17455.

266. Consolidated Report: In its Supplement, Pepco responds to this directive as follows: "The Company periodically evaluates the use of cathodic protection on underground network transformers and has implemented installation as appropriate."[672]

267. OPC Comments: OPC did not comment upon Pepco's compliance with this directive.

268. Staff Report and Staff Recommendation #5: The Staff Report observes that Pepco did not comment upon the adaptability of IEEE Standard C57.12.29[673] to Pepco's underground vaults and manholes, as the Commission directed in paragraphs 319 and 388 of Order No. 17455. Staff recommends that Pepco be directed to provide the previously-required assessment of the adaptability of this standard to underground equipment located in Pepco's vaults and manholes.[674]

269. Commission Decision: Paragraph 319 of Order No. 17455 reads as follows:

> Further, the Commission agrees with OPC that cathodic protection should be explored as a possible means of inhibiting corrosion on Pepco's equipment located in underground vaults and manholes. Corrosion resistance might also be improved for underground transformers by Pepco following ANSII Standard C57.12.29, which is a standard applicable to transformer enclosure integrity in coastal areas. At first impression, it appears that there may be rough similarities between open air dampness in coastal areas and the dampness to be encountered from time-to-time in Pepco's underground electrical vaults and manholes, particularly during winter conditions when salt is applied to roads. This may suggest that the ANSI standard could be adapted for use by Pepco with respect to equipment in its underground vaults and manholes. The Commission directs Pepco to comment upon this subject in a supplement to its 2014 Annual Consolidated Report (to be filed no later than June 2, 2014.)

270. Given the scope of the inquiry on this topic put forward in Order No. 17455, above, the Commission finds Pepco's cursory statement in its Supplement to be non-responsive and Pepco has not, therefore, complied with this directive. The Commission adopts Staff Recommendation #5 and requires Pepco to provide in its 2015 Consolidated Report, or in a supplement filed no later than 45-days thereafter, an analysis addressing the potential applicability of the cathodic protection described in IEEE Standard C57.12.29 to its underground

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672 Supplement at 24.

673 Order No. 17455 incorrectly referenced this corrosion standard applicable to above-ground transformer enclosures located in coastal areas as an ANSI standard. In our discussion in this Order, the Commission's reference to IEEE Standard C57.12.29 (2014) refers to the standard we intended to reference in Order No. 17455.

674 Staff Report at 82, Recommendation 5.

transformers. To lend specificity to this analysis, we direct Pepco to include responses to the following questions:

- What provisions within standard IEEE C57.12.29 (2014), if any, might render the standard unsuitable from a technical standpoint, for application in underground transformer vaults (for example, would it contribute to the build-up of heat within the transformer enclosure, above and beyond what would ordinarily be encountered)?
- How does this standard differ from the design, metallurgy, installation, maintenance and corrosion resistance of the underground transformer enclosures currently installed by Pepco in the District?
- What would be the incremental materials and maintenance cost, per enclosure, if Pepco were to follow this standard in its future installation of underground transformers?

> **Directive 10 (Order No. 17455 at ¶ 389): Pepco is to provide in a supplement to its 2014 Consolidated Report an explanation of its $183,000 expenditure, including details about any new software that was purchased and benefits to be achieved from that software consistent with paragraph 370 of Order No. 17455.**

271. Consolidated Report: Pepco described in its Supplement that in 2012, it purchased two project planning software packages that would better manage capital construction projects and to manage technology related projects.[675] Benefits include continuous, rather than periodic, reporting and monitoring of processes and better coordination of resources with project schedules, to reduce impacts of project delays due to unforeseen constraints.[676]

272. OPC Comments: OPC's Comments do not address Pepco's compliance with this directive.

273. Staff Report: The Staff Report notes Pepco's explanation of its new software purchases, but offers no recommendation regarding additional reporting on this topic.

274. Commission Decision: The Commission finds that Pepco's explanation for these purchases is unopposed and concludes that it has complied with this directive.

> **Directive 11 (Order No. 17455 at ¶ 390): Pepco is to provide, no later than 60 days after completing PILC remediation work on the last of the 13 5-in-10 feeders identified in its 2013 Consolidated Report, notice to the Commission of the actual PILC replacement activities undertaken on each of these 13**

675 Supplement at 25.

676 Supplement at 25.

feeders and the estimated number of feet or miles of non-replaceable PILC remaining on the feeder, consistent with paragraph 271 of Order No. 17455.

275. Consolidated Report: Tables 3 through 5 in Pepco's Supplement provide a detailed description of PILC replacement status for the 13 5-in-10 feeders referenced in Order No. 17455.[677] Pepco eliminated two of the 13 feeders from its description because its inspections revealed that all PILC in the affected half loops had already been replaced. Details in Pepco's description of the remaining 11 feeders include the status of the previously-initiated four replacement projects and a list of the number of feet of PILC planned to be replaced on each of the remaining seven feeders. Table 5 estimates the number of miles of non-replaceable PILC (22.796) that will remain after the future completion of PILC replacement in all 13 of the prioritized feeders. Pepco notes that these figures are subject to change once final construction is completed.[678]

276. OPC Comments: OPC's Comments did not address Pepco's reporting on these PILC replacement projects.

277. Staff Report: The Staff Report did not comment upon or make a recommendation regarding Pepco's compliance with this directive.

278. Siemens Reliability Audit Report: Section 9 of the Siemens Reliability Audit Report addresses Pepco's underground cables and PILC. Section 9 does not discuss Pepco's PILC replacement program or the 13 specific projects mentioned in the 2014 Consolidated Report.

279. Liberty Audit Report: Chapter V of the Liberty Audit Report addresses Pepco's underground cables and PILC. Chapter 5 does not discuss Pepco's PILC replacement program or the 13 specific projects mentioned in the 2014 Consolidated Report.

280. Commission Decision: Pepco's reporting provides the information sought by the Commission, insofar as the information pertains to the work already performed. Reporting this information in Pepco's Annual Consolidated Reports will continue, consistent with our prior directive, until the Company completes PILC remediation work on the last of these 13 5-in-10 feeders.

C. OPC Recommendations

OPC Recommendation #1: Pepco utilizes unreasonably aggressive load projections to justify four substation projects (a fourth transformer at the Florida Avenue Substation, a fourth transformer at the Northeast Substation, the L Street Substation, and the new Mt. Vernon Square Substation) and those projects should be delayed.[679]

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677 Supplement at 26-28.

678 Supplement at 28, footnote 2.

679 OPC Comments at 3, 8-15.

281. This OPC recommendation is discussed but not accepted in Part A of this discussion section, above, under the heading "LOAD GROWTH FORECASTS".

> **OPC Recommendation #2: The Commission should investigate whether the leveling of Pepco's annual budgets for capital investment in system reliability is due to practical limits on Pepco's ability to construct projects in a given year or whether Pepco has chosen to curtail such expenditures in anticipation of its compliance with the Commission's Electricity Quality of Service Standards ("EQSS").[680]**

282. Consolidated Report: Pepco's budgeted capital expenditures for distribution projects for the three year-period 2008 through 2010 remained essentially flat, ranging between $109.2 and $110.8 million.[681] Between 2011 and 2013, these budged amounts grew from $166.1 million to $221.4 million.[682] These projects fell into one of three categories: customer driven, reliability or load. Of these categories, beginning in 2009, reliability was allocated the largest share of Pepco's budget for capital expenditures on distribution projects. In 2013, Pepco underspent its budgeted amount for reliability projects ($138 million), by $22.1 million.[683] Excluding undergrounding projects to be funded under the terms provided in the ECIIFA, Pepco's five-year forecast of capital expenditures on distribution projects is shown below:[684]

Table S: Pepco: Forecasted Capital Expenditures on Distribution Projects (by category - $ million)

Construction Category	2014 Budget	2015 Forecast	2016 Forecast	2017 Forecast	2018 Forecast
Customer Driven	53.0	51.8	63.9	65.5	60.3
Reliability	132.7	140.1	136.5	139.7	153.4
Load	84.8	71.6	69.9	23.4	35.5
TOTAL	270.6	263.5	270.2	228.6	249.2

283. OPC Comments: OPC states that the trend is for the sum of Pepco's customer driven and reliability budgets to show modest future increases that seem to match inflationary pressures.[685] This, it states, shows a levelized annual capital investment of approximately two times the level of capital investment for the same categories in 2008 and 2009.[686] It is unclear to OPC whether the increased investment is leveling due to limits on Pepco's ability to construct reliability projects or if the leveling is because Pepco has chosen to curtail such expenditures on

680 OPC Comments at 4, 15-16.

681 2014 Consolidated Report at 36.

682 2014 Consolidated Report at 36.

683 2014 Consolidated Report at 37.

684 2014 Consolidated Report at 38, Table 1.2-J.

685 OPC Comments at 15.

686 OPC Comments at 15.

system improvement in anticipation of its attainment of the Commission's EQSS values.[687] OPC recommends that the Commission investigate the reason for this leveling of Pepco's annual budgets for capital investment in system reliability.

284. Pepco Response: Pepco disagrees with OPC's characterization of its capital spending as being levelized and questions why the Commission should commit resources to investigate a nonexistent curtailment in capital investment.[688] The Company, Pepco states, reviews it capital spending program each year and makes appropriate adjustments based on past system performance, reliability standards, and required infrastructure replacement and expansions; continuously improving reliability performance can only be maintained with a continued commitment to reliability spending.[689]

285. Staff Report and Staff Recommendation #7: Consistent with Pepco's position, the Staff Report concludes that Pepco's planned and forecasted budget for distribution project capital expenditures over the next five years is 64% greater than similar budgets and expenditures for the previous five years. The Staff Report recommends that when providing information on future capital expenditures for distribution projects, Pepco should also include a comparison of budgeted versus actual capital spending for the previous five-year period, along with continued variance reporting for the most recent year.[690]

286. Commission Decision: The Commission agrees that the 2014 Consolidated Report does not show a leveling in Pepco's upcoming capital expenditures for distribution projects. Moreover, any concerns that Pepco is failing to maintain investment in reliability projects is more than offset in light of the approximately $220 million investment in new underground distribution projects that will occur over the next three years with the Commission's recent approval of the first of four joint Pepco and District Department of Transportation ("DDOT") Triennial Underground Infrastructure Improvement Projects Plans, [691] plus the approximately $280 million additional investment in new underground infrastructure to follow over the next 10-12 years.[692] For this reason, the Commission will not adopt OPC's recommendation.

287. The Commission finds value in the recommendation contained in the Staff Report - that Pepco should also include a comparison of budgeted versus actual capital spending - in that the recommended reporting will help OPC and interested persons obtain an accurate depiction of

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687 OPC Comments at 16.

688 Pepco Response at 4.

689 Pepco Response at 4.

690 Staff Report at 82, Recommendation 7.

691 *Formal Case No. 1116*, Joint Application of Potomac Electric Power Company and District Department of Transportation for Approval of the Triennial Underground Infrastructure Improvement Projects Plan, Order No. 17697, rel. November 12, 2014.

692 *See* Sections 307(a) and 310(d) of the Electric Company Infrastructure Improvement Financing Act of 2014; 34 D.C. Code §§ 1313.07(a) and 1313.10(d) (2014).

Pepco's capital investment. Variance reporting may also help expose any weaknesses in Pepco's methodology for determining its budget for its future capital expenditures on distribution projects. We adopt this recommendation and direct Pepco to include in its 2015 ACR a comparison of budgeted and actual capital expenditures on distribution projects for the five-year period 2010-2014, inclusive, together with an analysis that identifies any variances of 10% or more, the reason(s) for those variances, and any actions taken or planned by Pepco to minimize the re-occurrence of future variances due to the same reason(s).

> **OPC Recommendation #3: Pepco should be directed to provide information comparing the Company's equipment-based approach for inspections to the feeder-based approach; in this information, Pepco should include an explanation for the discrepancy among the pole reject rates from Pepco's three different inspection programs (Pole Inspection, Overhead Feeder Inspection, and Priority Feeder remedies). Pepco should include its feeder inspection program in Table 1.3-B.[693]**

288. This OPC recommendation is discussed but not accepted in Part A of this discussion section, above, under the heading "OVERHEAD FEEDER INSPECTIONS".

> **OPC Recommendation #4: OPC recommends that the Commission order Pepco to provide a table listing each distribution equipment type for which it applies a run-to-failure maintenance model.[694]**

289. This OPC recommendation is discussed and accepted, with modifications, in Part A of this discussion section, above, under the heading "OVERHEAD FEEDER INSPECTIONS".

> **OPC Recommendation #5: Pepco should continue to report on the success of its hazard tree removal program and should clarify whether Enhanced Integrated Vegetation Management ("EIVM") is still a defined Pepco program and should continue to track the non-major tree-related sustained outages for further evidence of improvement in reliability attributable to the EIVM program;[695] and OPC Recommendation #6: OPC recommends continued observation on the impact of Pepco's vegetation management program(s) on sustained outages.[696]**

290. Consolidated Report:[697] Pepco reports that its tree trimming costs in 2013 were approximately $2.35 million, which was $134,225 above its budgeted amount.[698] The principal

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693 OPC Comments at4, 16-17.

694 OPC Comments at 4,18.

695 OPC Comments at 5, 8, 19-20, 38-39.

696 OPC Comments at 6, 31-32.

697 Because of the inter-related nature of OPC Recommendations 5 and 6, we are considering them together in the discussion that follows.

explanation it provides for this variance is that its vegetation management work involved the removal of large street trees in conflict with Pepco's facilities in the District. Because of the size, condition and location of these particular trees, removal can be very costly and resource-intensive.[699] In Table 2.4-P1, Pepco listed its tree trimming in the District, according to feeder number and Ward location.[700] In Table 2.4-P2, Pepco listed all tree-related power outages occurring during 2013 on its District feeders.[701]

291. OPC Comments: OPC states that in its 2013 Consolidated Report, Pepco explained that its EIVM program targets removal of trees that are likely to cause outages (*e.g.*, hazard trees) and limbs that overhang three-phase distribution lines, while Pepco's Vegetation Management ("VM") program focuses on a scheduled two-year, cycle-based maintenance strategy.[702] However, in the 2014 Consolidated Report, OPC states, there is no mention of the EIVM program.[703] OPC recommends that Pepco be directed to clarify whether EIVM is still a defined Pepco program.[704] OPC also provides a table summarizing the number of customers affected by various types of tree-related power outages between 2011 and 2013 [showing an overall reduction in numbers of customers affected], but recommends that Pepco continue to report the impact of its vegetation management on its sustained [non-major service] outages.[705]

292. Pepco Response: Pepco clarifies that it has incorporated all Enhanced Integrated Vegetation Management practices into its Vegetation Management program.[706]

293. Staff Report: The Staff Report does not address or offer a recommendation on this topic.

294. Commission Decision: Pepco has provided the clarification requested by OPC. Moreover, as earlier indicated, the Commission will issue a separate order addressing Pepco's reporting on its vegetation management in the District, in connection with the Siemens Reliability Audit Report. Therefore, the Commission will not, at this time, direct Pepco to clarify the continued viability of its EIVM (*i.e.*, hazard tree removal) activities nor comment on the treatment of this issue in future Annual Consolidated Reports.

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698 2014 Consolidated Report at 311.

699 2014 Consolidated Report at 312.

700 2014 Consolidated Report at 314-316.

701 2014 Consolidated Report at 317-322.

702 OPC Comments at 19.

703 OPC Comments at 19.

704 OPC Comments at 19.

705 OPC Comments at 31-32.

706 Pepco Response at 6.

OPC Recommendation #7: Pepco should demonstrate the need for the 4 kV to 13 kV voltage conversions at Pepco's North Capital and Fort Carroll Substations, and should explain how its Little Falls Substation 77 project "UDLPLLF1" could be affected by the Company's undergrounding program under the ECIIFA and what plans the Company has for coordinating these two efforts.[707]

295. Consolidated Report: The North Capital Substation 4 kV conversion project relates to an extension of existing and new 13 kV feeders to convert all 4 kV load served by that substation to 13 kV.[708] The first phase of this project, completed in 2013, involved converting 4 kV load on Feeders 482 and 485 (located along 4th Street, NW, between Buchanan and Hamilton Streets, NW) to 13 kV service supplied by Feeders 15006, 15012 and 15015.[709]

296. This 4 kV system is an isolated area on Pepco's distribution system that is not connected to any other 4 kV substations or systems.[710] Recent inspections revealed that the circuit breakers on this system (which are obsolete) are deteriorating and this necessitates the salvage of spare parts from like equipment because the original equipment manufacturer is no longer in business and other manufacturers no longer supply parts for this equipment.[711]

297. Pepco states that the switchgear at the Fort Carroll Substation was assessed to be in a deteriorated condition and in need of replacement.[712] Pepco determined that since this substation was to be retired at some point in the future, it is most economical to convert the 4 kV load and retire the substation in 2015, rather than to replace the switchgear first, then convert the 4 kV load to 13 kV, and retire the substation at a later date.

298. Generally, a 13 kV system is capable of supplying a greater density of load, when compared to a 4 kV system, and also produces less electrical loss.[713] Therefore, as load density on the 4 kV system increases, or as the system requires more maintenance, replacement becomes the best economic alternative. Consequently, over the next ten years, Pepco anticipates converting approximately 57 of its present 157 megawatts of 4 kV load to 13 kV service.[714]

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707 OPC Comments at 5, 20-21.

708 2014 Consolidated Report at 183.

709 2014 Consolidated Report at 183.

710 2014 Consolidated Report at 184.

711 2014 Consolidated Report at 184.

712 2014 Consolidated Report at 189.

713 2014 Consolidated Report at 179.

714 2014 Consolidated Report at 179. Pepco also anticipates an additional 15 kV of load growth on its 4 kV system over the next 10 years, resulting in an estimated 115 kV of 4 kV load remaining on the system in 10 years' time.

299. OPC Comments: OPC states that while it supports 4 kV conversion projects that are consistent with Pepco's long-range plan to cost-effectively improve reliability, it is not clear from the data presented in the 2014 Consolidated Report why the two new 4 kV conversion projects (North Capital and Fort Carroll Substations) are required.[715] Specifically, Pepco should answer the following questions:[716]

- Whether these projects are consistent with Pepco's long range 4 kV system plan;
- What the load is on the 4 kV system to be converted, relative to the capacity;
- What the outage history is for the last three years (feeder SAIFI and SAIDI) for the feeders to be converted; and
- Identify any impact on the capacity of the 13 kV substations that will be serving the converted load?

300. OPC is also concerned that the ductline required for the Little Falls Substation 77 project (feeder extension) could be affected by the undergrounding projects included in the joint Pepco/DDOT Triennial Undergrounding Plan.[717] OPC seeks an explanation of how the feeder extension project could be affected by this undergrounding and what plans, if any, Pepco has for coordinating this project with its Triennial Undergrounding Plan.[718]

301. Pepco Response: Pepco notes that its North Capital Substation upgrade was included as part of its original 2007 4 kV to 13 kV conversion plan and was also presented in its 2012 Consolidated Report.[719] Moreover, according to Pepco the North Capital Substation upgrade will be cost-effective because its circuit breakers are deteriorating and the switchgears in place are no longer being manufactured, requiring salvage of spare parts to make repairs.[720] In the 2012 Switchgear and HVCB [high voltage circuit breaker] Evaluation study conducted for Pepco by Kinectrics, the switchgear at the Fort Carroll Substation was identified as needing replacement, the condition of the Substation's bus sections was ranked as fifteenth worst of all 109 of Pepco's distribution substations, and the condition of its circuit breakers was ranked as the worst.[721] Pepco states that converting the load and retiring the substation in 2015 is a more cost-effective alternative to first performing the needed maintenance and then converting the load and retiring the station at a later date.[722]

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715 OPC Comments at 20-21.

716 OPC Comments at 21.

717 OPC Comments at 21.

718 OPC Comments at 21.

719 Pepco Response at 6, n. 21.

720 Pepco Response at 6.

721 Pepco Response at 6.

722 Pepco Response at 6.

302. With regard to the Little Falls Substation 77 feeder extension project, Pepco explains that this feeder, most of which will be constructed underground, will relieve some of the load currently served by Feeder 14766; Feeder 14766 is identified in Pepco's first Triennial Underground Projects Plan ("Triennial Plan") as a feeder to be relocated underground and this undergrounding work is slated to begin in 2017. Pepco also explains that the engineering and design work for Feeder 14766 that is depicted in its application in *Formal Case No. 1116* for approval of the Triennial Plan is preliminary, and that detailed engineering analysis of that feeder will be made, and the electrical design will be updated to reflect the load growth-related work performed near the Little Falls Substation, before the undergrounding work on Feeder 14766 will begin.[723]

303. Staff Report: The Staff Report observes that 4 kV to 13 kV conversion projects are directly, and in some cases, proactively, related to system reliability, but offers no conclusions or recommendations regarding OPC's comments.

304. Commission Decision: The Commission finds that Pepco has provided a *prima facie* case for both the North Capital Substation upgrade and for the Fort Carroll Substation retirement/conversion of its 4 kV load, and is persuaded by Pepco that these proposed actions will be cost-effective, due to the obsolescence of the switchgear installed at those locations. Moreover, the North Capital Substation project has been targeted since 2007 and was included in Pepco's 2012 Consolidated Report. In these circumstances, the Commission will not direct Pepco to provide the additional information posed by OPC's questions. The Commission also finds that Pepco has provided a credible explanation of how the Little Falls Substation feeder extension project will be coordinated with the undergrounding work Pepco will perform pursuant to our recent approval given to the Triennial Underground Infrastructure Improvement Projects Plan proposed in *Formal Case No. 1116*. Therefore, the Commission will not require Pepco to file a response to OPC's request for an explanation of the Company's future coordination between this project and the undergrounding to be performed pursuant to that Plan.

> **OPC Recommendation #8: OPC recommends that Pepco report planned improvements for [feeders associated with] susceptible neighborhoods in a fashion similar to the Priority Feeder Program.**[724]

305. This recommendation is discussed but not adopted in Part A of this discussion section, above, under the heading "FEEDER RELIABILITIY IMPROVEMENTS." However a discussion of corrective action plans and feeder improvements will be incorporated into the separate order that the Commission will issue as a follow-up to the Siemens Reliability Audit Report.

> **OPC Recommendation #9: OPC recommends that Pepco report whether it studied the six opportunities it identified and were described in Order No.**

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723 Pepco Response at 6-7.

724 OPC Comments at 7, 32-33.

17074[725] to reduce equipment failures and if so, the outcome of those studies, the opportunities Pepco plans to implement, the associated program goals and requirements, and the annual budgets for implementing those opportunities.[726]

306. Consolidated Report: In its 2014 Consolidated Report, Pepco stated that the effects of each of these itemized actions on overall reliability cannot be isolated [for purposes of reporting improvements in equipment-related outages.][727] However, in 2013 Pepco experienced a 14% improvement in SAIFI related to equipment failures and attributes this improvement to these six factors, acting in combination with other measures taken as part of its Reliability Enhancement Plan, maintenance, and daily operations of the system.[728]

307. OPC Comments: According to OPC, Order No. 17074 directed Pepco to quantify and report the improvements in equipment-related outages as a result of actions taken by Pepco under six identified opportunities that would potentially reduce equipment failures:[729]

- Improve outage data quality;
- Implement an Overhead Feeder Inspection Program;
- Review its existing overhead and underground switch maintenance program to optimize its effectiveness;
- Investigate programmatic replacement of oil-filled switches in the 4 kV system;
- Review its Manhole Inspection Program and correlate data to equipment failure/ reliability database; and
- Perform Very Low Frequency testing on feeders where actual cable failure was determined to be the root cause.

OPC states that Pepco did not provide such a report, but instead, asserted it is not possible to isolate the effects on reliability of these actions.[730]

308. OPC notes that the third item listed above calls for an investigation of programmatic replacement of oil-filled switches. According to OPC, this does not require

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725 *Formal Case No. 766, In the Matter of the Commission's Fuel Adjustment Clause Audit and Review Program; and Formal Case No. 991, In the Matter of the Investigation Into Explosions Occurring In or Around the Underground Distribution Systems of the Potomac Electric Power Company*, Order No. 17074, rel. February 15, 2013 ("Order No.17074").

726 OPC Comments at pp. 7 and 33-35.

727 2014 Consolidated Report at 293.

728 2014 Consolidated Report at 293.

729 OPC Comments at 33-34.

730 OPC Comments at 14.

separation of outage data to determine the effectiveness of such a program; rather, this type of program could be analyzed in a fashion similar to the analysis used by Pepco's Equipment Condition Assessment team on critical substation components.[731] OPC further notes that Feeder 14717 was named one of Pepco's 2014 Priority Feeders primarily because the feeder experienced five instances of failed switches within a year. In addition, Pepco plans to verify the condition of the underground oil-filled switches for Feeder 53, another 2014 Priority Feeder. In these circumstances, OPC asserts, it is appropriate to question whether Pepco is implementing a program to systematically replace all oil-filed switches on its 4 kV system and if so, at what cost?[732]

309. OPC also identifies Feeder 212 as another 2014 Priority Feeder, stating that it had numerous cable failures and yet Pepco has no plans for VLF testing [of the feeder's cables].[733] OPC questions whether this means Pepco does not believe that VLF testing is a viable option for improving reliability on feeders where actual cable failure was determined to be root cause [of power outages] or, should Pepco embrace a VLF testing program and if so, at what costs and how often should the testing occur?[734]

310. OPC recommends that for each of the six opportunities listed above, Pepco report the following: (a) whether the opportunity was studied and, if so, what the outcome was; (b) if the opportunity is to be implemented, identify the program goals and application requirements; and (c) identify the annual budgets for implementing the opportunity.[735]

311. Pepco Response: Pepco states that it cannot separate out and measure the improved reliability impacts of each of the six techniques recommended by Siemens and other individual programs, such as particular REP initiatives, and distinguish these from the aggregate of reliability initiatives it employs.[736]

312. Staff Report: The Staff Report notes the second consecutive year of measurable reductions in equipment-related outages, the number of customers interrupted by these outages, and the related customer minutes of interruption. The Staff Report also notes what it characterizes as the appropriate level of detailed equipment failure analysis provided by Pepco, as well as the combined analytical and remedial impact of Pepco's various feeder improvement initiatives. The Staff Report makes no recommendation on this topic.

313. Commission Decision: In Order No. 17455, the Commission had occasion to consider an argument regarding Pepco's failure to include in its 2013 Consolidated Report the

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731 OPC Comments at 34.

732 OPC Comments at 34.

733 OPC Comments at 35.

734 OPC Comments at 35.

735 OPC Comments at 35.

736 Pepco Response at 10.

report quantifying improvements in feeder equipment-related outages, due to these six described actions.[737] Pepco argued then, as it does now, that it cannot segregate the improvements in equipment related outages so as to apportion the improvement between these six actions and among other reliability improvement programs. In response, the Commission accepted Pepco's explanation for reporting equipment-related reliability improvements (SAIFI) on an aggregated basis. We hold to this same result today.

314. However, there is nothing in Pepco's inability to disaggregate the causes for improvements in equipment related outages that disqualifies Pepco from reporting, as OPC suggests, on whether opportunities for improvements in the number and remediation of equipment-related outages were studied and, if so, the outcomes of those studies. The Commission accepts OPC's Recommendation #9, in part, and directs Pepco to report in its 2015 Consolidated Report whether, in 2013 or 2014, it conducted an investigation into the possible programmatic replacement of oil-filled switches in its 4 kV system, and if not, why not. If Pepco has undertaken such a review and investigation, it is to provide the results, including a description of its actual and/or future implementation measures, an implementation timeline, and associated costs, as recommended by OPC. The Commission also deferred from last year a decision on a concern raised by OPC with respect to equipment failures for AMI meters. This concern was not raised again in connection with the 2014 Consolidated Report. It is not clear whether this is because there was no issue with AMI equipment or because any issue with AMI equipment failures has been resolved. To answer this question, Pepco is further directed to report in its 2015 Consolidated Report the number of AMI equipment failures in 2013 and 2014 and how any such failures are being addressed.

> **OPC Recommendation #10: Pepco should provide increased analysis of, and identify remedial efforts associated with, each of the top-three equipment failures identified in the 2014 Consolidated Report (cable failures, connection failures, and transformer failures).[738]**

315. Consolidated Report: Pepco states that cable failure remains the largest contributor to customer outages caused by equipment failure.[739] From its analysis, Pepco identified that one third of the reported cable failures are attributed to a cascading three-day event during an extreme heat wave, occurring between July 6 and July 8, 2013.[740] During this heat wave, five feeders were affected, interrupting 12,660 customers. As a result, Pepco referred these feeders to its engineering department for further analysis to determine the cause and methods to address these types of events.[741]

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737 Order No. 17455 at ¶¶ 258-264.

738 OPC Comments at 7, 35-37.

739 2014 Consolidated Report at 295, 303.

740 2014 Consolidated Report at 303.

741 2014 Consolidated Report at 303.

316. Connection and transformer failures made up the remaining two of Pepco's top three causes of equipment-related power outages. Pepco's OMS reported that 80% of the customers impacted by connection failures were impacted through seven events; six of these seven events were attributed to a tripped breaker, including two events where the faulty connections were found to be the root cause.[742] The remaining event was attributed to a connections failure while crews were working on the feeder.[743] Pepco's OMS reported that 80% of the customers impacted by transformer failures were impacted through 13 events spaced over 12 feeders.[744] Pepco concludes that most of the issues that contributed to the top three equipment failure modes during the evaluation period have been or are schedule to be addressed in various element of the REP.[745]

317. OPC Comments: OPC states that cable failures were the number one equipment failure cause in 2013, in terms of frequency.[746] 60% of these failures occurred on 11 feeders, and although 8 of these feeders are part of Pepco's REP, three of these eight feeders have no planned work associated with cable replacement or cable enhancement.[747] OPC suggests that Pepco should address how VLF testing is used or not used in connection with helping to reduce cable failures.[748]

318. The second most common equipment failure in 2013, according to OPC, is connection failure, including loose connections.[749] OPC believe that a more systematic plan by Pepco for infrared inspection to detect connection failures and loose connections may be warranted (*i.e.*, extending deployment of infrared inspection beyond the remediation of Priority Feeders).[750] OPC also faults Pepco as failing to provide plans for decreasing the number of transformer failures, the third most common form of equipment failure.[751] OPC recommends that the Commission direct Pepco to provide a more substantial analysis of network transformer failures, since the longest outages from transformer failures were associated with network transformers.[752]

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742 2014 Consolidated Report at 298.

743 2014 Consolidated Report at 298.

744 2014 Consolidated Report at 300.

745 2014 Consolidated Report at 302.

746 OPC Comments at 35.

747 OPC Comments at 35.

748 OPC Comments at 35-36.

749 OPC Comments at 36.

750 OPC Comments at 36.

751 OPC Comments at 36.

752 OPC Comments at 36. Network transformer failures tend to result in de-energizing an entire feeder, thus magnifying the customer impact of the equipment loss.

319. Finally, OPC takes issue with the percentage of outages that occur from unknown causes, questioning whether it is possible to take effective action to reduce the re-occurrence of an outage when the outage cause is unknown.[753] To illustrate, OPC describes that during 2013, Feeder 14753 had five outages identified as tripped breakers, with the cause of the breaker operation listed as unknown. Nevertheless, Pepco is planning to invest $492,874 to improve the reliability of this feeder even though, in OPC's opinion, Pepco does not have a clear understanding of the root cause of its outages.[754]

320. Pepco Response: Pepco states that it uses VLF testing where underground cable is identified as the root cause of outages.[755] It also performs VLF testing annually on predominantly underground worst performing feeders, as well as on other feeders prioritized by outage events or other maintenance history. Pepco cautions, however, that because the technical characteristics of VLF testing can cause insulation stress, the Company limits re-testing using VLF on cable sections that have been recently tested.[756]

321. Pepco clarified that it performs infrared inspections as part of its Overhead Feeder Inspection Program, in addition to performing infrared inspections on the overhead portions of Priority Feeders (where appropriate). The Company's Equipment Condition Assessment program is assessing substation transformers.[757] It also has routine Underground Network Transformers/Protectors inspection programs in place that evaluate network protectors and transformers in both energized and de-energized states and replaces transformers where appropriate.[758] Pepco did not respond to OPC's comments taking issue with the percentage of outage that occur from unknown causes.

322. Staff Report: The Staff Report offers no comments or recommendations concerning the issues raised in connection with the top three equipment failure modes on Pepco's distribution system.

323. Siemens Reliability Audit Report: The Siemens Reliability Audit examined Pepco's outage data for the period 2009-2012 and found equipment failure to be the leading cause of outages and, in general, with the exception of 2012, it had a greater contribution to SAIDI than to SAIFI, indicating that these types of faults also take longer to repair.[759] Underground cable failures was the lead cause of equipment failures during this period (as identified by contribution to SAIFI), followed by either sectionalizers/switches (2009 and 2011)

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753 OPC Comments at 36-37.

754 OPC Comments at 36.

755 Pepco Response at 10.

756 Pepco Response at 10.

757 Pepco Response at 11.

758 Pepco Response at 10-11.

759 Siemens Reliability Audit Report at 2-15.

or joint failure (2010) and bare wire (2012).[760] Siemens characterizes as "outstanding" the contribution of cable failures as a cause of Pepco's power outages.[761]

324. According to this Audit Report, Pepco's approach to cable failures has largely been reactive and concentrated on those underground feeders that, in a given year, are the lead contributors to cable outages (for example, addressing these most egregious underground feeders in the Company's Reliability Enhancement Plan). Siemens recommends that Pepco undertake more testing of underground cable insulation in order to identify deterioration and, hence, future failure points.[762] Siemens recommends that aging and overloading should be included among the drivers that identify underground cables to be subjects of an enhanced testing plan.[763] The elements of this enhanced testing plan advocated by Siemens are:

- Diagnostic applied voltage type 2 (Std. IEEE 400) to determine the relation among leakage current/Tension/Time (including Tension VLF);
- Tangent delta test as per Std. IEEE 400.2;
- Partial discharges test as per Std. IEEE 200.2 and Std. IEEE 400.3; and
- (Optional) measurement of insulation resistance during 10 minutes and calculation of the polarizing and absorption index, per Std. IEEE 400.[764]

325. OPC, in its Comments on the Siemens Reliability Audit Report, agrees that enhanced cable testing can be useful, but cautions that Pepco must balance the cost of this cable testing against the improvement to be obtained in system reliability.[765] OPC concludes that an economic analysis is warranted before deciding to implement the recommended enhanced testing.[766] Commission staff agrees with OPC that an economic analysis is called for and recommends the analysis be made and results filed with the Commission before implementing enhanced underground cable testing.[767] In the interim, Staff supports increased testing, monitoring and reporting to the Commission on cable insulation quality on uniquely identified feeders to determine the effectiveness of such testing.[768]

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760 Siemens Reliability Audit Report at 2-15.

761 Siemens Reliability Audit Report at 2-15.

762 Siemens Reliability Audit Report at 2-15.

763 Siemens Reliability Audit Report at 9-4.

764 Siemens Reliability Audit Report at 9-3 through 9-4.

765 F.C. 1076, OPC Comments on Siemens Reliability Audit Report at 34 (August 15, 2014).

766 F.C. 1076, OPC Comments on Siemens Reliability Audit Report at 34-35 (August 15, 2014).

767 F.C. 1076, Staff Memorandum on Siemens' final Report – Management Audit of Potomac Electric Power Company – Task 1 – Assessment of PEPCO's System Reliability at 56.

768 F.C. 1076, Staff Memorandum on Siemens' final Report – Management Audit of Potomac Electric Power Company – Task 1 – Assessment of PEPCO's System Reliability at 56.

326. Commission Decision: The 2014 Consolidated Report shows that Pepco's overall level of equipment-related outages has decreased each fiscal year since the fiscal year ending September 2011. Although cable failures accounted for the largest share of equipment-related power outages, the number of those events has decreased each fiscal year since 2011. However, the number of customers impacted by these outages increased between fiscal 2012 and 2013, as did the number of customer minutes of interruption. In both instances, the fiscal 2013 results still represent an improvement from 2011.

327. Pepco showed that the majority of the feeders having the most customers affected by power outages from underground cable failures are being addressed and improved results are being obtained, when compared to 2011 base year results, without Pepco having implemented the enhanced inspection practices and procedures recommended in the Siemens Reliability Audit Report. For this reason, and to forestall the potential degradation in insulation quality that may occur from more frequent VLJ testing, the Commission will not adopt the recommended inspection enhancements at this time. However, the Commission directs that Pepco include in its 2015 Consolidated Report an analysis of its underground cable failures occurring in 2014 that will allow the Commission to determine whether the improvements obtained in prior years regarding these failures, are continuing.

328. This same pattern (between fiscal 2012 and 2013) holds true for outages caused by loose connections. However, while the number of transformer failures between fiscal 2012 and 2013 held relatively stable, the impact of these failures increased significantly between fiscal 2012 and 2013. Nevertheless, for the 12 months ending September 30, 2014, the number of transformer outages reached its three-year low (100), the number of customers affected by those outages declined from 2013 (4,968 versus 9,075) and the customer minutes of interruption also declined from 2013 (1,661,633 versus 1,677,608).[769] In light of these Pepco's demonstrated reductions in the number and effect on customers of its equipment-related power outages, the Commission declines to adopt OPC's recommendation #10 at this time.

> **OPC Recommendation #11: OPC believes that the systematic failure to adequately secure the cables in manholes on the Pepco system is a design flaw in the racking system and recommends that Pepco improve its cable racking system to reduce the cost of subsequent problems from the known magnetic forces.[770]**

329. Consolidated Report: Pepco reports that re-racking primary and secondary cables, securing cables, making structural repairs, and retagging feeders and buses are all Priority 4 faults requiring corrective action within 18 months of inspection.[771] According to Pepco, Priority 4 conditions accounted for over 85% of all Priority conditions found between 2007 and

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[769] In this regard, the Commission takes administrative notice of Pepco's December 2013 and September 2014 cumulative monthly outage reports, at schedule 1, filed in response to Order No. 15131, rel. December 2, 2008, in *Formal Case Nos. 982 and 1002*.

[770] OPC Comments at 8, 41-42.

[771] 2014 Consolidated Report at 375.

2013,[772] and 85.6% (2,416) of the Priorities found in 2013.[773] In part, Pepco attributes the 2013 findings to deployment of more comprehensive and thorough underground inspections.[774]

330. OPC Comments: OPC notes that the percentage of Priority 4 items discovered in the most recent inspection cycle applicable to Pepco's manholes in the District increased by 18% and 21% in 2012 and 2013, respectively.[775] Priority 4 items revealed in these underground inspections include the need to re-rack primary and secondary cables, remedy cables that are not secured, to re-tag feeders and electrical buses, and affect structural repairs.[776] Pepco previously stated that cables that were appropriately racked during one inspection cycle may be re-racked during another cycle; therefore, Pepco does not anticipate a sharp reduction in the number of Priority 4 corrective actions required through the present Phase 3 inspection cycle.[777] Nevertheless, OPC claims that cable racking should be made adequate for the known magnetic forces that occur in the manhole, and that the systematic failure to adequately secure the cables is a design flaw in Pepco's racking system. Therefore, OPC recommends that Pepco improve its cable racking system to reduce the cost of subsequent problems from the known magnetic forces.[778]

331. Pepco Response: Pepco denies that there is a design flaw in its practices for securing cables in the underground system. It notes that in Siemens' 8th Year Technical Audit of the Company's manhole inspections, Siemens' inspectors continued to observe a considerable number of new saddles and other recent racking improvements.[779] Pepco also suggest OPC is overstating the number of Priority 4 conditions attributable to cable racking issues by ignoring the existence of several other characteristics that can lead to finding a Priority 4 condition within a manhole, including corrosion and rust, structural repairs, and retagging feeders and buses.[780] Finally, since Priority 4 conditions are required to be remediated within 18 months of the inspection date, the increase in the number of Priority 4 conditions from 2010-2011 to 2012-2013 does not suggest that there is a systematic failure to adequately secure the cables.[781]

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772 2014 Consolidated Report at 377. Priority conditions found during the manhole inspections represent a maintenance need and are not necessarily associated with either an outage, or a the more severe condition of a reportable event (such as fire, smoke or an explosion).

773 2014 Consolidated Report at 376.

774 2014 Consolidated Report at 376.

775 OPC Comments at 41.

776 OPC Comments at 41-42.

777 OPC Comments at 42, citing to Pepco's Response to OPC's Comments Addressing Pepco's 2013 Consolidated Report, filed May 31, 2014.

778 OPC Comments at 42.

779 *Formal Case No. 991*, 8th Year Technical Audit (December 27, 2013) at p. 2-5.

780 Pepco Response at 12.

781 Pepco Response at 12.

332. Staff Report: The Staff Report offers no conclusions or recommendations regarding Pepco's method of securing cables in its underground system.[782] However, in the 8th Year Technical Audit of Pepco's manholes, Siemens observed that its inspectors found a considerable number of new saddles and other recent racking improvements in its latest round of manhole inspections.[783]

333. Commission Decision: OPC recommends that Pepco improve its cable racking system to reduce the cost of subsequent problems from the known magnetic forces. The observations of Siemens' inspectors regarding racking improvements encountered in their latest round of manhole inspections, coupled with the explanation given by Pepco regarding the number of Priority 4 maintenance conditions attending its underground facilities demonstrate that Pepco is working to address the issue that OPC has identified. Therefore, the Commission concludes that Pepco should not be required at this time to take further actions to improve its system for racking cables within its manholes and underground electrical vaults.

> **OPC Recommendation #12: OPC recommends that Pepco conduct an analysis of the corrective actions recommended for manholes in Phase III of the Manhole Inspection Program and compare the results to the corrective actions recommended in Phases I and II to determine if the corrective actions recommended by the program were in fact carried out, and if the corrective actions will last longer than several years.[784]**

334. Consolidated Report: The 2014 Consolidated Report does not include a qualitative evaluation comparing the Phase III inspection results with corrective actions taken in Phases I and II.

335. OPC Comments: OPC notes that Pepco reports that its manhole inspection program costs about $2.8 million annually.[785] Given this expenditure, OPC believes that rate payers should know if the corrective actions recommended by the program were in fact carried out, and if the corrective actions will last for more than a few years.[786] Therefore, OPC recommends that Pepco conduct an analysis of the corrective actions recommended for manholes in Phase III and compare the results to the corrective actions recommended in Phases I and II. OPC suggests that since this information is in an electronic format, the correlation of the data should not be overly burdensome.[787]

336. Pepco Response: Pepco's Response did not address OPC's recommendation regarding comparing Phase III inspection results with corrective actions taken in Phases I and II.

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782 Staff Report.

783 *Formal Case No. 991*, Order No. 17411, rel. March7, 2014, Attachment at 2-5.

784 OPC Comments at 8, 42.

785 OPC Comments at 42.

786 OPC Comments at 42.

787 OPC Comments at 42.

337. Staff Report: The Staff Report did not comment or offer recommendations on this topic.

338. Commission Decision: Inasmuch as OPC's recommendation is unopposed and OPC represents that this information is in an electronic format such that correlating the data should not be overly burdensome, the Commission adopts OPC's recommendation and directs Pepco to provide in a separate report to the Commission, no later than 180 days from the date of this Order, an analysis of the corrective actions for manholes undertaken in Phase III of its Manhole Inspection Program, and compare the results to the corrective actions undertaken in Phases I and II of its manhole inspection program.

D. Staff Report and Staff Recommendation #8 Concerning Pepco's Vegetation Management Budget

339. Consolidated Report: Pepco reports the annual changes in its vegetation management budget over the period 2011 through 2016 and its actual spending over the period 2011 through 2013, as shown in the table below:

Table T: Pepco Forecasted and Actual Spending on Vegetation Management (2011-2016)

Description	**2011** ($)	**2012** ($)	**2013** ($)	**2014** ($)	**2015** ($)	**2016** ($)
Budget Forecast	1,668,154	2,218,154	2,218,342	2,113,300	2,155,566	2,198,677
Annual Increase/Decrease		32.97%+	0%	-4.74%	2%+	2%+
Actual Spending	1,585,406	1,981,233	2,352,567	n/a	n/a	n/a
Annual Increase/Decrease		24.96%	18.74%	n/a	n/a	n/a

Source: 2014 Consolidated Report, p. 312, Table 2.4-01

What this table demonstrates is that Pepco's vegetation management budget increased by almost one-third, between 2011 and 2012, stabilized between 2012 and 2014, and is projected to increase by 2% per year, beginning in 2015. Pepco's actual spending on vegetation management increased less than expected between 2011 and 2012 (by one-quarter) and increased more than expected (by almost 19%) between 2012 and 2013.

340. In Table 2.4-P1[788] of the 2014 Consolidated Report, Pepco reports the number of feeders inspected or inspected and pruned in 2013 (117 feeders) and in Table 2.4-P2,[789] the number of tree-caused outages in the District occurring in 2013 (258). In contrast, Pepco's 2013 Consolidated Report indicates that in 2012 Pepco inspected or inspected and pruned along 137 feeders and that there were 1,084 tree-caused outages in that year.[790]

341. Staff Report and Staff Recommendation #8: The Staff Report discusses the variances between Pepco's annual vegetation management expenses and budget, plus the annual growth rate in Pepco's vegetation management budget.[791] The Staff Report expresses concern with Pepco's departure from its previously-announced intent to increase its vegetation

788 2014 Consolidated Report at 314-316.

789 2014 Consolidated Report at 317-322.

790 2013 Consolidated Report at 382-411.

791 Staff Report at 62-64.

management budget by 2% each year, a matter not commented upon by OPC.[792] Consequently, the Staff Report recommends that Pepco be directed to provide an explanation to the Commission as to why the Company's 2013 tree trimming budget did not represent a 2% increase over its 2012 tree trimming budget.[793] The Staff Report conditionally recommends that Pepco re-state its 2014-2016 tree trimming budgets, as needed, depending upon the explanation Pepco provides for the level of its 2013 tree trimming budget.[794]

342. Commission Decision: The vegetation management budget and performance data provided by Pepco in its last two Annual Consolidated Reports suggests that Pepco temporarily deferred its 2% per year budget increases as it adjusted the implementation of its vegetation management program to take into account the large numbers of downed trees and tree limbs occurring in 2012 as a result of the Derecho Major Service Outage event and "Super-Storm" Sandy, following some months later.

343. These budget and spending adjustments allowed Pepco to remove a large number of hazard street trees, to complement its traditional tree trimming in 2013. Pepco's customers suffered no detriment as a result, given that Pepco's 2013 vegetation management work, coupled with the lack of Major Service Outages occurring in 2013, and possibly the "prune by storm" effect of 2012's weather events, combined to reduce the number of tree-caused outages by approximately 76% between 2012 and 2013.

344. The adequacy of the vegetation management budget is an issue that was carried over from the 2013 Consolidated Report. The 2014 Consolidated Report shows that Pepco's vegetation management budget in 2013 was $2,218,154 and that Pepco prospective vegetation management budget process calls for an annual 2% growth factor, beginning with its 2014 vegetation management budget.[795] The Siemens Report raised no question about the adequacy of the budget; neither did OPC in its Comments on the Siemens Reliability Audit Report. In Order No. 16930, the Commission required Pepco to submit on a going- forward basis an annual Enhanced Integrated Vegetation Management ("EIVM") plan and quarterly reports outlining progress made with respect to the milestones outlined in the annual EIVM plan.[796] In addition, the Commission directed that budgeted vegetation management dollars, including incremental funding, be fully spent on vegetation management and not be diverted for other uses.[797] On reconsideration of Order No. 16930, the Commission clarified that directive and stated:

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792 Staff Report at 64.

793 Staff Report at 82, Recommendation #8.

794 Staff Report at 82, Recommendation #8.

795 2014 Consolidated Report at 312, Table 2.4-O1.

796 *Formal Case No. 1087, In the Matter of the Application of the Potomac Electric Power Company for Authority to Increase Existing Retail Rates and Charges for Electric Distribution Service, Order No. 16930,* rel. September 27, 2012) ("Order No. 16930") at ¶ 103.

797 Order No. 16930 at ¶ 103.

> To the extent budgeted amounts [for vegetation management] remain unspent at the end of a year the unspent funds can be placed in a contingency reserve so that funds not spent in one year may be called upon in a future year to fund higher than expected [vegetation management] costs."[798] The accounting constraints the Commission put into place to prevent the diversion of budgeted vegetation management funds, both ensure an adequate vegetation management budget.

345. Finally, because Pepco is required by our orders in *Formal Case No. 1087* to, in effect, escrow its vegetation management budget dollars so that once budgeted, the funds cannot be spent elsewhere, year-to-year variances between projected and actual spending is of less concern than previously, since these amounts cannot be diverted to fund capital projects or for other uses. For these reasons, as long as Pepco is successful at managing the number and customer impacts of tree-caused outages on its system (*i.e.*, reducing its tree-SAIFI and tree-SAIDI over time), the Commission sees no reason, based upon the information contained in Pepco's 2014 Consolidated Report, to require Staff's recommended explanation or to require Pepco to re-state its 2014-2016 annual vegetation management budgets. The Commission will not adopt this Staff recommendation.

V. FINDINGS AND CONCLUSIONS

346. Based upon our review of the 2014 Consolidated Report, as supplemented, and our consideration of the Staff Report, the Comments of OPC, and the Responses of Pepco as described herein, the Commission finds that, on balance, the 2014 Consolidated Report is in substantial compliance with our rules and the past Commission Directives, including those found in Order No. 17455. Specifically, the Commission finds that Pepco has complied with Order No. 17455 Directives 1, 7, 8, 10 and 11; complied in-part with Directives 2, 5 and 6; and did not comply with Directives 3, 4 and 9.

347. For the reasons previously set out in this Order, Pepco is to file with the Commission in its 2015 Consolidated Report the additional information described in our Directives, below, which we find is necessary for Pepco's full compliance with the Commission's prior Directives 3, 4 and 9 set out in Order No. 17455 and which is necessary to address our new directives in response to our acceptance of certain recommendations made in Staff Recommendations 2 through 7 and in OPC Recommendations 4, 9 and 12 that we are adopting in this Order.

348. The Commission finds that Pepco has provided a reasonable explanation for not assigning its improvements in equipment-related power outages to one or more of the six opportunities it previously identified as means to reduce the number of its equipment failures, and for not reporting in its Annual Consolidated Reports its plans to implement the program goals and requirements, and annual budgets, associated with implementing these opportunities. Accordingly, we conclude it is unnecessary to require this information in Pepco's 2015 Annual Consolidated Report and will vacate our prior requirement that Pepco report this information.

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[798] Order No. 17027 at ¶ 22.

349. For the reasons set out in this Order, the Commission will be directing Pepco to provide additional information about several issues related to the Consolidated Report in the follow-up order that the Commission will issue in response to the Siemens Reliability Audit and the Liberty Audit. **THEREFORE, IT IS ORDERED THAT:**

350. The 2014 Annual Consolidated Report of the Potomac Electric Power Company, as supplemented by Pepco, is **ACCEPTED** and **APPROVED;**

351. Pepco is **DIRECTED** to provide in its 2015 Annual Consolidated Report the clarifications to its L Street and Mt Vernon Square substation projects and related load projections described in paragraph 167 of this Order;

352. Pepco is **DIRECTED** to include in its 2015 Annual Consolidated Reports the historical five-year load forecast comparisons and related analysis of variances, and trends in the accuracy of its load forecasts described in paragraph 169 of this Order;

353. Pepco is **ALLOWED** to include only 10 years of priority and neighborhood feeder data in its future Annual Consolidated Reports, consistent with paragraph 180 of this Order;

354. Pepco is **DIRECTED** to include in its 2015 Annual Consolidated Report an updated Table 1-3.B that identifies among the particular types of equipment overhead equipment listed in that Table the specific equipment types that are inspected as part of its Overhead Feeder Inspection Program, consistent with paragraph 198 of this Order;

355. Pepco is **DIRECTED** to provide in its 2015 Consolidated Report a table listing by year the overhead feeders that it has inspected under its Overhead Feeder Inspection Program, from the commencement of the Program through December 31, 2014, and, if known, the feeder numbers of the overhead feeders scheduled to be inspected by Pepco in 2015, consistent with paragraph 206 of this Order;

356. Pepco is **DIRECTED** to include in its 2015 Consolidated Report, an update on its inclusion of the location of PILC on its system into its GIS, consistent with paragraph 225 of this Order;

357. Pepco is **DIRECTED** to include in its ECA Team Meeting Minutes contained in future Annual Consolidated Reports information clarifying the status of the action items (projects) listed in the Minutes, consistent with paragraph 231 of this Order;

358. Pepco is **DIRECTED** to improve the legibility of its two priority feeder service area maps included in its future Annual Consolidated Reports, consistent with paragraph 235 of this Order;

359. Pepco is **DIRECTED** to include in its 2015 Annual Consolidated Report an explanation of the metric or metrics it will use to report upon the reliability performance of its cross-jurisdictional feeders, consistent with paragraph 241 of this Order;

360. Pepco is **DIRECTED** to include in future Annual Consolidated Reports additional information in Table 1.3-B or its equivalent to describe Pepco's maintenance methodology (reactive, preventive, predictive, and/or reliability-centered) for each equipment type or asset group listed in this Table, consistent with paragraph 246 of this Order;

361. Pepco is **DIRECTED** to report in its 2015 Annual Consolidated Report the costs it incurred during 2012-2014 to improve its data quality, including its costs for new software, hardware, training and implementation, and a timeline that indicates when these costs were or will be incurred and when training was or will be performed, consistent with paragraph 253 of this Order;

362. Pepco is **DIRECTED** to utilize validated OMS outage data in its monthly outage reporting to the Commission pursuant to Order No. 15131 and 15360, consistent with paragraph 253 of this Order;

363. Pepco is **DIRECTED** to describe in its 2015 Annual Consolidated Report whether there has been or will be any incremental annual revenue associated with the substation projects described in its 2013 through 2015 Consolidated Reports and if so, Pepco is directed to provide information in its 2015 Consolidated Report showing the actual and forecasted incremental gross annual revenue from those projects, consistent with paragraph 257 of this Order;

364. Pepco is **DIRECTED** to include in its 2015 Annual Consolidated Report information on the Table describing current slotted manhole cover installations (shown as Figure 3.19 in the 2014 Annual Consolidated Report) that identifies the Ward and District neighborhood where each newly reported slotted manhole cover was installed, consistent with paragraph 265 of this Order;

365. Pepco is **DIRECTED** to provide in its 2015 Annual Consolidated Report an analysis addressing the potential applicability of the cathodic protection described in IEEE Standard C57.12.29 to its underground transformers, consistent with paragraph 270 and to include in its analysis its responses to the three questions posed in that paragraph;

366. Pepco is **DIRECTED** to include in its 2015 Annual Consolidated Report a comparison of budgeted and actual capital expenditures on distribution projects for the five-year period 2010-2014, together with an analysis that identifies any variances of 10% or more, the reason(s) for those variances, and any actions taken or planned by Pepco to minimize the re-occurrence of future variances due to the same reason(s), consistent with paragraph 287 of this Order;

367. Pepco is **DIRECTED** to include in its 2015 Annual Consolidated Report information describing whether, in 2014, it conducted an investigation into programmatic replacement of oil-filled switches in its 4 kV system and, if such an investigation was conducted, the results of that investigation; Pepco is further directed to report in its 2015 Consolidated Report the number of AMI equipment failures in 2013 and 2014 and how any such failures are being addressed, consistent with paragraph 314 of this Order;

368. Pepco is **DIRECTED** to include in its 2015 Annual Consolidated Report information describing the number of AMI equipment failures occurring in 2013 and 2014, and how any such failures are being addressed, consistent with paragraph 314 of this Order;

369. Pepco is **DIRECTED** to include in its 2015 Annual Consolidated Report an analysis of its underground cable failures occurring in the District during 2014, consistent with paragraph 327 of this Order; and

370. Consistent with paragraph 338 of this Order, Pepco is **DIRECTED** to provide an analysis that compares the results of the corrective actions undertaken with respect to Phase III of its Manhole Inspection Program with the results of the corrective actions undertaken in Phases I and II of its Manhole Inspection Program and to file this analysis as a separate report due within 180 days of this Order

A TRUE COPY: **BY DIRECTION OF THE COMMISSION:**

CHIEF CLERK: **BRINDA WESTBROOK-SEDGWICK**
COMMISSION SECRETARY

APPENDIX A
Pepco's 2013 Annual Consolidated Report
Issues Deferred for Future Consideration

	Topic	Issue	¶¶ Order No. 17455
1.	Overhead Feeder Inspections	Create an ECA-type team to address non-substation equipment investment	158
2.	Overhead Feeder Inspections	Is inspection adequate to reveal faulty lightning arresters and is Pepco's remediation appropriate?	215
3.	Overhead Feeder Inspections	Are Pepco's repair priorities correctly matched to conditions found? Should repair times be shortened within priorities?	302
4.	Overhead Feeder Inspections	Do differing results obtained from OH feeder and priority feeder inspections indicate OH feeder inspection methodology is deficient?	335
5.	Vegetation Management	Adequacy of budgeted amount and actual expenditures	165
6.	Vegetation Management	Is Pepco implementing best practices relating to vegetation management?	242
7.	Vegetation Management	Adequacy of Pepco's hazard tree removal work – are reductions in tree-SAIFI/SAIDI due to vegetation management practices or 2012's "prune-by-storm" weather events?	264
8.	Load Growth Forecasts	Appropriateness of methodology	173
9.	Load Growth Forecasts	Is forecast informed by AMI data and load management system?	177
10.	2% High Priority Feeder Program	Does repeat feeder designation indicate program failure? What program changes are needed?	201
11.	Most Susceptible Neighborhood Feeders	What plan(s) and schedule(s) should Pepco follow to remediate outage conditions on MSN feeders?	303
12.	2% High Priority Feeder Program Most Susceptible Neighborhood Feeders	Is Pepco devoting enough man hours to analyzing outages and choice of outage remediation methods on these feeders?	341
13.	2% High Priority Feeder Program	Did Pepco's priority feeder remediation tactics change between 2012 and 2013?	347
14.	Small Feeder Reliability	Are metrics used by Pepco to identify problem feeders sufficient to identify least reliable feeders serving smaller numbers of customers?	344
15.	Equipment Failure Rates	Is Pepco acting appropriately to reduce the number of equipment –related outages and to minimize their impacts on customers?	225
16.	Equipment Failure Rates	Is the failure rate for new AMI meters too high?	360
17.	Underground PILC (Cable) Replacement	Adequacy of Pepco's opportunistic PILC replacement strategy	277
18.	Underground PILC (Cable) Replacement	How many of the approximately 1,100 miles of PILC are replaceable?	309
19.	Segmentation	Is Pepco's scheme for isolating upstream customers from downstream outages adequate?	357
20.	Segmentation	Is Pepco's overload protection scheme (lightning arresters) adequate?	358

APPENDIX B
Best Practices Relating to Distribution System Reliability and Outage Restoration Performance

1. Individual asset strategies for repair, replace, retire, run-to-fail decision are defined for specific asset groups (transformers, poles, cable, breakers, etc.).

2. Maintenance and inspection practices are determined by asset condition, asset criticality, and desired operational performance.

3. Condition Based Maintenance (CBM) program for analyzing asset performance and condition data and optimizing maintenance/replacement activities based on prioritization.

4. Repair, rebuild, replace, retire, run-to-fail decisions are based on operational performance, financial cost/benefit, reliability improvement, risk mitigation and equipment criticality.

5. Worst performing circuit analysis based on System Average Interruption Duration Index (SAIDI), System Average Interruption Frequency Index (SAIFI), and Customer Average Interruption Duration Index (CAIDI).

6. Formal Quality Assurance program in place by contractors to manage progress, quality, resources, and budget.

7. Single project owner and point of contact responsible for all activities form project initiation through design, construction and completion.

8. Work Management System in place to manage resource allocation, scheduling, and progress tracking.

9. Critical customers and equipment identified to manage restoration priorities.

10. Estimated Time of Restoration (ETR) metrics in place (default and field updated) with accuracy tracking.

11. Extended hour (nights/weekends) trouble response shift coverage based on outage volume profile.

12. Stepped restoration processes in place (isolate first, restore next, repair last).

13. Substation SCADA on all major equipment (feeder and tie breakers, transformer protection, power factor correction, voltage regulation, etc.).

14. Aggressive removals of problem trees.

15. Appropriate balances of cycle and hot spot pruning (preventive vs. corrective).

APPENDIX B
Best Practices Relating to Distribution System Reliability and Outage Restoration Performance

16. Centralized requirements and specifications for Vegetation Management (VM) with local control and implementation.

17. Cycle-based trimming is based on growth rate, inspections, and circuit criticality (circuit trim, not block trim).

18. Multiple metrics in place to understand VM program performance (cost/mile, corrective/ preventive, etc.).

19. Random field inspections and audits to verify trimming practices and clearances.

20. Use of worst performing feeder analysis for trimming work prioritization.