



An AEP Company

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Legal Department

American Electric Power
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June 15, 2018

The Honorable Greta See
The Honorable Sarah Parrot
Attorney Examiners
Public Utilities Commission of Ohio
180 East Broad Street
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Re: *In the of the Implementation of the gridSMART Phase
2 Rider of Ohio Power Company*, Case No. 18-203-
EL-RDR

Dear Examiners:

On behalf of Ohio Power Company (AEP Ohio) and the other Signatory Parties, on April 7, 2016, AEP Ohio filed a Stipulation and Recommendation (Stipulation) for the Commission's consideration in resolving Case No. 13-1939-EL-RDR (gridSMART Phase 2 case). On February 1, 2017, the Commission issued an Opinion and Order in the 13-1939 case adopting the gridSMART Phase 2 Stipulation. On February 2, 2018, AEP Ohio filed its Phase 2 Feasibility and Selection Study draft report in this docket. Per the gridSMART Phase 2 Stipulation, AEP Ohio is also working on a separate feasibility study that encompasses all circuits and all meters to determine the full extent of cost justified future possible deployments of AMI, DACR, and VVO (including Volt-Amp Reactive power and Conservation Voltage Reduction technology); for this study can be referred to as the Phase 3 Feasibility Study. Consistent with my April 9, 2018 correspondence, the Phase 3 Feasibility Study and the Company is enclosed.

Thank you for your attention to this matter.

Respectfully Submitted,

//s/ Steven T. Nourse

cc: Parties of Record in 13-1939-EL-RDR



AEP Ohio

Phase 3 Full System Feasibility Study Final Report

June 15, 2018

Phase 3 Full System Feasibility Study Final Report

Table of Contents

1	Executive Summary	1
2	DACR Business Case and Portfolio Analysis	2
2.1	DACR Benefit and Cost Data and Assumptions.....	2
2.2	DACR Business Case and Portfolio Analysis Results.....	4
3	VVO Business Case and Portfolio Analysis	7
3.1	VVO Benefit and Cost Data and Assumptions	7
3.2	VVO Business Case and Portfolio Analysis Results.....	8
4	AMI Business Case	13
5	Phase 3 Full System Feasibility Study Summary	16
6	Appendix.....	18
6.1	Prioritized Portfolio Analysis of DACR Scheme Candidates	19
6.2	Prioritized Portfolio Analysis of VVO Bus Candidates	23
6.3	Financial and Other Assumptions	34

Table of Figures

Figure 1: Prioritized Business Case Portfolio of DACR Schemes	5
Figure 2: Prioritized Business Case Portfolio of VVO Distribution Buses With AMI.....	9
Figure 3: Revised Prioritized Business Case Portfolio of VVO Distribution Buses Without AMI	12

Table of Tables

Table 1: Estimated Interruption Cost per Event by Duration and Customer Class	3
Table 2: Description of Capital and O&M Costs for DACR Infrastructure	3
Table 3: Cash Flow Model for Highest Ranked DACR Scheme "CRA991"	6
Table 4: Prioritized Business Case Portfolio of DACR Schemes (Top 10)	7
Table 5: Description of Capital and O&M Costs for VVO Infrastructure.....	8
Table 6: Prioritized Business Case Portfolio of VVO Buses (Top 10)	10

Table 7: Cash Flow Model for Highest Ranked VVO Bus “HILLIARD (#0021) 1X 2X”	11
Table 8: Cash Flow Model for AMI Business Case	15
Table 9: 15 Year Business Case Summary for DACR, VVO and AMI.....	16
Table 10: Prioritized Business Case Portfolio of DACR Schemes	19
Table 11: Prioritized Business Case Portfolio of VVO Distribution Buses	23
Table 12: Financial Assumptions	34

Phase 3 Full System Feasibility Study Report

1 Executive Summary

American Electric Power's ("AEP") Ohio subsidiary ("AEP Ohio") received approval to proceed with its Smart Grid Phase 2 plan from the Public Utilities Commission of Ohio ("Commission") in February 2017. That plan describes how AEP Ohio proposes to deploy advanced metering infrastructure ("AMI"), distribution automation circuit reconfiguration ("DACR"), and Volt-VAR optimization ("VVO") technology within specific locations of AEP Ohio's service area.

In addition to approving AEP Ohio's Smart Grid Phase 2 plan, the Commission's order required that AEP Ohio prepare and submit two engineering and feasibility and selection studies. The "Phase 2 Feasibility and Selection Study" report ("Phase 2 report") was submitted by AEP Ohio to the Commission in February 2018. That report describes how AEP Ohio will prioritize and select locations where AMI, DACR, and VVO will be deployed within the Smart Grid Phase 2 project area. Section 3 of the Phase 2 report describes feasibility and selection study objectives applicable for both AEP Ohio's authorized Smart Grid Phase 2 and future anticipated Smart Grid Phase 3 deployments. A common theme among all the objectives identified in Table 1 of the Phase 2 report is to "maximize customer and company benefits for the technologies proposed." ¹ Section 4 of the Phase 2 report presents specific metrics and prioritization processes that fulfill all Table 1 objectives for AMI, DACR, and VVO. In addition, Section 4 describes how DACR and VVO metrics will be monetized to develop a prioritized business case portfolio analysis of all proposed DACR and VVO candidates, how the portfolios will be annually updated, and how DACR and VVO candidates will ultimately be selected for deployment.

This document, the "Phase 3 Full System Feasibility Study" ("Phase 3 report") presents the results of a benefit-cost analysis or business case for all future anticipated AMI, DACR, and VVO Phase 3 deployments within all remaining areas of AEP Ohio's service area. ² Specifically, Sections 2 and 3 of this Phase 3 report present the prioritized business case portfolio analysis of all DACR and VVO distribution bus candidates respectively that is described in Sections 4 of the Phase 2 report. For this reason, the Phase 2 report should be regarded as a companion reference document to this Phase 3 report to avoid repetitive content describing the business case portfolio analysis development process.

In contrast to DACR and VVO, the Phase 2 report does not describe the business case development process for AMI. The Phase 2 report describes how AEP Ohio's approved AMI deployment will be prioritized across 43 cities within the Phase 2 AMI deployment area, but does not discuss an AMI business case. Section 4 of this Phase 3 Full System Feasibility report will present all relevant benefit and cost estimates, and business case results for a proposed Phase 3 AMI deployment within the remainder of AEP Ohio's service

¹ Commission Order and Opinion dated February 1, 2017, Section IV (1) (B) (iii).

² AEP Ohio eliminated distribution circuits from the business case for a variety reasons. Circuits excluded from the Phase 3 Full System Feasibility Study include, but are not necessarily limited to: 4 kV circuits, network circuits, circuits serving a few dedicated customers, circuits with insufficient capacity, or circuits have inadequate (or no) interconnections with adjoining circuits, etc.

territory. Finally, Section 6 consists of an Appendix providing details of the prioritized DACR and VVO business case portfolio analysis for all candidate DACR schemes and VVO distribution buses and a description of all financial assumptions used throughout all DACR, VVO, and AMI business cases.

2 DACR Business Case and Portfolio Analysis

AEP Ohio has prepared a benefit-cost analysis or “business case portfolio analysis” for every DACR scheme candidate proposed for a Phase 3 deployment. All the benefit and cost data and associated assumptions used to prepare DACR business case portfolio analysis is presented in Sections 2.1. Results of the business case portfolio analysis for all Phase 3 DACR scheme candidates are summarized in Section 2.2.

2.1 DACR Benefit and Cost Data and Assumptions

AEP Ohio’s 2013 application to the Commission seeking approval of its proposed Smart Grid Phase 2 plan included a business case justifying the proposed deployment of DACR on selected circuits throughout the AEP Ohio’s service territory. The benefits component of this DACR business case was based on the societal economic benefits to customers associated with improved electric service reliability that is well documented through research sponsored by the U.S. Department of Energy’s Lawrence Berkley National Laboratory (“LBNL”).³ In addition to AEP Ohio, LBNL’s sponsored research has been referenced in numerous studies and by other electric utilities to justify their proposed smart grid programs. AEP Ohio’s application of the methodology described in LBNL sponsored research to estimate the value of improved distribution reliability achievable with DACR was recognized and approved by order of the Commission in February 2017.

The Phase 3 business case portfolio analysis prepared for every DACR scheme candidate is based on the same LBNL methodology and approach previously used by AEP Ohio to monetize reliability improvements associated with DACR previously accepted by the Commission. However, the Phase 3 study relies on updated estimates on the value of improved electric service reliability recently published by LBNL and updated reliability data for the three year period ending calendar year 2017 on all candidate DACR schemes and circuits.^{4,5} Updated estimates on the value of improved electric service reliability for LBNL’s methodology are reproduced in Table 1 on page 3.

A properly designed DACR business case portfolio analysis includes the capital costs and operations and maintenance (“O&M”) costs required to purchase, deploy, own, and maintain DACR infrastructure to realize the anticipated reliability benefits. A description of these costs incurred by AEP Ohio over the 15 year time horizon of the DACR business case portfolio analysis is provided in Table 2 on pages 3-4.

³ The economic benefits of improving electric service reliability is based on the LBNL sponsored research of Sullivan, M., Mercurio, M., Schellenberg, J., & Eto, J. in their (2010) paper "How to Estimate the Value of Service Reliability Improvements."

⁴ Sullivan, M., Schellenberg, J., & Blundell, M. (Jan 2015). *Updated Value of Service Reliability Estimates for Electric Utility Customers in the United States (LBNL-6941E)* (p. xii). Ernest Orlando Lawrence Berkeley National Laboratory.

⁵ All AEP Ohio reliability data excludes transmission outages and major event days.

Table 1
Estimated Interruption Cost per Event by Duration and Customer Class

Duration (Min)	Residential	Small C&I	Med-Large C&I
Momentary	\$3.90	\$412	\$12,952
30	\$4.50	\$520	\$15,241
60	\$5.10	\$647	\$17,804
240	\$9.50	\$1,880	\$39,458
480	\$17.20	\$4,690	\$84,083
960	\$32.40	\$9,055	\$165,482

Table 1 Notes:

1. Interruption costs per event by duration and customer class represents the outage cost associated with an individual interruption for a typical or average sized customer within the meta-database used by the principal investigators who performed the LBNL sponsored research. Table durations represent customer average interruption duration index ("CAIDI") values.
2. See Footnote 4 on page 2 of this report for the LBNL source where these estimated interruption costs are published. The interruption costs above published by LBNL are in 2013 dollars. These costs have been escalated to 2018 dollars within the DACR business case portfolio analysis using the Consumer Price Index published by the U.S. Bureau of Labor Statistics.
3. Example calculation:

Assume a distribution circuit serves 1000 residential customers, 100 small C&I customers, and 2 medium & large C&I customers. Also, assume the circuit has a circuit CAIDI of 60 minutes and a system average interruption frequency index ("SAIFI") of 1.00. (The system average interruption duration index or "SAIDI" is 60 minutes.)

The annual societal economic cost of interruptions on this circuit is 1000 residential customers × \$5.10 per residential customer + 100 small C&I customers × \$647 per small C&I customer + 2 medium & large C&I customer × \$17,804 per medium & large C&I customer = \$105,408. If the annual outage frequency is reduced by 50 percent (SAIFI is 0.50 and CAIDI is unchanged) the annual economic cost of interruptions is reduced by half, i.e. \$105,408 × 0.50 = \$52,704.

Table 2
Description of Capital and O&M Costs for DACR Infrastructure

1. Substation infrastructure

Includes estimated capital costs associated with breaker, capacitor bank, and voltage regulator control upgrades, new or upgraded remote terminal units, control house panel upgrades, and station yard cable raceway upgrades including fiber optic or other control cabling replacements.

2. Distribution line infrastructure

Includes initial capital costs, O&M costs for each candidate distribution circuit and DACR scheme associated with:

- a) Reclosers/controls or recloser control upgrades

- b) Voltage regulator banks/controls or regulator bank control upgrades
 - c) Switched capacitor bank/controls or capacitor bank control upgrades
3. Communication infrastructure
- Includes initial and replacement capital costs and O&M costs for each candidate distribution circuit and DACR scheme associated with cellular LTE and/or mesh radios installed at (or near) each recloser, voltage regulator bank, and switched capacitor bank location.
4. Information technology infrastructure
- Includes initial and replacement capital costs and O&M costs associated with all DACR controller hardware, software licensing, fees and maintenance support.

2.2 DACR Business Case and Portfolio Analysis Results

AEP Ohio has prepared a benefit-cost analysis or “business case” for 147 DACR schemes involving 710 distribution circuits identified as candidates for a possible Smart Grid Phase 3 deployment.⁶ As described within the Phase 2 report, a business case for each DACR scheme candidate is essential to ensure that AEP Ohio is delivering the greatest monetized benefits of improved electric service reliability minus the costs (i.e. net benefits) previously identified in Table 2 to procure, deploy, operate, and maintain the proposed DACR infrastructure.

The business case prepared for each DACR scheme candidate represents the net benefit “cash flows” that are discounted at AEP Ohio’s after-tax weighted cost of capital to estimate the 15 year net present value (“NPV”) of the proposed scheme.⁷ These net benefit cash flows include the monetized LBNL benefits associated with improved reliability, initial and replacement capital costs, and O&M costs associated with substation, distribution, communication, and information technology (“IT”) infrastructure.⁸ Also, these cash flows incorporate the combined tax effects associated with the depreciation of capitalized infrastructure assets and the tax effects associated with annual O&M expenses. The cash flow model for DACR scheme “CRA991” provided in Table 3 on page 6 illustrates all the annual cash flows that yields a 15 year NPV of \$8,040,439 in the bottom right corner of the table.

⁶ Each DACR circuit scheme candidate includes 2 or more interconnected distribution circuits served from one or more substations that can be automatically switched and reconfigured as necessary to isolate and limit an outage to the smallest area impacting the fewest number of customers that is practical.

⁷ The term “net benefit cash flows” or simply “cash flows” used hereinafter within this report include benefits from the perspective of customers such as the societal economic benefit of improved reliability and improved energy efficiency / reduced retail power costs associated with DACR and VVO respectively. Also, the term net benefit cash flows or simply cash flows also includes operational savings associated with AMI.

⁸ AEP Ohio operating savings associated with outage restoration and lost retail revenue were originally examined, but eventually discarded from the DACR business cases because their contributions were negligible.

This level of business case modeling detail illustrated in Table 3 was repeated for each of the other 147 DACR scheme candidates before assembling all business case results into AEP Ohio’s DACR portfolio. This DACR portfolio of DACR scheme candidates was then prioritized and ranked by their individual 15 year NPV values in descending order from candidates with the highest NPV to candidates with the lowest (or most negative) to identify DACR scheme candidates delivering the greatest value to AEP Ohio customers. A graphical summary of the NPV results for all 147 Phase 3 DACR scheme candidates is provided in Figure 1.

The business case developed for all 147 DACR scheme candidates is based on a common set of financial assumptions and notes that are summarized within Section 6.3 (Appendix) of this Phase 3 report. Among the 147 DACR scheme candidates investigated, 99 schemes impacting 495 distribution circuits have business cases with positive 15 year NPV values. Collectively, these 99 DACR schemes deliver to AEP Ohio customers improved electric service reliability estimated to have a 15 year present value societal economic benefit of \$617,353,054 compared to the estimated 15 year present value cost of \$312,728,604 to deploy, own, operate, and maintain the needed DACR infrastructure. (The 15 year NPV for all 99 schemes is \$304,624,450.) In other words, AEP Ohio customers realize \$1.97 in DACR benefits for every dollar of DACR related capital and O&M costs incurred over 15 years on these 99 schemes. A tabular listing of all 147 DACR scheme candidates graphically illustrated in Figure 1 is provided in Table 10 of Section 6.1 (Appendix). The DACR scheme candidates with the 10 highest 15 year NPV values from Table 10 is reproduced in Table 4 on page 7.

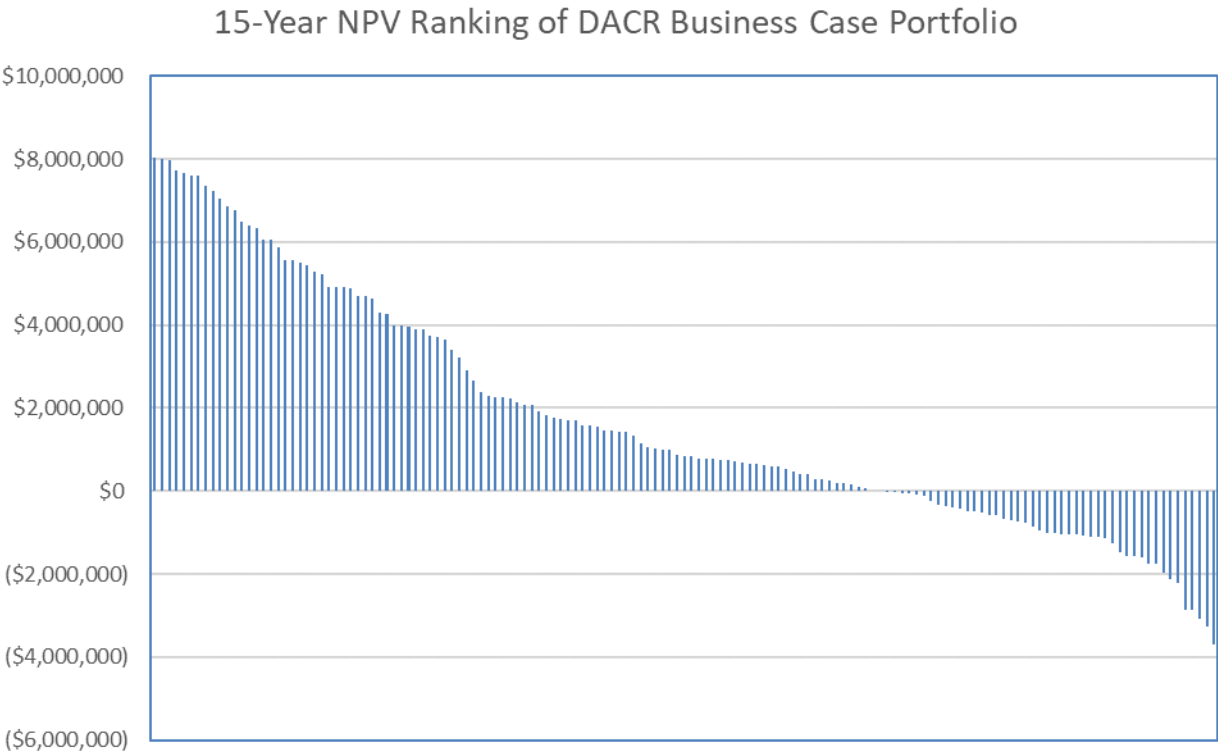


Figure 1: Prioritized Business Case Portfolio of DACR Schemes

Table 3
Cash Flow Model for Highest Ranked DACR Scheme “CRA991”

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Capital Related Costs	\$2,945,945	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$323,115	\$0	\$0	\$0	\$0
Capital Cost - T&D Infrastructure	\$2,596,750	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Capital Cost - Communication Infrastructure	\$300,545	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$308,688	\$0	\$0	\$0	\$0
Capital Cost - Info Tech Infrastructure	\$48,650	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$14,428	\$0	\$0	\$0	\$0
Capital Cost - Customer Infrastructure	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Subtotal - Capital Costs	\$2,945,945	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$323,115	\$0	\$0	\$0	\$0
Depreciation Related Costs															
Dep Exp - T&D Infrastructure	\$86,558	\$86,558	\$86,558	\$86,558	\$86,558	\$86,558	\$86,558	\$86,558	\$86,558	\$86,558	\$86,558	\$86,558	\$86,558	\$86,558	\$86,558
Dep Exp - Communication Infrastructure	\$60,109	\$60,109	\$60,109	\$60,109	\$60,109	\$0	\$0	\$0	\$0	\$0	\$61,738	\$61,738	\$61,738	\$61,738	\$61,738
Dep Exp - Info Tech Infrastructure	\$9,730	\$9,730	\$9,730	\$9,730	\$9,730	\$0	\$0	\$0	\$0	\$0	\$2,886	\$2,886	\$2,886	\$2,886	\$2,886
Dep Exp - Customer Infrastructure	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Tax Benefit of Dep - T&D Infrastructure	\$18,939	\$18,939	\$18,939	\$18,939	\$18,939	\$18,939	\$18,939	\$18,939	\$18,939	\$18,939	\$18,939	\$18,939	\$18,939	\$18,939	\$18,939
Tax Benefit of Dep - Com Infrastructure	\$13,152	\$13,152	\$13,152	\$13,152	\$13,152	\$0	\$0	\$0	\$0	\$0	\$13,508	\$13,508	\$13,508	\$13,508	\$13,508
Tax Benefit of Dep - Info Tech Infrastructure	\$2,129	\$2,129	\$2,129	\$2,129	\$2,129	\$0	\$0	\$0	\$0	\$0	\$631	\$631	\$631	\$631	\$631
Tax Benefit of Dep - Customer Infrastructure	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Subtotal - Tax Benefit of Depreciation	\$34,220	\$34,220	\$34,220	\$34,220	\$34,220	\$18,939	\$18,939	\$18,939	\$18,939	\$18,939	\$33,078	\$33,078	\$33,078	\$33,078	\$33,078
Net Book - T&D Infrastructure	\$2,510,192	\$2,423,633	\$2,337,075	\$2,250,517	\$2,163,958	\$2,077,400	\$1,990,842	\$1,904,283	\$1,817,725	\$1,731,167	\$1,644,608	\$1,558,050	\$1,471,492	\$1,384,933	\$1,298,375
Net Book - Communication Infrastructure	\$240,436	\$180,327	\$120,218	\$60,109	\$0	\$0	\$0	\$0	\$0	\$0	\$246,950	\$185,213	\$123,475	\$61,738	\$0
Net Book - Info Tech Infrastructure	\$38,920	\$29,190	\$19,460	\$9,730	\$0	\$0	\$0	\$0	\$0	\$0	\$11,542	\$8,657	\$5,771	\$2,886	\$0
Net Book - Customer Infrastructure	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Property Tax - T&D Infrastructure	\$76,561	\$73,921	\$71,281	\$68,641	\$66,001	\$63,361	\$60,721	\$58,081	\$55,441	\$52,801	\$50,161	\$47,521	\$44,880	\$42,240	\$39,600
Property Tax - Communication Infrastructure	\$7,333	\$5,500	\$3,667	\$1,833	\$0	\$0	\$0	\$0	\$0	\$0	\$7,532	\$5,649	\$3,766	\$1,883	\$0
Property Tax - Info Tech Infrastructure	\$1,187	\$890	\$594	\$297	\$0	\$0	\$0	\$0	\$0	\$0	\$352	\$264	\$176	\$88	\$0
Property Tax - Customer Infrastructure	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Subtotal - Property Tax	\$85,081	\$80,311	\$75,541	\$70,771	\$66,001	\$63,361	\$60,721	\$58,081	\$55,441	\$52,801	\$58,045	\$53,434	\$48,823	\$44,211	\$39,600
Operations & Maintenance Expense	\$96,218	\$96,809	\$98,261	\$99,735	\$101,231	\$102,750	\$104,291	\$105,855	\$107,443	\$109,055	\$110,935	\$112,599	\$114,288	\$116,003	\$117,743
O&M - T&D Infrastructure	\$77,903	\$79,071	\$80,257	\$81,461	\$82,683	\$83,923	\$85,182	\$86,460	\$87,757	\$89,073	\$90,409	\$91,765	\$93,142	\$94,539	\$95,957
O&M - Communication Infrastructure	\$14,371	\$14,587	\$14,806	\$15,028	\$15,253	\$15,482	\$15,714	\$15,950	\$16,189	\$16,432	\$16,662	\$16,902	\$17,142	\$17,382	\$17,622
O&M - Info Tech Infrastructure	\$3,945	\$3,151	\$3,198	\$3,246	\$3,295	\$3,344	\$3,395	\$3,446	\$3,497	\$3,550	\$3,564	\$3,618	\$3,672	\$3,727	\$3,783
O&M - Customer Infrastructure	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Subtotal - O&M Expenses	\$96,218	\$96,809	\$98,261	\$99,735	\$101,231	\$102,750	\$104,291	\$105,855	\$107,443	\$109,055	\$110,935	\$112,599	\$114,288	\$116,003	\$117,743
Customer Benefits	\$1,250,457	\$1,269,213	\$1,288,252	\$1,307,575	\$1,327,189	\$1,347,097	\$1,367,303	\$1,387,813	\$1,408,630	\$1,429,760	\$1,451,206	\$1,472,974	\$1,495,069	\$1,517,495	\$1,540,257
Operating Benefits	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Operating Benefits & Expenses Net of Taxes	(\$107,411)	(\$104,146)	(\$101,554)	(\$98,979)	(\$96,422)	(\$110,826)	(\$109,968)	(\$109,128)	(\$108,306)	(\$107,502)	(\$98,929)	(\$96,626)	(\$94,344)	(\$92,081)	(\$89,838)
Depreciation Tax Benefit	\$34,220	\$34,220	\$34,220	\$34,220	\$34,220	\$18,939	\$18,939	\$18,939	\$18,939	\$18,939	\$33,078	\$33,078	\$33,078	\$33,078	\$33,078
Property Tax Expense	\$66,465	\$62,739	\$59,013	\$55,286	\$51,560	\$49,497	\$47,435	\$45,373	\$43,310	\$41,248	\$45,344	\$41,742	\$38,140	\$34,538	\$30,936
O&M Expense	\$75,166	\$75,627	\$76,762	\$77,913	\$79,082	\$80,268	\$81,472	\$82,694	\$83,934	\$85,193	\$86,663	\$87,963	\$89,282	\$90,621	\$91,981
Operating Benefits	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Subtotal - Cash Flow Net of Taxes	(\$107,411)	(\$104,146)	(\$101,554)	(\$98,979)	(\$96,422)	(\$110,826)	(\$109,968)	(\$109,128)	(\$108,306)	(\$107,502)	(\$98,929)	(\$96,626)	(\$94,344)	(\$92,081)	(\$89,838)
Annual Customer & Utility Net Cash Flow	(\$1,802,900)	\$1,165,067	\$1,186,697	\$1,208,596	\$1,230,767	\$1,236,271	\$1,257,335	\$1,278,685	\$1,300,324	\$1,322,257	\$1,029,162	\$1,376,348	\$1,400,725	\$1,425,414	\$1,450,419
Cumulative Customer & Utility Net Cash Flow	(\$1,802,900)	(\$637,833)	\$548,864	\$1,757,460	\$2,988,227	\$4,224,498	\$5,481,833	\$6,760,518	\$8,060,843	\$9,383,100	\$10,412,262	\$11,788,610	\$13,189,335	\$14,614,749	\$16,065,168
Annual PV Customer & Utility Cash Flow	(\$1,672,449)	\$1,002,567	\$947,291	\$894,965	\$845,439	\$787,773	\$743,224	\$701,154	\$661,428	\$623,919	\$450,482	\$558,860	\$527,605	\$498,056	\$470,124
Cumulative NPV Customer & Utility Cash Flow	(\$1,672,449)	(\$669,882)	\$277,409	\$1,172,375	\$2,017,813	\$2,805,586	\$3,548,810	\$4,249,964	\$4,911,393	\$5,535,312	\$5,985,794	\$6,544,654	\$7,072,259	\$7,570,315	\$8,040,439

Table 4
Prioritized Business Case Portfolio of DACR Schemes (Top 10)

Candidate	Rank	NPV	PV Benefits	PV Costs	Circuits	Total	Rule 11	District	District Sub-Area
CRA991	1	\$8,040,439	\$12,057,382	\$4,016,943	7	7	0	Columbus	Columbus, SW - 65
CRC200	2	\$7,990,236	\$12,437,644	\$4,447,409	8	15	0	Columbus	Columbus, SE - 64
CRA109	3	\$7,974,373	\$15,328,031	\$7,353,658	11	26	0	Canton	North Canton - 20, South Canton -21
CRA995	4	\$7,717,233	\$11,132,625	\$3,415,392	6	32	0	Columbus	Columbus, SW - 65
CRC985	5	\$7,673,183	\$9,382,376	\$1,709,192	3	35	1	Columbus	Columbus, SE - 64
CRA999	6	\$7,598,849	\$11,616,539	\$4,017,690	7	42	0	Columbus	Columbus, SE - 64
CRC517	7	\$7,587,491	\$11,620,963	\$4,033,472	7	49	0	Columbus	Columbus, SE - 64
CRA397	8	\$7,356,381	\$16,653,885	\$9,297,505	14	63	0	Canton	Wooster - 70
CRC414	9	\$7,214,813	\$9,987,273	\$2,772,460	5	68	0	Columbus	Columbus, NW - 66
CRC407	10	\$7,045,918	\$9,969,005	\$2,923,087	5	73	0	Columbus	Columbus, NW - 66

The DACR business case and portfolio analysis presented in this report assumes AEP Ohio will utilize the same DACR technology in previous and current deployments approved by the PUCO to achieve a reduction in outage frequency (SAIFI) of 15.8 percent. AEP Ohio intends to examine additional technology options and applications to further enhance distribution reliability, deliver additional customer benefits, and improve DACR business case outcomes before filing any formal application to the PUCO for a Phase 3 DACR deployment. This examination includes how DACR may be further leveraged to deliver additional customer benefits associated with improved reliability by mitigating or reducing the impact of transmission outage events. In addition, AEP Ohio intends to examine business processes, evaluate the recent performance of existing DACR schemes, and review other external performance outcomes that may contribute to additional reductions in outage frequency.

3 VVO Business Case and Portfolio Analysis

AEP Ohio has prepared a benefit-cost analysis or “business case portfolio analysis” for every VVO bus candidate proposed for a Phase 3 deployment. All the benefit and cost data and associated assumptions used to prepare VVO business case portfolio analysis is presented in Sections 3.1. Results of the business case portfolio analysis for all Phase 3 VVO bus candidates are summarized in Section 3.2.

3.1 VVO Benefit and Cost Data and Assumptions

The net change or reduction in demand and energy that may be realized by deploying VVO are measures associated with improving energy efficiency. Estimating AEP Ohio improvements in energy efficiency achievable with VVO required that calendar year 2017 data on peak loads, and retail sales and revenue data by customer rate class and distribution circuit be collected and totalized for each Phase 3 VVO bus candidate. The benefits of improved energy efficiency are monetized by estimating reductions in customers’ retail power costs associated with a given average percent reduction in voltage and energy at each VVO bus.

A properly designed VVO business case portfolio analysis includes the capital costs and operations and maintenance (“O&M”) costs required to purchase, deploy, own, and maintain VVO infrastructure to realize the anticipated reliability benefits. A description of these costs incurred by AEP Ohio over the 15 year time horizon of the VVO business case portfolio analysis is provided in Table 5.

Table 5
Description of Capital and O&M Costs for VVO Infrastructure

1. Substation infrastructure

Includes estimated capital costs associated with capacitor bank and voltage regulator control upgrades, new or upgraded remote terminal units, control house panel upgrades, and station yard cable raceway upgrades including fiber optic or other control cabling replacements.

2. Distribution line infrastructure

Includes initial capital costs and O&M costs for each candidate distribution circuit and VVO distribution bus associated with:

- a) Voltage regulator banks/controls or regulator bank control upgrades
- b) Switched capacitor bank/controls or capacitor bank control upgrades
- c) New line voltage monitors

3. Communication infrastructure

Includes initial and replacement capital costs and O&M costs for each candidate distribution circuit and VVO distribution bus associated with cellular LTE and/or mesh radios installed at (or near) each voltage regulator bank, switched capacitor bank, and line voltage monitor locations.

4. Information technology infrastructure.

Includes initial and replacement capital costs and O&M costs associated with all VVO controller hardware, VVO and AMI module software licensing, fees and maintenance support.

3.2 VVO Business Case and Portfolio Analysis Results

AEP Ohio has prepared a benefit-cost analysis or “business case” for 448 VVO buses involving 978 distribution circuits identified as candidates for a possible Smart Grid Phase 3 deployment. As described within the Phase 2 report, a business case for each VVO bus candidate is essential to ensure that AEP Ohio is delivering the greatest monetized benefits of energy efficiency from the perspective customers, i.e. retail power cost savings minus the costs (i.e. net benefits) previously identified in Table 5 to procure, deploy, operate, and maintain the proposed VVO infrastructure.

The business case prepared for each VVO bus candidate represents the net benefit cash flows that are discounted at AEP Ohio’s after-tax weighted cost of capital to estimate the 15 year net present value (“NPV”) of the proposed scheme. These net benefit cash flows include retail customer power costs savings, initial and replacement capital costs, and O&M costs associated with substation, distribution,

communication, and information technology (“IT”) infrastructure.^{9, 10} Also, these cash flows incorporate the combined tax effects associated with the depreciation of capitalized infrastructure assets and the tax effects associated with annual O&M expenses. The cash flow model for VVO bus “HILLIARD (#0021) 1X 2X” provided in Table 7 on page 11 illustrates all the annual cash flows that yields a 15 year NPV of \$1,957,872 in the bottom right corner of the table.

This level of business case modeling detail illustrated in Table 7 was repeated for each of the other 447 VVO bus candidates before assembling all business case results into AEP Ohio’s VVO portfolio. This VVO portfolio of VVO bus candidates was then prioritized and ranked by their individual 15 year NPV values in descending order from candidates with the highest NPV to candidates with the lowest (or most negative) to identify VVO bus candidates delivering the greatest value to AEP Ohio customers. A graphical summary of the NPV results for all 448 Phase 3 VVO bus candidates is provided in Figure 2.

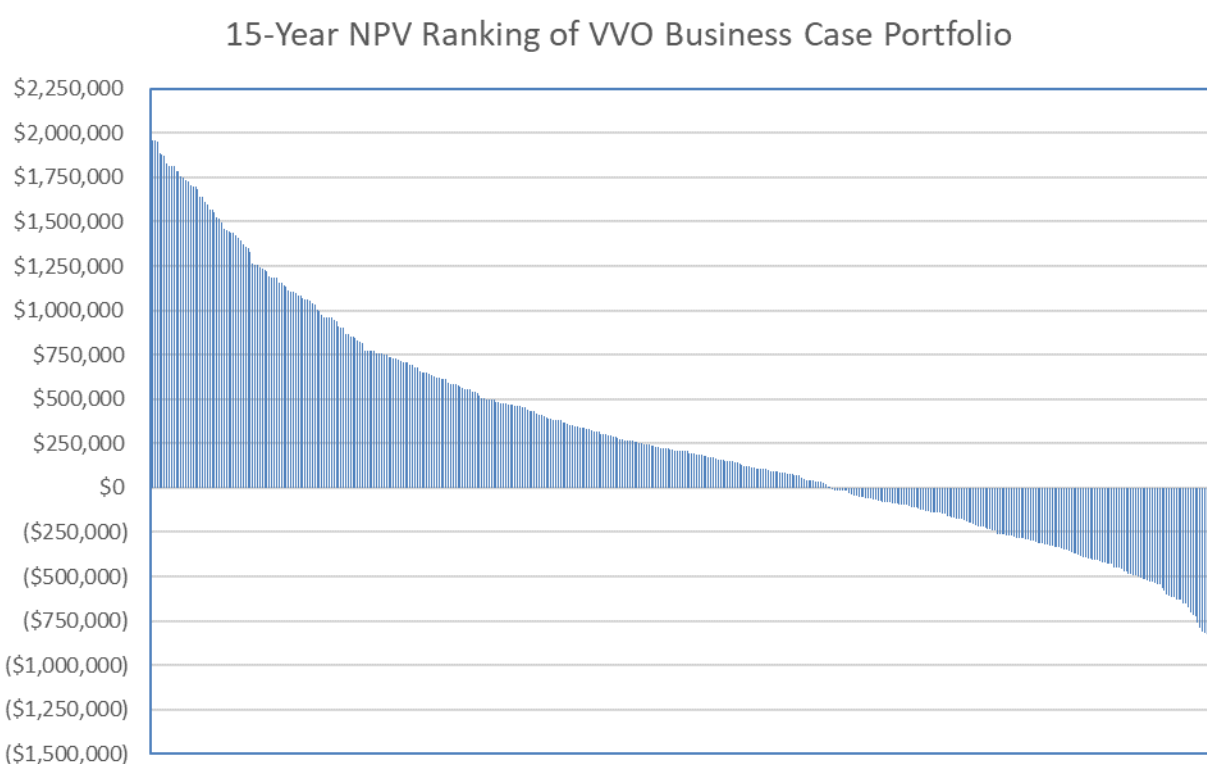


Figure 2: Prioritized Business Case Portfolio of VVO Distribution Buses With AMI

⁹ AEP Ohio operating savings associated with deferred plant investment was originally investigated, but eliminated from the VVO business case because no tangible benefits could be estimated or their contributions were negligible.

¹⁰ Reductions in CO₂ are identified in the business case, but not monetized pending establishment of an incentivized U.S. cap-and-trade, tax credit, or other program.

The business case developed for all 448 VVO bus candidates is based on a common set of financial assumptions and notes that are summarized within Section 6.3 (Appendix) of this Phase 3 report. Among the 448 VVO bus candidates investigated, 285 buses impacting 695 distribution circuits have business cases with positive 15 year NPV values. Collectively, these 285 VVO buses with positive business cases deliver greater energy efficiency (and reduced retail power costs) yielding an estimated 15 year present value benefit of \$548,381,961. In contrast, AEP Ohio incurs an estimated 15 year present value capital and O&M cost of \$361,782,325 to procure, deploy, operate, and maintain the needed VVO infrastructure. (The 15 year NPV for all 285 buses is \$186,599,636.) In other words, AEP Ohio retail customers realize \$1.52 in VVO benefits for every dollar of VVO related capital and O&M costs incurred over 15 years on these 285 buses. In addition, improved energy efficiency associated with VVO is estimated to reduce CO₂ emissions by 8,602,913 metric tons (“t”) over 15 years.¹¹ A tabular listing of all 448 VVO bus candidates graphically illustrated in Figure 2 is provided in Table 11 of Section 6.2 (Appendix). The VVO bus candidates with the 10 highest 15 Year NPV values from Table 11 is reproduced in Table 6.

Table 6
Prioritized Business Case Portfolio of VVO Buses (Top 10)

Candidate	Rank	NPV	PV Benefits	PV Costs	Reduced CO2	Circuits	Total	OHA
HILLIARD (#0021) 1X 2X	1	\$1,957,872	\$3,819,835	\$1,861,963	57,153	4	4	0
BROOKSIDE 1X	2	\$1,955,402	\$3,854,248	\$1,898,845	71,377	4	8	0
CANAL STREET (#0013) 1X 2X	3	\$1,953,998	\$5,617,833	\$3,663,835	91,714	8	16	3
E.WOOSTER 1X	4	\$1,889,688	\$3,421,385	\$1,531,697	57,979	3	19	2
ZUBER 1X	5	\$1,876,012	\$3,407,709	\$1,531,697	57,373	3	22	1
BEXLEY 1Y	6	\$1,868,534	\$3,713,602	\$1,845,067	63,384	4	26	0
WHITE RD 1X	7	\$1,827,229	\$3,824,436	\$1,997,208	66,810	4	30	0
LAZELLE (#0098) 1X 2X	8	\$1,817,615	\$4,271,852	\$2,454,237	67,234	5	35	0
MARION ROAD 25E3-4Y	9	\$1,814,338	\$3,156,724	\$1,342,386	41,374	3	38	1
ASTOR (#0046) 1Y 2Y	10	\$1,813,018	\$4,521,445	\$2,708,426	75,625	6	44	0

All the VVO business case portfolio analysis results heretofore presented within this Phase 3 report assumes AEP Ohio will utilize its VVO vendor’s proprietary software to achieve greater voltage reduction and energy efficiency by analyzing metering interval and voltage data wherever AMI is deployed. The VVO vendor asserts that AEP Ohio can achieve an average 4 percent reduction in energy usage (and retail power costs) if AEP Ohio integrates the vendor’s proprietary software with its other VVO hardware and software wherever AMI is deployed. However, the VVO vendor asserts only an average 3 percent voltage reduction can be achieved if AEP Ohio doesn’t have AMI interval and voltage data (i.e. no AMI has been deployed) and doesn’t procure and integrate the vendor’s software with its other VVO infrastructure.

AEP Ohio’s VVO business case portfolio analysis is significantly impacted if AMI isn’t deployed where VVO is proposed, the VVO vendor’s proprietary software isn’t purchased and integrated with the vendor’s other systems, and average voltage and energy reduction is limited to 3 percent. A graphical summary of these impacts on NPV results for all 448 Phase 3 VVO bus candidates is provided in Figure 3 on page 12.

¹¹ The official symbol for the metric ton in the International System of Units (“SI”) is “t”.

Table 7
Cash Flow Model for Highest Ranked VVO Bus “HILLIARD (#0021) 1X 2X”

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Capital Related Costs	\$1,068,200	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$136,026	\$0	\$133,590	\$0	\$0	\$0	\$0
Capital Cost - T&D Infrastructure	\$739,520	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Capital Cost - Communication Infrastructure	\$130,760	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$133,590	\$0	\$0	\$0	\$0
Capital Cost - Info Tech Infrastructure	\$197,920	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$136,026	\$0	\$0	\$0	\$0	\$0	\$0
Capital Cost - Customer Infrastructure	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Subtotal - Capital Costs	\$1,068,200	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$136,026	\$0	\$133,590	\$0	\$0	\$0	\$0
Depreciation Related Costs															
Dep Exp - T&D Infrastructure	\$24,651	\$24,651	\$24,651	\$24,651	\$24,651	\$24,651	\$24,651	\$24,651	\$24,651	\$24,651	\$24,651	\$24,651	\$24,651	\$24,651	\$24,651
Dep Exp - Communication Infrastructure	\$26,152	\$26,152	\$26,152	\$26,152	\$26,152	\$0	\$0	\$0	\$0	\$0	\$26,718	\$26,718	\$26,718	\$26,718	\$26,718
Dep Exp - Info Tech Infrastructure	\$39,584	\$39,584	\$39,584	\$39,584	\$39,584	\$0	\$0	\$0	\$27,205	\$27,205	\$27,205	\$27,205	\$27,205	\$0	\$0
Dep Exp - Customer Infrastructure	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Tax Benefit of Dep - T&D Infrastructure	\$5,394	\$5,394	\$5,394	\$5,394	\$5,394	\$5,394	\$5,394	\$5,394	\$5,394	\$5,394	\$5,394	\$5,394	\$5,394	\$5,394	\$5,394
Tax Benefit of Dep - Com Infrastructure	\$5,722	\$5,722	\$5,722	\$5,722	\$5,722	\$0	\$0	\$0	\$0	\$0	\$5,846	\$5,846	\$5,846	\$5,846	\$5,846
Tax Benefit of Dep - Info Tech Infrastructure	\$8,661	\$8,661	\$8,661	\$8,661	\$8,661	\$0	\$0	\$0	\$5,953	\$5,953	\$5,953	\$5,953	\$5,953	\$0	\$0
Tax Benefit of Dep - Customer Infrastructure	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Subtotal - Tax Benefit of Depreciation	\$19,777	\$19,777	\$19,777	\$19,777	\$19,777	\$5,394	\$5,394	\$5,394	\$11,346	\$11,346	\$17,192	\$17,192	\$17,192	\$11,239	\$11,239
Net Book - T&D Infrastructure	\$714,869	\$690,219	\$665,568	\$640,917	\$616,267	\$591,616	\$566,965	\$542,315	\$517,664	\$493,013	\$468,363	\$443,712	\$419,061	\$394,411	\$369,760
Net Book - Communication Infrastructure	\$104,608	\$78,456	\$52,304	\$26,152	\$0	\$0	\$0	\$0	\$0	\$0	\$106,872	\$80,154	\$53,436	\$26,718	\$0
Net Book - Info Tech Infrastructure	\$158,336	\$118,752	\$79,168	\$39,584	\$0	\$0	\$0	\$0	\$108,821	\$81,616	\$54,410	\$27,205	\$0	\$0	\$0
Net Book - Customer Infrastructure	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Property Tax - T&D Infrastructure	\$21,804	\$21,052	\$20,300	\$19,548	\$18,796	\$18,044	\$17,292	\$16,541	\$15,789	\$15,037	\$14,285	\$13,533	\$12,781	\$12,030	\$11,278
Property Tax - Communication Infrastructure	\$3,191	\$2,393	\$1,595	\$798	\$0	\$0	\$0	\$0	\$0	\$0	\$3,260	\$2,445	\$1,630	\$815	\$0
Property Tax - Info Tech Infrastructure	\$4,829	\$3,622	\$2,415	\$1,207	\$0	\$0	\$0	\$0	\$3,319	\$2,489	\$1,660	\$830	\$0	\$0	\$0
Property Tax - Customer Infrastructure	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Subtotal - Property Tax	\$29,823	\$27,067	\$24,310	\$21,553	\$18,796	\$18,044	\$17,292	\$16,541	\$19,108	\$17,526	\$19,204	\$16,808	\$14,411	\$12,844	\$11,278
Operations & Maintenance Expense	\$82,226	\$83,439	\$84,691	\$85,961	\$87,250	\$88,559	\$89,888	\$91,236	\$92,100	\$93,482	\$94,983	\$96,407	\$97,854	\$99,321	\$100,811
O&M - T&D Infrastructure	\$22,186	\$22,518	\$22,856	\$23,199	\$23,547	\$23,900	\$24,259	\$24,623	\$24,992	\$25,367	\$25,747	\$26,134	\$26,526	\$26,923	\$27,327
O&M - Communication Infrastructure	\$6,243	\$6,336	\$6,431	\$6,528	\$6,626	\$6,725	\$6,826	\$6,929	\$7,032	\$7,138	\$7,344	\$7,454	\$7,566	\$7,679	\$7,794
O&M - Info Tech Infrastructure	\$53,798	\$54,584	\$55,403	\$56,234	\$57,078	\$57,934	\$58,803	\$59,685	\$60,076	\$60,977	\$61,892	\$62,820	\$63,763	\$64,719	\$65,690
O&M - Customer Infrastructure	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Subtotal - O&M Expenses	\$82,226	\$83,439	\$84,691	\$85,961	\$87,250	\$88,559	\$89,888	\$91,236	\$92,100	\$93,482	\$94,983	\$96,407	\$97,854	\$99,321	\$100,811
Customer Benefits	\$368,400	\$377,665	\$387,164	\$396,901	\$406,883	\$417,116	\$427,606	\$438,361	\$449,385	\$460,687	\$472,274	\$484,151	\$496,328	\$508,810	\$521,607
Operating Benefits	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Operating Benefits & Expenses Net of Taxes	(\$67,756)	(\$66,550)	(\$65,375)	(\$64,213)	(\$63,067)	(\$77,885)	(\$78,335)	(\$78,801)	(\$75,530)	(\$75,373)	(\$72,011)	(\$71,252)	(\$70,509)	(\$76,384)	(\$76,324)
Depreciation Tax Benefit	\$19,777	\$19,777	\$19,777	\$19,777	\$19,777	\$5,394	\$5,394	\$5,394	\$11,346	\$11,346	\$17,192	\$17,192	\$17,192	\$11,239	\$11,239
Property Tax Expense	\$23,298	\$21,144	\$18,991	\$16,837	\$14,684	\$14,096	\$13,509	\$12,922	\$14,927	\$13,691	\$15,002	\$13,130	\$11,258	\$10,034	\$8,810
O&M Expense	\$64,235	\$65,183	\$66,160	\$67,153	\$68,160	\$69,182	\$70,220	\$71,273	\$71,949	\$73,028	\$74,200	\$75,313	\$76,443	\$77,590	\$78,754
Operating Benefits	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Subtotal - Cash Flow Net of Taxes	(\$67,756)	(\$66,550)	(\$65,375)	(\$64,213)	(\$63,067)	(\$77,885)	(\$78,335)	(\$78,801)	(\$75,530)	(\$75,373)	(\$72,011)	(\$71,252)	(\$70,509)	(\$76,384)	(\$76,324)
Annual Customer & Utility Net Cash Flow	(\$767,556)	\$311,115	\$321,789	\$332,687	\$343,816	\$339,231	\$349,271	\$359,559	\$237,829	\$385,314	\$266,673	\$412,900	\$425,819	\$432,426	\$445,283
Cumulative Customer & Utility Net Cash Flow	(\$767,556)	(\$456,441)	(\$134,652)	\$198,035	\$541,851	\$881,081	\$1,230,352	\$1,589,911	\$1,827,741	\$2,213,055	\$2,479,728	\$2,892,627	\$3,318,446	\$3,750,872	\$4,196,154
Annual PV Customer & Utility Cash Flow	(\$712,019)	\$267,721	\$256,871	\$246,355	\$236,174	\$216,164	\$206,458	\$197,161	\$120,975	\$181,814	\$116,727	\$167,656	\$160,391	\$151,095	\$144,329
Cumulative NPV Customer & Utility Cash Flow	(\$712,019)	(\$444,297)	(\$187,426)	\$58,928	\$295,102	\$511,266	\$717,724	\$914,884	\$1,035,860	\$1,217,673	\$1,334,401	\$1,502,057	\$1,662,448	\$1,813,543	\$1,957,872

Assuming AMI is not deployed and only an average 3 percent voltage and energy reduction can be achieved, the number of VVO bus candidates with positive business cases falls from 285 buses and 695 distribution circuits to 178 buses and 473 distribution circuits. Collectively, these 178 VVO buses with positive business cases deliver an average 3 percent reduction in energy usage (and retail power costs) with an estimated 15 year present value benefit of \$302,380,983 compared to \$548,381,961 if AMI is deployed and an average 4 percent voltage can be achieved. AEP Ohio's 15 year present value capital and O&M cost to procure, deploy, operate and maintain less VVO infrastructure falls from \$361,782,325 to \$233,440,478 if AMI is not deployed. However, the overall impact is that AEP Ohio retail customers realize \$1.30 in VVO benefits for every dollar of VVO related capital and O&M costs incurred over 15 years if AMI isn't deployed versus \$1.52 in VVO benefits for every dollar VVO costs if AMI is deployed. In addition, less energy efficiency associated with a less ambitious VVO deployment is estimated to reduce CO₂ emissions by 4,772,977 t versus 8,602,913 t over 15 years.

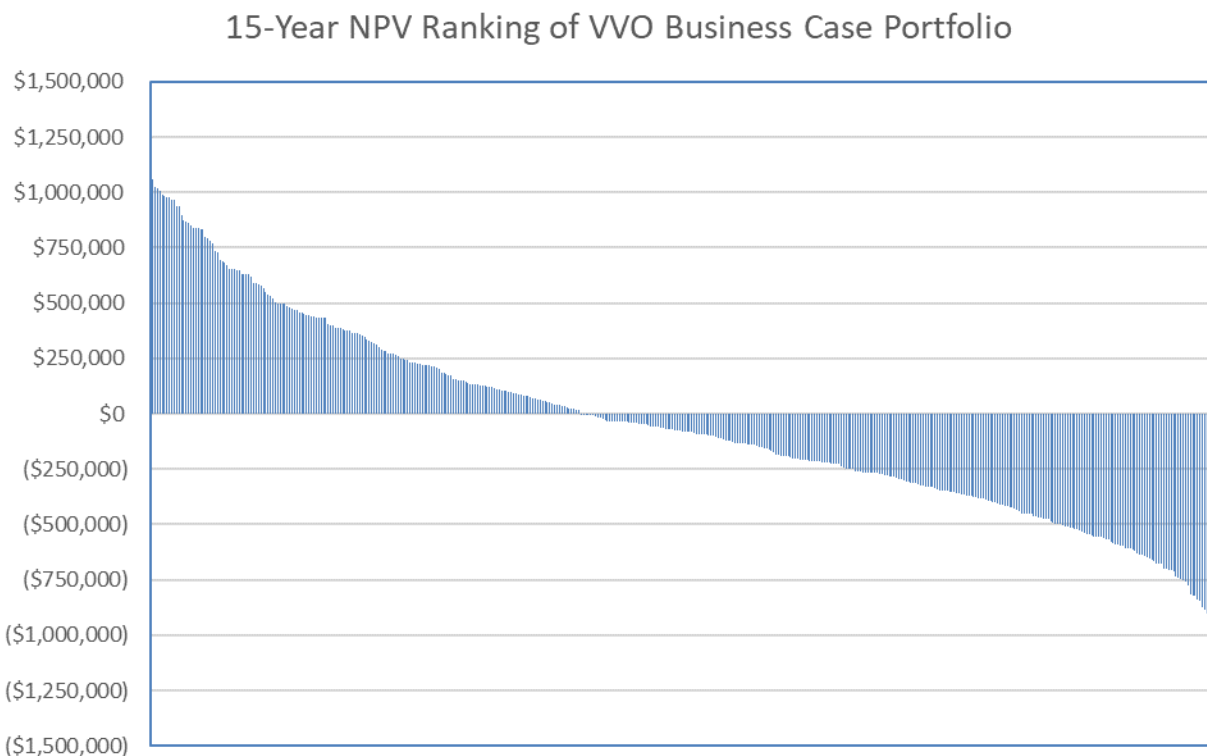


Figure 3: Revised Prioritized Business Case Portfolio of VVO Distribution Buses Without AMI

The VVO business case and portfolio analysis presented in this report assumes AEP Ohio will utilize the same VVO technology in previous and current deployments approved by the PUCO. However, AEP Ohio intends to monitor rapidly emerging technologies such as photovoltaics, electric vehicle charging loads and infrastructure requirements, micro grids, and demand response that can all potentially impact future proposed VVO deployments. These technologies (and perhaps others) have potential to alter load shapes and energy usage patterns that may influence how AEP Ohio reliably serves customers' future power requirements.

4 AMI Business Case

The remainder of AEP Ohio's service territory where AMI may be deployed as part of a proposed Smart Grid Phase 3 project is already equipped with a legacy drive-by automated meter reading ("AMR") system employing one-way radio communication technology. Preparing an AMI business case for a proposed Phase 3 AMI deployment typically begins with identifying and estimating relevant benefits and costs associated with one or more AMI vendors and communication technologies.¹² However, AEP Ohio is presently deploying as part of its Smart Grid Phase 2 project a Silver Spring Networks™ ("SSN") AMI solution. The AMI business case assumes this SSN solution will be expanded as part of a future Smart Grid Phase 3 deployment because the costs associated with expansion are relatively well known.¹³ Also, the cost of expanding the existing SSN solution doesn't depend on legacy systems or processes; in other words, the cost to expand the existing SSN solution is the same regardless of if AMI replaces traditional manual meter reading or the existing AMR system. (The choice of communication technology will be revisited later in this section.)

In contrast to costs, many of the benefits associated with AMI are impacted by the legacy systems or processes that AMI is intended to replace or augment. For example, AMR has displaced traditional meter reading and the added benefit of migrating from a legacy AMR system to AMI represents an incremental impact on the AMI business case; benefits originally realized with AMR cannot be recaptured. Aside from incremental metering reading benefits, additional benefits identified by AEP Ohio is based on the ability to remotely connect and disconnect meters and reduce bad debt expenses on past due accounts.

AEP Ohio's AMI business case results is similar to the experience of other utilities replacing legacy AMR system with AMI; the cost of migrating from AMR to AMI isn't impacted and fewer tangible benefits result in negative business cases. Similar to DACR and VVO, the AMI business case represents the net benefit cash flows discounted at AEP Ohio's after-tax weighted cost of capital to estimate the 15 year net present value ("NPV") of the proposed Phase 3 AMI deployment. These net benefit cash flows include the aforementioned benefits, initial and replacement capital costs, and O&M costs associated with smart meters, communication, and information technology ("IT") infrastructure. Also, these cash flows incorporate the combined tax effects associated with the depreciation of capitalized infrastructure assets and the tax effects associated with annual O&M expenses. The cash flow model for the AMI business case provided in Table 8 on page 15 illustrates all the annual cash flows that yields a negative 15 year NPV of \$65,822,331 in the bottom right corner of the table. Not illustrated in the cash flow model is the 15 year reduction in CO₂ emissions from vehicles, which is estimated to be 5,810 t.¹⁴

¹² AMI may include a variety of communication technologies such as licensed radio frequency ("RF"), unlicensed RF mesh, or power line carrier that enables two-way communications.

¹³ AEP Ohio's SSN solution features unlicensed RF mesh communication technology and public LTE carriers.

¹⁴ Reductions in CO₂ are identified in the business case, but not monetized pending establishment of an incentivized U.S. cap-and-trade, tax credit, or other program.

A major factor contributing to a negative AMI business case is the estimated cost of deploying RF mesh communication infrastructure in the remaining portion AEP Ohio's service area that is predominantly rural. AEP Ohio intends to reexamine its communication options and revise its AMI business case to identify its preferred least cost alternative(s). Pending revision of this business case, AEP Ohio asserts that AMI is a desirable and necessary technology as part of a future Smart Grid Phase 3 deployment for a variety of reasons including, but not necessarily limited to:

1. The ability of VVO to "maximize customer and company benefits" is dependent on AMI to provide meter interval and voltage data.¹⁵
2. AMI is required to fulfil a Phase 2 report Table 1 objective to ". . . provide customers and CRES providers with customer interval data . . . [and] develop such systems and processes using a phase-in approach, and transfer as much data as possible to customers and CRES providers through the implementation stages."¹⁶ Existing and future customers would not have the opportunity to participate in existing or future energy efficiency programs if AMI is not deployed.
3. AMI will be leveraged to enable the deployment of additional smart grid technologies such as smart street lighting, demand management, etc. and,
4. AMI will augment AEP Ohio's outage management system and service restoration processes.

¹⁵ Commission Order and Opinion dated February 1, 2017, Section IV (1) (B) (iii).

¹⁶ Commission Opinion and Order dated February 1, 2017, Section IV (B), Par. (21).

Table 8
Cash Flow Model for AMI Business Case

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Capital Related Costs	\$65,020,860	\$191,953	\$188,408	\$199,360	\$195,799	\$207,038	\$212,775	\$207,226	\$219,160	\$217,192	\$227,565	\$233,889	\$227,981	\$242,820	\$236,919
Capital Cost - T&D Infrastructure	\$52,659,793	\$153,989	\$157,089	\$160,248	\$166,744	\$170,084	\$176,744	\$173,487	\$177,025	\$180,558	\$184,157	\$187,898	\$191,634	\$195,439	\$199,474
Capital Cost - Communication Infrastructure	\$6,780,367	\$37,965	\$31,319	\$39,112	\$32,266	\$40,294	\$42,691	\$33,739	\$42,135	\$36,634	\$43,408	\$45,990	\$36,347	\$47,381	\$37,446
Capital Cost - Info Tech Infrastructure	\$5,580,700	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Capital Cost - Customer Infrastructure	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Subtotal - Capital Costs	\$65,020,860	\$191,953	\$188,408	\$199,360	\$195,799	\$207,038	\$212,775	\$207,226	\$219,160	\$217,192	\$227,565	\$233,889	\$227,981	\$242,820	\$236,919
Depreciation Related Costs															
Dep Exp - T&D Infrastructure	\$3,510,653	\$3,520,919	\$3,531,391	\$3,542,075	\$3,552,977	\$3,564,093	\$3,575,432	\$3,586,998	\$3,598,800	\$3,610,837	\$3,623,114	\$3,635,640	\$3,648,416	\$3,661,445	\$3,674,744
Dep Exp - Communication Infrastructure	\$1,356,073	\$1,363,666	\$1,369,930	\$1,377,753	\$1,384,206	\$36,191	\$37,136	\$37,620	\$38,225	\$39,099	\$39,721	\$40,381	\$40,903	\$41,952	\$42,114
Dep Exp - Info Tech Infrastructure	\$1,116,140	\$1,116,140	\$1,116,140	\$1,116,140	\$1,116,140	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Dep Exp - Customer Infrastructure	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Tax Benefit of Dep - T&D Infrastructure	\$768,131	\$770,377	\$772,668	\$775,006	\$777,391	\$779,824	\$782,305	\$784,835	\$787,417	\$790,051	\$792,737	\$795,478	\$798,273	\$801,124	\$804,034
Tax Benefit of Dep - Com Infrastructure	\$296,709	\$298,370	\$299,741	\$301,452	\$302,864	\$7,919	\$8,125	\$8,231	\$8,364	\$8,555	\$8,691	\$8,835	\$8,950	\$9,179	\$9,215
Tax Benefit of Dep - Info Tech Infrastructure	\$244,211	\$244,211	\$244,211	\$244,211	\$244,211	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Tax Benefit of Dep - Customer Infrastructure	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Subtotal - Tax Benefit of Depreciation	\$1,309,051	\$1,312,959	\$1,316,621	\$1,320,670	\$1,324,467	\$787,742	\$790,430	\$793,066	\$795,781	\$798,606	\$801,428	\$804,314	\$807,223	\$810,303	\$813,249
Net Book - T&D Infrastructure	\$49,149,140	\$45,782,210	\$42,407,908	\$39,026,081	\$35,636,638	\$32,239,289	\$28,833,941	\$25,420,430	\$21,998,656	\$18,568,377	\$15,129,420	\$11,681,678	\$8,224,896	\$4,758,890	\$1,283,620
Net Book - Communication Infrastructure	\$5,424,294	\$4,098,592	\$2,759,981	\$1,421,340	\$69,400	\$73,503	\$79,058	\$75,177	\$79,087	\$76,622	\$80,309	\$85,918	\$81,362	\$86,790	\$82,122
Net Book - Info Tech Infrastructure	\$4,464,560	\$3,348,420	\$2,232,280	\$1,116,140	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Net Book - Customer Infrastructure	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Property Tax - T&D Infrastructure	\$1,499,049	\$1,396,357	\$1,293,441	\$1,190,295	\$1,086,917	\$983,298	\$879,435	\$775,323	\$670,959	\$566,336	\$461,447	\$356,291	\$250,859	\$145,146	\$39,150
Property Tax - Communication Infrastructure	\$165,441	\$125,007	\$84,179	\$43,351	\$2,117	\$2,242	\$2,411	\$2,293	\$2,412	\$2,337	\$2,449	\$2,620	\$2,482	\$2,647	\$2,505
Property Tax - Info Tech Infrastructure	\$136,169	\$102,127	\$68,085	\$34,042	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Property Tax - Customer Infrastructure	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Subtotal - Property Tax	\$1,800,659	\$1,623,491	\$1,445,705	\$1,267,689	\$1,089,034	\$985,540	\$881,846	\$777,616	\$673,371	\$568,672	\$463,897	\$358,912	\$253,341	\$147,793	\$41,655
Operations & Maintenance Expense	\$4,220,096	\$4,177,951	\$4,248,070	\$4,320,041	\$4,392,751	\$4,467,390	\$4,543,484	\$4,620,359	\$4,699,221	\$4,778,982	\$4,862,429	\$4,945,896	\$5,030,226	\$5,116,854	\$5,204,385
O&M - T&D Infrastructure	\$2,155,062	\$2,079,627	\$2,116,467	\$2,154,043	\$2,192,375	\$2,231,476	\$2,271,367	\$2,312,136	\$2,353,665	\$2,396,040	\$2,439,357	\$2,483,491	\$2,528,611	\$2,574,587	\$2,621,600
O&M - Communication Infrastructure	\$430,559	\$439,332	\$447,726	\$456,862	\$465,604	\$475,120	\$484,911	\$494,209	\$504,332	\$514,098	\$526,196	\$537,077	\$547,407	\$558,746	\$569,511
O&M - Info Tech Infrastructure	\$1,634,475	\$1,658,992	\$1,683,877	\$1,709,135	\$1,734,772	\$1,760,794	\$1,787,206	\$1,814,014	\$1,841,224	\$1,868,843	\$1,896,875	\$1,925,328	\$1,954,208	\$1,983,521	\$2,013,274
O&M - Customer Infrastructure	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Subtotal - O&M Expenses	\$4,220,096	\$4,177,951	\$4,248,070	\$4,320,041	\$4,392,751	\$4,467,390	\$4,543,484	\$4,620,359	\$4,699,221	\$4,778,982	\$4,862,429	\$4,945,896	\$5,030,226	\$5,116,854	\$5,204,385
Customer Benefits	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Operating Benefits	\$3,234,597	\$3,299,532	\$3,365,770	\$3,433,338	\$3,502,262	\$3,572,570	\$3,644,289	\$3,717,448	\$3,792,076	\$3,868,202	\$3,945,856	\$4,025,069	\$4,105,872	\$4,188,298	\$4,272,378
Operating Benefits & Expenses Net of Taxes	(\$867,495)	(\$641,534)	(\$502,017)	(\$362,341)	(\$221,937)	(\$681,195)	(\$600,920)	(\$519,761)	(\$438,918)	(\$357,142)	(\$276,994)	(\$195,418)	(\$112,792)	(\$30,541)	\$52,624
Depreciation Tax Benefit	\$1,309,051	\$1,312,959	\$1,316,621	\$1,320,670	\$1,324,467	\$787,742	\$790,430	\$793,066	\$795,781	\$798,606	\$801,428	\$804,314	\$807,223	\$810,303	\$813,249
Property Tax Expense	\$1,406,675	\$1,268,271	\$1,129,385	\$990,318	\$850,753	\$769,904	\$688,898	\$607,474	\$526,038	\$444,247	\$362,396	\$280,382	\$197,910	\$115,456	\$32,541
O&M Expense	\$3,296,739	\$3,263,816	\$3,318,592	\$3,374,816	\$3,431,617	\$3,489,925	\$3,549,370	\$3,609,424	\$3,671,031	\$3,733,340	\$3,798,529	\$3,863,734	\$3,929,613	\$3,997,287	\$4,065,666
Operating Benefits	\$2,526,867	\$2,577,594	\$2,629,339	\$2,682,123	\$2,735,967	\$2,790,892	\$2,846,919	\$2,904,071	\$2,962,370	\$3,021,839	\$3,082,503	\$3,144,384	\$3,207,508	\$3,271,898	\$3,337,582
Subtotal - Cash Flow Net of Taxes	(\$867,495)	(\$641,534)	(\$502,017)	(\$362,341)	(\$221,937)	(\$681,195)	(\$600,920)	(\$519,761)	(\$438,918)	(\$357,142)	(\$276,994)	(\$195,418)	(\$112,792)	(\$30,541)	\$52,624
Annual Customer & Utility Net Cash Flow	(\$65,888,355)	(\$833,488)	(\$690,425)	(\$561,701)	(\$417,736)	(\$888,234)	(\$813,695)	(\$726,987)	(\$658,078)	(\$574,334)	(\$504,559)	(\$429,307)	(\$340,773)	(\$273,361)	(\$184,296)
Cumulative Customer & Utility Net Cash Flow	(\$65,888,355)	(\$66,721,843)	(\$67,412,268)	(\$67,973,969)	(\$68,391,705)	(\$69,279,938)	(\$70,093,633)	(\$70,820,621)	(\$71,478,699)	(\$72,053,033)	(\$72,557,592)	(\$72,986,899)	(\$73,327,672)	(\$73,601,033)	(\$73,785,329)
Annual PV Customer & Utility Cash Flow	(\$61,120,923)	(\$717,235)	(\$551,138)	(\$415,939)	(\$286,951)	(\$565,998)	(\$480,984)	(\$398,636)	(\$334,741)	(\$271,005)	(\$220,854)	(\$174,318)	(\$128,357)	(\$95,516)	(\$59,736)
Cumulative NPV Customer & Utility Cash Flow	(\$61,120,923)	(\$61,838,158)	(\$62,389,296)	(\$62,805,236)	(\$63,092,187)	(\$63,658,185)	(\$64,139,168)	(\$64,537,804)	(\$64,872,545)	(\$65,143,550)	(\$65,364,404)	(\$65,538,723)	(\$65,667,080)	(\$65,762,596)	(\$65,822,331)

5 Phase 3 Full System Feasibility Study Summary

Results of the DACR, VVO, and AMI business cases previously presented within this Phase 3 report can now be aggregated to provide a summary of the Phase 3 Full System Feasibility Study. Viewed holistically, AEP Ohio asserts these business cases support a proposed Smart Grid Phase 3 deployment of DACR, VVO, and AMI within AEP Ohio's remaining service territory. This holistic view of the DACR, VVO, and AMI business cases provided in Table 9 includes a total column that assumes these project are independent of each other. In reality, the VVO business case illustrated in Table 9 is dependent on the assumption that AMI will also be deployed to deliver an average 4 percent reduction in energy consumption and retail power costs savings to AEP Ohio customers.

Table 9
15 Year Business Case Summary for DACR, VVO and AMI

Description	DACR	VVO	AMI	Total
Present Value Benefits	\$617,353,054	\$548,381,961	\$33,568,914	\$1,199,303,929
Present Value Costs	\$312,728,604	\$361,782,325	\$99,391,245	\$773,902,174
Net Present Value	\$304,624,450	\$186,599,636	(\$65,822,331)	\$425,401,755
Benefit-Cost Ratio	1.97	1.52	0.34	1.55
Reduced CO ₂ Emissions	Not Applicable	8,602,913 t	5,810 t	8,608,723 t

Table 9 Notes:

1. The DACR column represents totals for the 99 schemes impacting 495 distribution circuits that have positive 15 year NPV business case outcomes.
2. The VVO column represents totals for the 285 buses impacting 695 distribution circuits that have positive 15 year NPV values business case outcomes.
3. VVO business case results assumes AMI is deployed and AMI interval and voltage data is available to achieve an average 4 percent voltage and energy reduction.
4. The total column assumes the proposed DACR, VVO, and AMI projects are independent of each other and any project with a positive business case may be selected for deployment. In other words, the proposed DACR, VVO, and AMI projects do not represent mutually exclusive projects where the acceptance of one or more projects implies that other projects must be rejected. Mutually exclusive projects arise for a variety of reasons including, but not necessarily limited to: dependencies that exist among projects, funding or budgeting constraints, or the existence of projects that differ in scale, size, or timing of cash flows where projects should be selected on the basis of NPV.
5. Present value benefits and present value costs include the effects of combined federal/state income taxes and property taxes where appropriate. Present value benefits is the sum of the annual benefit cash flows that are discounted at AEP Ohio's after-tax weighted average cost of

capital. Similarly, present value costs is the sum of the annual cost cash flows that are discounted at AEP Ohio's after-tax weighted average cost of capital.

6. The benefit-cost ratio is defined as ratio of the present value benefits to the present value costs.
7. Other items of interest.

All business case results presented within this Phase 3 report including annual benefits, costs, and net benefits (i.e. benefits minus costs) are discounted by AEP Ohio's after-tax cost of capital, which is subject to change. A comparison of the non-discounted benefits and costs in the table below is useful to illustrate the overall scale of the net benefits delivered to AEP Ohio retail customers assuming that DACR, VVO, and AMI are all part of a future Smart Grid Phase 3 deployment. All DACR and VVO totals within the table only include DACR schemes and VVO buses with positive business cases.

Description	DACR	VVO	AMI	Total
Non-discounted benefits	\$1,089,817,504	\$979,154,483	\$58,307,764	\$2,127,279,751
Non-discounted costs	\$405,763,708	\$505,084,251	\$132,093,093	\$1,042,941,052
Non-discounted net benefit	\$684,053,796	\$474,070,232	(\$73,785,329)	\$1,084,338,699
Ratio of benefits-to-costs	2.69	1.94	0.44	2.04

6 Appendix

Section 6.1 provides a tabular summary of business case results for all 146 DACR scheme candidates and 710 distribution circuits included within the Phase 3 Full System Feasibility Study.

Section 6.2 provides a tabular summary of business case results for all 448 VVO bus candidates and 978 distribution circuits included within the Phase 3 Full System Feasibility Study.

Section 6.3 provides a compilation of all financial evaluation and other assumptions used to develop the DACR business case and portfolio analysis, the VVO business case and portfolio analysis, and the AMI business case.

6.1 Prioritized Portfolio Analysis of DACR Scheme Candidates

Table 10
Prioritized Business Case Portfolio of DACR Schemes

Candidate	Rank	NPV	PV Benefits	PV Costs	Circuits	Total	Rule 11	District	District Sub-Area
CRA991	1	\$8,040,439	\$12,057,382	\$4,016,943	7	7	0	Columbus	Columbus, SW - 65
CRC200	2	\$7,990,236	\$12,437,644	\$4,447,409	8	15	0	Columbus	Columbus, SE - 64
CRA109	3	\$7,974,373	\$15,328,031	\$7,353,658	11	26	0	Canton	North Canton - 20, South Canton - 21
CRA995	4	\$7,717,233	\$11,132,625	\$3,415,392	6	32	0	Columbus	Columbus, SW - 65
CRC985	5	\$7,673,183	\$9,382,376	\$1,709,192	3	35	1	Columbus	Columbus, SE - 64
CRA999	6	\$7,598,849	\$11,616,539	\$4,017,690	7	42	0	Columbus	Columbus, SE - 64
CRC517	7	\$7,587,491	\$11,620,963	\$4,033,472	7	49	0	Columbus	Columbus, SE - 64
CRA397	8	\$7,356,381	\$16,653,885	\$9,297,505	14	63	0	Canton	Wooster - 70
CRC414	9	\$7,214,813	\$9,987,273	\$2,772,460	5	68	0	Columbus	Columbus, NW - 66
CRC407	10	\$7,045,918	\$9,969,005	\$2,923,087	5	73	0	Columbus	Columbus, NW - 66
CRA996	11	\$6,868,545	\$10,850,832	\$3,982,287	7	80	0	Columbus	Columbus, SW - 65
CRA120	12	\$6,771,050	\$13,738,149	\$6,967,099	11	91	1	Newark	Coshocton - 82
CRC433	13	\$6,502,881	\$9,913,574	\$3,410,693	5	96	2	Newark	Mt Vernon - 51
CRC518	14	\$6,402,150	\$9,302,735	\$2,900,586	5	101	0	Columbus	Columbus, SE - 64, Columbus, SW - 65
CRC211	15	\$6,339,230	\$8,762,762	\$2,423,532	4	105	1	Columbus	Columbus, SW - 65
CRA987	16	\$6,068,498	\$9,597,520	\$3,529,022	5	110	0	Newark	Belmont - 61
CRC019	17	\$6,049,673	\$11,179,414	\$5,129,741	8	118	2	Chillicothe	Ironton - 81
CRC210	18	\$5,877,865	\$9,839,459	\$3,961,593	7	125	0	Columbus	Columbus, SE - 64
CRC508	19	\$5,552,795	\$9,030,315	\$3,477,520	6	131	0	Columbus	Columbus, NE - 63, Columbus, SE - 64
CRC434	20	\$5,547,855	\$10,228,172	\$4,680,317	7	138	2	Athens	McConnelsville - 13
CRA104	21	\$5,509,602	\$9,532,580	\$4,022,977	6	144	0	Canton	North Canton - 20
CRC002	22	\$5,425,754	\$8,554,713	\$3,128,960	5	149	0	Chillicothe	Chillicothe - 20
CRA111	23	\$5,274,051	\$8,803,073	\$3,529,022	5	154	1	Canton	North Canton - 20 South Canton - 21
CRC021	24	\$5,220,355	\$7,094,360	\$1,874,005	3	157	0	Chillicothe	Chesapeake - 22
CRC028	25	\$4,923,299	\$8,136,776	\$3,213,478	5	162	1	Athens	Gallipolis - 14
CRC411	26	\$4,919,784	\$9,472,241	\$4,552,457	8	170	0	Columbus	Columbus, NW - 66
CRC994	27	\$4,913,869	\$7,890,695	\$2,976,826	5	175	0	Columbus	Columbus, SE - 64
CRA113	28	\$4,873,054	\$6,048,010	\$1,174,956	2	177	0	Canton	North Canton - 20
CRC507	29	\$4,693,338	\$7,541,992	\$2,848,654	5	182	0	Columbus	Columbus, NE - 63, Columbus, SW - 64
CRC201	30	\$4,688,367	\$8,082,325	\$3,393,958	6	188	0	Columbus	Columbus, SW - 65
CRC416	31	\$4,627,742	\$6,300,766	\$1,673,024	3	191	2	Columbus	Columbus, NE - 63, Columbus, NW - 66
CRC993	32	\$4,288,757	\$6,145,846	\$1,857,089	3	194	0	Western Ohio	Kenton - 34
CRC205	33	\$4,264,737	\$8,286,775	\$4,022,038	7	201	0	Columbus	Columbus, SW - 65
CRA110	34	\$4,002,128	\$11,166,448	\$7,164,321	11	212	0	Canton	South Canton - 21
CRC998	35	\$3,998,712	\$9,119,112	\$5,120,400	9	221	0	Columbus	Columbus, NW - 66
CRA118	36	\$3,959,706	\$6,006,132	\$2,046,426	3	224	0	Canton	New Philadelphia - 71

Candidate	Rank	NPV	PV Benefits	PV Costs	Circuits	Total	Rule 11	District	District Sub-Area
CRC430	37	\$3,910,459	\$9,521,170	\$5,610,710	9	233	0	Newark	Mt Vernon - 51
CRA600	38	\$3,901,922	\$14,366,292	\$10,464,370	17	250	0	Western Ohio	Findlay - 33
CRA998	39	\$3,727,446	\$5,395,224	\$1,667,778	3	253	1	Columbus	Columbus, SE - 64
CRA119	40	\$3,717,688	\$4,987,312	\$1,269,624	2	255	0	Canton	New Philadelphia - 71
CRC988	41	\$3,641,413	\$6,925,898	\$3,284,486	5	260	1	Canton	East Liverpool - 51
CRC036	42	\$3,397,152	\$6,425,474	\$3,028,321	4	264	0	Athens	Marietta - 260
CRC014	43	\$3,215,985	\$6,165,420	\$2,949,435	4	268	0	Chillicothe	Portsmouth - 82
CRC223N	44	\$2,913,071	\$6,020,272	\$3,107,201	4	272	0	Newark	Newark - 50
CRC982	45	\$2,673,245	\$4,554,002	\$1,880,756	3	275	0	Columbus	Columbus, NE - 63, Delaware - 62
CRC402	46	\$2,387,216	\$4,623,887	\$2,236,671	4	279	0	Columbus	Columbus, NW - 66
CRA367	47	\$2,304,192	\$7,524,653	\$5,220,461	8	287	1	Canton	Steubenville - 50
CRC521	48	\$2,274,465	\$3,591,411	\$1,316,946	2	289	0	Athens	Crooksville - 11
CRC519	49	\$2,255,955	\$5,666,648	\$3,410,693	5	294	0	Athens	Crooksville - 11
CRA333	50	\$2,214,809	\$3,689,526	\$1,474,718	2	296	0	Canton	New Philadelphia - 71, Wooster - 70
CRA115	51	\$2,133,927	\$5,544,620	\$3,410,693	5	301	0	Canton	South Canton - 21
CRC005	52	\$2,087,134	\$5,564,654	\$3,477,520	6	307	0	Chillicothe	Chillicothe - 20
CRC204	53	\$2,071,257	\$4,310,731	\$2,239,474	4	311	0	Columbus	Columbus, SW - 65
CRC509	54	\$1,905,742	\$4,940,328	\$3,034,586	5	316	0	Columbus	Columbus, SE - 64
CRA368	55	\$1,830,137	\$5,560,098	\$3,729,961	6	322	0	Canton	Steubenville - 50
CRA100	56	\$1,781,874	\$7,558,248	\$5,776,374	9	331	0	Canton	North Canton - 20
CRA989	57	\$1,736,659	\$6,653,634	\$4,916,975	7	338	0	Newark	Cambridge - 81
CRC025	58	\$1,713,600	\$3,570,690	\$1,857,089	3	341	0	Chillicothe	Wellston - 16
CRC004	59	\$1,705,351	\$3,720,212	\$2,014,861	3	344	1	Chillicothe	Chillicothe - 20
CRC437	60	\$1,586,786	\$6,424,876	\$4,838,089	7	351	1	Newark	Zanesville - 80
CRC011	61	\$1,567,260	\$2,923,648	\$1,356,389	2	353	1	Chillicothe	Seaman - 23
CRC001	62	\$1,556,502	\$6,767,945	\$5,211,443	8	361	0	Chillicothe	Chillicothe - 20
CRA993	63	\$1,468,626	\$3,817,044	\$2,348,418	4	365	0	Columbus	Columbus, SW - 65
CRA101	64	\$1,449,591	\$4,699,139	\$3,249,548	5	370	0	Canton	North Canton - 20, South Canton - 21
CRC020	65	\$1,441,926	\$2,649,003	\$1,207,077	2	372	0	Chillicothe	Ironton - 81
CRC018	66	\$1,440,257	\$4,929,836	\$3,489,579	5	377	1	Chillicothe	Ironton - 81
CRC983	67	\$1,338,838	\$3,736,083	\$2,397,246	4	381	0	Athens	Lancaster - 22
CRC410	68	\$1,138,561	\$2,818,167	\$1,679,605	3	384	0	Columbus	Columbus, NW - 66
CRC418	69	\$1,050,867	\$2,462,481	\$1,411,614	2	386	1	Columbus	Delaware - 62
CRC419	70	\$1,025,479	\$2,241,011	\$1,215,532	2	388	0	Columbus	Columbus, NE - 63
CRA125	71	\$998,952	\$2,394,783	\$1,395,832	2	390	0	Western Ohio	Bucyrus - 11
CRC513	72	\$995,761	\$2,312,706	\$1,316,946	2	392	1	Columbus	Columbus, SE - 64
CRA400	73	\$872,803	\$4,393,947	\$3,521,144	5	397	0	Newark	Cambridge - 81
CRA117	74	\$849,463	\$2,639,718	\$1,790,255	2	399	0	Canton	New Philadelphia - 71
CRA985	75	\$847,544	\$2,941,292	\$2,093,747	3	402	0	Newark	Belmont - 61
CRC026	76	\$791,140	\$2,186,972	\$1,395,832	2	404	0	Chillicothe	Portsmouth - 82
CRC436	77	\$784,457	\$4,195,150	\$3,410,693	5	409	0	Newark	Zanesville - 80
CRC520	78	\$766,288	\$3,873,488	\$3,107,201	4	413	0	Athens Newark	Crooksville - 11 Zanesville - 80

Candidate	Rank	NPV	PV Benefits	PV Costs	Circuits	Total	Rule 11	District	District Sub-Area
CRA102	79	\$754,139	\$2,548,124	\$1,793,986	3	416	0	Canton	North Canton - 20
CRC207	80	\$737,681	\$1,904,032	\$1,166,351	2	418	0	Columbus	Columbus, SW - 65
CRC016	81	\$710,089	\$2,724,950	\$2,014,861	3	421	1	Chillicothe	Portsmouth - 82
CRC427	82	\$681,754	\$1,809,376	\$1,127,622	2	423	0	Columbus	Columbus, NE - 63
CRC023	83	\$663,192	\$2,019,580	\$1,356,389	2	425	0	Chillicothe	Portsmouth - 82, Wellston - 16
CRA133	84	\$646,702	\$3,320,036	\$2,673,334	4	429	0	Western Ohio	Fremont - 12
CRC405	85	\$624,780	\$3,514,835	\$2,890,055	5	434	0	Columbus	Columbus, NE - 63, Columbus, NW - 66
CRC010	86	\$609,753	\$3,125,315	\$2,515,562	4	438	0	Chillicothe	Seaman - 23
CRC425	87	\$581,888	\$2,273,320	\$1,691,432	3	441	1	Columbus	Delaware - 62
CRC008	88	\$535,290	\$3,827,654	\$3,292,364	5	446	2	Chillicothe	Seaman - 23
CRA990	89	\$472,392	\$3,264,056	\$2,791,663	4	450	0	Newark	Belmont - 61
CRC417	90	\$415,218	\$1,563,128	\$1,147,910	2	452	0	Columbus	Columbus, NW - 66
CRA108	91	\$412,106	\$4,639,043	\$4,226,938	6	458	0	Canton	North Canton - 20, South Canton - 21
CRC421	92	\$301,287	\$3,179,521	\$2,878,235	5	463	0	Columbus	Columbus, NW - 66
CRC209	93	\$275,193	\$4,990,792	\$4,715,599	8	471	0	Columbus	Columbus, SW - 65
CRC042	94	\$248,350	\$2,618,192	\$2,369,842	3	474	1	Athens	Marietta - 260
CRA373	95	\$196,076	\$2,226,719	\$2,030,644	3	477	2	Canton	Steubenville - 50
CRC997	96	\$183,193	\$4,780,600	\$4,597,407	8	485	0	Columbus	Columbus, NW - 66
CRA988	97	\$158,673	\$2,094,648	\$1,935,975	3	488	0	Newark	Cambridge - 81
CRC017	98	\$98,932	\$3,430,739	\$3,331,807	5	493	0	Chillicothe	Portsmouth - 82
CRC214	99	\$83,256	\$1,400,202	\$1,316,946	2	495	0	Western Ohio	Paulding - 31
CRC422	100	\$0	\$0	\$0	0	495	0	Columbus	Columbus, NE - 63, Delaware - 62
CRC027	101	\$0	\$0	\$0	0	495	0	Chillicothe	Wellston - 16
CRC992	102	(\$15,436)	\$1,959,982	\$1,975,418	3	498	0	Western Ohio	Kenton - 34, Lima - 30
CRA103	103	(\$29,828)	\$3,041,660	\$3,071,488	5	503	0	Canton	North Canton - 20
CRA114	104	(\$39,295)	\$1,632,631	\$1,671,926	2	505	0	Canton	South Canton - 21
CRA994	105	(\$44,973)	\$1,664,469	\$1,709,441	3	508	0	Columbus	Columbus, SW - 65
CRA107	106	(\$83,485)	\$1,947,159	\$2,030,644	3	511	0	Canton	North Canton - 20
CRA984	107	(\$103,633)	\$3,070,402	\$3,174,035	5	516	0	Newark	Belmont - 61
CRA126	108	(\$227,049)	\$4,421,703	\$4,648,752	7	523	0	Western Ohio	Willard - 14
CRC432	109	(\$323,174)	\$1,230,430	\$1,553,604	2	525	0	Newark	Mt Vernon - 51
CRC216	110	(\$364,518)	\$4,855,943	\$5,220,461	8	533	0	Western Ohio	Van Wert - 32
CRA112	111	(\$397,977)	\$918,969	\$1,316,946	2	535	0	Canton	South Canton - 21
CRC986	112	(\$423,805)	\$1,669,942	\$2,093,747	3	538	0	Canton	Steubenville - 50
CRA601	113	(\$480,130)	\$4,511,564	\$4,991,694	8	546	0	Western Ohio	Findlay - 33
CRA621	114	(\$496,755)	\$4,534,369	\$5,031,124	8	554	0	Western Ohio	Lima - 30
CRA105	115	(\$507,040)	\$679,749	\$1,186,789	2	556	0	Canton	North Canton - 20
CRC409	116	(\$568,692)	\$629,931	\$1,198,623	2	558	0	Columbus	Columbus, NW - 66
CRA334	117	(\$568,784)	\$1,761,615	\$2,330,399	3	561	0	Canton	Wooster - 70
CRC428	118	(\$655,359)	\$3,532,136	\$4,187,495	6	567	0	Columbus	Delaware - 62
CRC987	119	(\$695,926)	\$1,318,935	\$2,014,861	3	570	0	Canton	East Liverpool - 51
CRC213	120	(\$724,647)	\$1,909,244	\$2,633,891	4	574	0	Western Ohio	Paulding - 31

Candidate	Rank	NPV	PV Benefits	PV Costs	Circuits	Total	Rule 11	District	District Sub-Area
CRA622	121	(\$764,059)	\$8,982,657	\$9,746,716	16	590	0	Western Ohio	Lima - 30
CRC408	122	(\$847,519)	\$2,022,254	\$2,869,774	5	595	0	Columbus	Columbus, NW - 66, Columbus, SW - 65
CRC223W	123	(\$959,508)	\$1,134,239	\$2,093,747	3	598	0	Western Ohio	Paulding - 31
CRA134	124	(\$996,849)	\$1,057,455	\$2,054,304	3	601	0	Western Ohio	Fremont - 12
CRA124	125	(\$1,023,879)	\$269,406	\$1,293,285	2	603	0	Western Ohio	Bucyrus - 11
CRA106	126	(\$1,041,441)	\$334,672	\$1,376,113	2	605	0	Canton	North Canton - 20
CRA335	127	(\$1,052,100)	\$422,618	\$1,474,718	2	607	0	Canton	Wooster - 70
CRC423	128	(\$1,055,915)	\$1,132,501	\$2,188,416	3	610	0	Columbus	Delaware - 62
CRA986	129	(\$1,079,160)	\$2,753,347	\$3,832,507	6	616	0	Newark	Belmont - 61
CRC991	130	(\$1,093,594)	\$2,317,099	\$3,410,693	5	621	0	Western Ohio	Findlay - 33, Lima - 30
CRA128	131	(\$1,098,569)	\$376,149	\$1,474,718	2	623	0	Western Ohio	Upper Sandusky - 13
CRA611	132	(\$1,134,901)	\$134,723	\$1,269,624	2	625	0	Western Ohio	Ottawa - 35
CRC400	133	(\$1,251,642)	\$501,473	\$1,753,115	3	628	0	Columbus	Columbus, NW - 66
CRC516	134	(\$1,461,955)	\$91,648	\$1,553,604	2	630	0	Columbus	Columbus, SW - 65
CRC989	135	(\$1,560,741)	\$533,006	\$2,093,747	3	633	0	Western Ohio	Ottawa - 35
CRA131	136	(\$1,579,419)	\$1,007,151	\$2,586,570	4	637	0	Western Ohio	Tiffin - 10
CRA123	137	(\$1,589,938)	\$1,012,414	\$2,602,352	4	641	0	Western Ohio	Bucyrus - 11
CRC984	138	(\$1,747,552)	\$1,729,968	\$3,477,520	6	647	0	Columbus	Columbus, SE - 64
CRA130	139	(\$1,764,592)	\$2,001,081	\$3,765,674	5	652	0	Western Ohio	Fremont - 12, Tiffin -10
CRA121	140	(\$1,973,914)	\$1,436,779	\$3,410,693	5	657	0	Newark	Coshocton - 82
CRC412	141	(\$2,107,435)	\$2,268,818	\$4,376,253	7	664	0	Columbus	Columbus, NW - 66
CRC401	142	(\$2,226,266)	\$1,135,040	\$3,361,306	6	670	0	Columbus	Columbus, NW - 66
CRC215	143	(\$2,849,545)	\$3,735,182	\$6,584,728	10	680	0	Western Ohio	Lima - 30, Van Wert -32
CRA127	144	(\$2,874,377)	\$2,117,304	\$4,991,681	8	688	0	Western Ohio	Upper Sandusky - 13
CRA135	145	(\$3,071,421)	\$1,068,746	\$4,140,167	6	694	0	Western Ohio	Fremont - 12
CRC219	146	(\$3,276,913)	\$2,767,684	\$6,044,597	9	703	0	Western Ohio	Paulding - 31
CRA610	147	(\$3,693,717)	\$1,033,922	\$4,727,638	7	710	0	Western Ohio	Ottawa - 35

6.2 Prioritized Portfolio Analysis of VVO Bus Candidates

Table 11
Prioritized Business Case Portfolio of VVO Distribution Buses

Candidate	Rank	NPV	PV Benefits	PV Costs	Reduced CO2	Circuits	Total	OHA
HILLIARD (#0021) 1X 2X	1	\$1,957,872	\$3,819,835	\$1,861,963	57,153	4	4	0
BROOKSIDE 1X	2	\$1,955,402	\$3,854,248	\$1,898,845	71,377	4	8	0
CANAL STREET (#0013) 1X 2X	3	\$1,953,998	\$5,617,833	\$3,663,835	91,714	8	16	3
E.WOOSTER 1X	4	\$1,889,688	\$3,421,385	\$1,531,697	57,979	3	19	2
ZUBER 1X	5	\$1,876,012	\$3,407,709	\$1,531,697	57,373	3	22	1
BEXLEY 1Y	6	\$1,868,534	\$3,713,602	\$1,845,067	63,384	4	26	0
WHITE RD 1X	7	\$1,827,229	\$3,824,436	\$1,997,208	66,810	4	30	0
LAZELLE (#0098) 1X 2X	8	\$1,817,615	\$4,271,852	\$2,454,237	67,234	5	35	0
MARION ROAD 25E3-4Y	9	\$1,814,338	\$3,156,724	\$1,342,386	41,374	3	38	1
ASTOR (#0046) 1Y 2Y	10	\$1,813,018	\$4,521,445	\$2,708,426	75,625	6	44	0
EAST PROCTORVILLE 2X	11	\$1,781,926	\$2,881,944	\$1,100,017	37,966	2	46	0
BLENDON 3X	12	\$1,781,761	\$2,308,109	\$526,348	36,414	1	47	0
CLINTON 2Y	13	\$1,758,472	\$3,555,314	\$1,796,842	48,668	4	51	0
S.SIDELIM 3X	14	\$1,746,622	\$3,278,319	\$1,531,697	56,410	3	54	1
ASTOR (#0046) 1X 2X	15	\$1,737,042	\$4,896,873	\$3,159,831	82,599	7	61	0
NEW LEXINGTON 3X	16	\$1,728,487	\$3,260,184	\$1,531,697	44,225	3	64	0
CLINTON 2X	17	\$1,707,283	\$3,504,126	\$1,796,842	50,011	4	68	1
E.SIDE 1X	18	\$1,701,155	\$3,037,831	\$1,336,676	51,164	2	70	1
W.MELROSE 1X	19	\$1,697,726	\$3,661,116	\$1,963,390	66,044	4	74	0
DUBLIN (#0023) 2X 3X	20	\$1,687,203	\$5,298,438	\$3,611,235	104,433	8	82	2
BIXBY 4X	21	\$1,641,547	\$3,486,614	\$1,845,067	71,018	4	86	0
N.LIBERTY 3X	22	\$1,637,853	\$2,737,871	\$1,100,017	40,431	2	88	0
BRIGGS DALE (#0073) 1X 2X	23	\$1,609,426	\$3,141,123	\$1,531,697	44,637	3	91	0
ROCKHILL 4X	24	\$1,593,893	\$3,125,590	\$1,531,697	46,868	3	94	0
DELAWARE 2Y	25	\$1,569,513	\$2,480,207	\$910,694	39,113	2	96	0
SHANNON 1X	26	\$1,565,868	\$3,450,359	\$1,884,491	51,981	4	100	0
NORTH NEWARK 5X	27	\$1,556,301	\$3,087,998	\$1,531,697	41,217	3	103	0
HESS STREET (#0054) 3X 4X	28	\$1,528,348	\$4,241,921	\$2,713,574	68,759	6	109	1
VANWERT 1X	29	\$1,517,258	\$3,096,303	\$1,579,044	48,172	3	112	0
ST. CLAIR 2X	30	\$1,494,927	\$3,316,314	\$1,821,387	66,695	4	116	1
HESS STREET (#0054) 1X 2X	31	\$1,463,206	\$4,176,780	\$2,713,574	94,110	6	122	0
BIXBY 3X	32	\$1,450,172	\$3,295,239	\$1,845,067	54,906	4	126	0
ADA 1X	33	\$1,448,088	\$3,098,114	\$1,650,026	47,242	3	129	1
NORTH ZANESVILLE 1X	34	\$1,441,251	\$2,422,946	\$981,695	33,641	2	131	0
WILSON ROAD 3X	35	\$1,440,374	\$2,794,587	\$1,354,213	59,848	3	134	0
WEST CANTON 3X	36	\$1,425,750	\$1,904,764	\$479,014	33,704	1	135	0
ROBERTS 3X	37	\$1,410,122	\$3,282,484	\$1,872,362	60,244	4	139	0
BEXLEY 3Y	38	\$1,394,879	\$3,239,946	\$1,845,067	51,553	4	143	0

Candidate	Rank	NPV	PV Benefits	PV Costs	Reduced CO2	Circuits	Total	OHA
MOUND (#0030) 1X 2Y	39	\$1,372,491	\$4,368,302	\$2,995,811	88,665	6	149	3
WESTERVILLE (#0055) 1X 2X	40	\$1,357,399	\$3,125,754	\$1,768,355	46,032	3	152	0
KARL ROAD (#0009) 1X 2X	41	\$1,353,736	\$4,559,592	\$3,205,855	67,038	7	159	0
UPSANDUSK 4X	42	\$1,332,935	\$2,864,632	\$1,531,697	43,288	3	162	1
N.COSHOCT 3X	43	\$1,267,124	\$2,798,821	\$1,531,697	39,538	3	165	1
KENTON 1X	44	\$1,255,906	\$1,766,472	\$510,566	27,429	1	166	1
WEST CANTON 4X	45	\$1,255,887	\$1,734,901	\$479,014	30,808	1	167	1
KENNY ROAD (#0003) 1X 2X	46	\$1,243,774	\$3,505,085	\$2,261,311	78,238	5	172	2
HILLIARD 4X	47	\$1,238,462	\$2,634,934	\$1,396,472	38,352	3	175	0
WILSON ROAD 2Y	48	\$1,226,295	\$2,580,509	\$1,354,213	52,272	3	178	1
SOUTH COSHOCTON 4X	49	\$1,218,438	\$2,750,135	\$1,531,697	40,816	3	181	0
BERKSHIRE 1X	50	\$1,188,840	\$2,288,858	\$1,100,017	38,474	2	183	0
KARL ROAD 3X	51	\$1,186,655	\$3,018,573	\$1,831,917	44,896	4	187	0
CALCUTTA 1X	52	\$1,186,539	\$2,286,557	\$1,100,017	32,998	2	189	0
WILSON ROAD 1Y	53	\$1,183,541	\$2,989,159	\$1,805,618	44,000	4	193	0
PLEASANTS 1X	54	\$1,156,109	\$2,628,652	\$1,472,542	38,380	3	196	0
MARION ROAD W2	55	\$1,154,082	\$2,496,469	\$1,342,386	34,822	3	199	0
HYATT 2X	56	\$1,142,854	\$3,106,244	\$1,963,390	47,090	4	203	0
CLINTON 3X	57	\$1,132,636	\$2,929,479	\$1,796,842	41,832	4	207	0
GROVES ROAD (#0038) 7X 8X	58	\$1,114,660	\$3,354,689	\$2,240,028	45,841	5	212	0
SAWMILL 4X	59	\$1,108,919	\$2,505,391	\$1,396,472	35,055	3	215	0
W.LOGAN 1X	60	\$1,108,074	\$2,208,091	\$1,100,017	31,134	2	217	1
DUBLIN 1X	61	\$1,098,001	\$2,903,618	\$1,805,618	54,895	4	221	1
BRIDGEVILLE 1X	62	\$1,085,909	\$2,617,607	\$1,531,697	53,591	3	224	0
ADDISON 1X	63	\$1,081,639	\$2,613,336	\$1,531,697	44,768	3	227	0
SHARON VALLEY 1X	64	\$1,068,767	\$2,600,464	\$1,531,697	36,920	3	230	0
ROCKHILL 1X	65	\$1,063,917	\$1,574,483	\$510,566	23,858	1	231	0
MILL CREEK 4X	66	\$1,062,203	\$2,466,474	\$1,404,272	45,396	3	234	1
N.MCCONNE 1X	67	\$1,058,090	\$1,726,428	\$668,338	25,154	1	235	0
MARION ROAD 15E1-5Y	68	\$1,042,333	\$1,937,258	\$894,924	34,403	2	237	0
LIVINGSTON AVE (#0025) 1X 2X	69	\$1,035,600	\$2,567,298	\$1,531,697	42,303	3	240	0
GREELY 2X	70	\$1,005,124	\$2,184,028	\$1,178,904	33,226	2	242	0
SOUTH NEWARK 2X	71	\$996,508	\$1,978,203	\$981,695	26,746	2	244	0
GLENMOOR 1X	72	\$975,750	\$2,154,653	\$1,178,904	28,018	2	246	0
GROVES ROAD 3X	73	\$963,975	\$3,652,008	\$2,688,034	50,518	6	252	0
MARTINSBURG ROAD 1X	74	\$961,709	\$2,493,406	\$1,531,697	51,450	3	255	0
WILSON ROAD 3Y	75	\$959,784	\$2,765,401	\$1,805,618	39,997	4	259	0
LINCOLN STREET (#0218) 1X 2X	76	\$958,316	\$2,490,013	\$1,531,697	39,600	3	262	0
EAST NEWARK 1X	77	\$945,519	\$2,477,216	\$1,531,697	32,402	3	265	0
CLINTON 3Y	78	\$937,674	\$2,734,516	\$1,796,842	36,731	4	269	0
JUG STREET 1X	79	\$909,522	\$2,246,198	\$1,336,676	65,730	2	271	0
GRANVILLE 1X	80	\$906,467	\$2,379,009	\$1,472,542	29,597	3	274	0
BOLIVAR 1X	81	\$900,555	\$2,000,572	\$1,100,017	32,483	2	276	0

Candidate	Rank	NPV	PV Benefits	PV Costs	Reduced CO2	Circuits	Total	OHA
LANCASTER JUNCTION 2X	82	\$869,001	\$1,867,605	\$998,604	27,949	2	278	1
LANCASTER JUNCTION 1X	83	\$864,017	\$1,862,621	\$998,604	27,118	2	280	1
W.WOOSTER 1X	84	\$854,813	\$2,191,489	\$1,336,676	37,457	2	282	0
MORSE ROAD 3X	85	\$851,327	\$1,773,861	\$922,534	29,485	2	284	0
MAPLE GROVE 1X	86	\$843,842	\$2,022,746	\$1,178,904	30,198	2	286	0
CORWIN 1X	87	\$827,855	\$1,848,986	\$1,021,131	26,093	2	288	0
ETNA ROAD (#0070) 1X 3X	88	\$820,553	\$2,705,044	\$1,884,491	53,154	4	292	1
S.VANWERT 2X	89	\$819,443	\$2,351,140	\$1,531,697	41,475	3	295	1
KENNY ROAD (#0003) 1Y 2Y	90	\$776,245	\$3,942,082	\$3,165,836	68,281	7	302	3
DELPHOS 1X	91	\$772,947	\$1,322,956	\$550,009	21,466	1	303	0
SUGRCRTRM 1X	92	\$771,385	\$2,108,061	\$1,336,676	43,826	2	305	0
ETNA ROAD 2X	93	\$769,536	\$1,711,781	\$942,245	24,022	2	307	0
EASTOWNRD 1X	94	\$769,264	\$2,182,632	\$1,413,368	34,323	3	310	0
TWORIDGES 1X	95	\$761,621	\$1,940,525	\$1,178,904	28,187	2	312	0
LEIPSIC 2X	96	\$759,536	\$1,285,885	\$526,348	24,036	1	313	0
GALLOWAY 1X	97	\$757,555	\$1,706,977	\$949,423	26,411	2	315	0
AVONDALE 2X	98	\$751,524	\$1,301,532	\$550,009	18,724	1	316	0
NORTH ZANESVILLE 2X	99	\$749,423	\$1,731,117	\$981,695	24,636	2	318	1
FRAZEYSBURG 1X	100	\$737,896	\$1,406,234	\$668,338	18,780	1	319	0
STEUBENVI 1X	101	\$737,596	\$2,269,293	\$1,531,697	37,582	3	322	1
NEWPHILA 4X	102	\$728,425	\$1,254,774	\$526,348	17,031	1	323	0
EAST WILLARD 1X	103	\$726,569	\$1,394,907	\$668,338	20,738	1	324	0
CIRCLEVILLE 1X	104	\$724,503	\$2,137,871	\$1,413,368	34,092	3	327	1
CRESTWOOD 1X	105	\$714,951	\$2,187,493	\$1,472,542	43,509	3	330	0
DOGWOOD RIDGE 1X	106	\$709,719	\$2,241,416	\$1,531,697	28,385	3	333	0
BANNOCKRD 1X	107	\$709,506	\$1,888,410	\$1,178,904	25,539	2	335	0
KIRK 1X	108	\$706,524	\$2,043,200	\$1,336,676	31,208	2	337	1
W.NEWPHIL 4X	109	\$691,556	\$1,744,253	\$1,052,696	22,238	2	339	0
CLARK STREET 2X	110	\$690,586	\$2,114,720	\$1,424,134	34,913	3	342	0
ACADEMIA 1Y	111	\$681,189	\$1,781,207	\$1,100,017	26,882	2	344	1
SHAWNEERD 1X	112	\$676,371	\$2,208,069	\$1,531,697	36,027	3	347	0
ROSEMOUNT 2X	113	\$654,570	\$1,244,022	\$589,452	19,137	1	348	0
N.W.LIMA 1X	114	\$649,192	\$2,612,582	\$1,963,390	38,177	4	352	0
SUGARHILL 1X	115	\$648,147	\$1,748,164	\$1,100,017	22,046	2	354	0
MEMORIALD 1X	116	\$647,653	\$2,611,043	\$1,963,390	38,651	4	358	1
ASHAVENUE 1X	117	\$641,452	\$2,173,150	\$1,531,697	33,404	3	361	0
SUNNYSIDE 6X	118	\$633,252	\$2,164,949	\$1,531,697	33,100	3	364	0
EASTONSTR 2X	119	\$631,725	\$1,589,753	\$958,028	28,713	2	366	0
UTICA 1X	120	\$621,260	\$1,721,277	\$1,100,017	23,903	2	368	0
MARION ROAD 15W1-4Y	121	\$619,843	\$1,962,229	\$1,342,386	39,970	3	371	0
LINDEN AVENUE 2X	122	\$616,336	\$2,148,033	\$1,531,697	30,265	3	374	1
LOUISVILL 1X	123	\$612,644	\$2,144,342	\$1,531,697	29,096	3	377	0
PARSONS (#0057) 2X 3X	124	\$612,187	\$2,654,450	\$2,042,263	45,777	4	381	0

Candidate	Rank	NPV	PV Benefits	PV Costs	Reduced CO2	Circuits	Total	OHA
EASTONSTR 1X	125	\$592,233	\$2,029,274	\$1,437,042	29,747	3	384	0
DELAWARE 3X	126	\$587,589	\$1,498,283	\$910,694	26,362	2	386	1
RIO 1X	127	\$586,440	\$1,607,571	\$1,021,131	22,187	2	388	0
CENTER STREET 1X	128	\$586,185	\$2,117,882	\$1,531,697	29,676	3	391	0
SOUTH POINT 7X	129	\$577,123	\$1,076,425	\$499,302	13,849	1	392	0
N.WILLARD 1X	130	\$572,214	\$2,103,911	\$1,531,697	32,071	3	395	0
SUNSETBOU 1X	131	\$560,292	\$2,091,989	\$1,531,697	29,450	3	398	1
BEALLAVEN 3X	132	\$556,562	\$2,324,917	\$1,768,355	38,955	3	401	0
MILLBROPA 6X	133	\$553,082	\$1,731,985	\$1,178,904	24,339	2	403	0
COLUMBIA 1X	134	\$552,883	\$1,652,901	\$1,100,017	24,814	2	405	0
SHANNON 2X	135	\$543,768	\$1,486,013	\$942,245	20,887	2	407	0
GENOA 1Y	136	\$542,949	\$1,042,251	\$499,302	16,597	1	408	0
BYESVILLE 1X	137	\$537,515	\$2,116,560	\$1,579,044	31,288	3	411	0
E.DOVER 1X	138	\$522,988	\$1,191,326	\$668,338	16,385	1	412	0
ETNA 2X	139	\$505,022	\$1,055,030	\$550,009	15,139	1	413	0
S.E.LOGAN 1X	140	\$503,069	\$1,171,407	\$668,338	17,830	1	414	0
GROVES ROAD 8Y	141	\$500,799	\$1,396,810	\$896,011	21,227	2	416	0
THORNVILLE 1X	142	\$498,026	\$1,598,043	\$1,100,017	19,941	2	418	0
BELLVILLE 1X	143	\$495,607	\$1,163,945	\$668,338	17,673	1	419	0
DUCK CREEK 1X	144	\$494,757	\$2,026,454	\$1,531,697	36,703	3	422	0
E.LOGAN 1X	145	\$484,797	\$2,063,842	\$1,579,044	29,186	3	425	0
ELK 2X	146	\$483,664	\$1,583,681	\$1,100,017	21,985	2	427	0
MARION ROAD E2	147	\$477,689	\$1,820,075	\$1,342,386	38,200	3	430	0
RIVERVIEW 2X	148	\$476,975	\$2,127,001	\$1,650,026	35,207	3	433	2
MILES AVE 1X	149	\$474,195	\$2,005,892	\$1,531,697	29,751	3	436	1
WOOSTER 3X	150	\$472,437	\$1,809,113	\$1,336,676	30,987	2	438	0
MEIGS 1X	151	\$469,424	\$1,019,432	\$550,009	13,929	1	439	0
BILLIAR 2X	152	\$466,851	\$1,056,303	\$589,452	15,613	1	440	0
W.GALION 1X	153	\$464,989	\$1,643,893	\$1,178,904	23,352	2	442	0
LANCASTER 4X	154	\$461,416	\$1,561,433	\$1,100,017	23,573	2	444	0
BLUFFTON 1X	155	\$460,194	\$1,560,211	\$1,100,017	26,866	2	446	1
SEAMAN 1X	156	\$456,332	\$2,106,358	\$1,650,026	27,902	3	449	1
CORNERSTONE 2X	157	\$452,839	\$1,434,534	\$981,695	23,967	2	451	0
CARROLLTON 2X	158	\$443,062	\$1,543,080	\$1,100,017	22,462	2	453	1
GROVES ROAD 7Y	159	\$435,093	\$1,331,104	\$896,011	19,135	2	455	0
NEWPHILA 3X	160	\$434,154	\$1,486,850	\$1,052,696	20,385	2	457	0
NORTH HEBRON 1X	161	\$430,188	\$1,530,206	\$1,100,017	23,364	2	459	0
STRASBURG 1X	162	\$418,745	\$1,518,762	\$1,100,017	23,208	2	461	0
COOLVILLE 1X	163	\$409,945	\$959,954	\$550,009	14,827	1	462	0
WILLISTON 1X	164	\$408,604	\$2,176,960	\$1,768,355	28,464	3	465	0
VIGO 1X	165	\$404,086	\$1,582,990	\$1,178,904	19,484	2	467	0
SCIOTO TRAIL 2X	166	\$394,004	\$1,730,680	\$1,336,676	31,665	2	469	0
S.DELPHOS 1X	167	\$390,119	\$1,490,136	\$1,100,017	23,834	2	471	0

Candidate	Rank	NPV	PV Benefits	PV Costs	Reduced CO2	Circuits	Total	OHA
HIGHLAND AVENUE 1X	168	\$388,288	\$1,919,985	\$1,531,697	27,969	3	474	0
N.CANTON 1X	169	\$385,580	\$2,427,843	\$2,042,263	40,059	4	478	0
RUHLMAN 1X	170	\$381,028	\$2,344,418	\$1,963,390	33,560	4	482	2
CLIFTMONT AVE 1X	171	\$380,883	\$1,049,221	\$668,338	16,173	1	483	0
BARNESVIL 1X	172	\$380,565	\$2,148,921	\$1,768,355	29,066	3	486	1
HEBRON 1X	173	\$368,774	\$1,037,112	\$668,338	14,042	1	487	0
MILLWOOD 1X	174	\$367,104	\$1,898,802	\$1,531,697	24,512	3	490	0
WEST GRANVILLE 1X	175	\$359,372	\$1,027,710	\$668,338	17,066	1	491	0
FINDLAY 2X	176	\$352,570	\$863,136	\$510,566	13,706	1	492	0
STONESTREET 3X	177	\$351,311	\$1,883,009	\$1,531,697	30,819	3	495	1
SMITHVILL 1X	178	\$349,363	\$1,017,701	\$668,338	15,582	1	496	0
JEFFERSON (#0145) 1X 2X	179	\$348,758	\$1,998,784	\$1,650,026	26,286	3	499	0
WHEELERSB 1X	180	\$341,887	\$1,010,224	\$668,338	13,816	1	500	0
EAST UNION 1X	181	\$338,306	\$1,517,210	\$1,178,904	22,502	2	502	0
SOUTH NEWARK 1X	182	\$337,294	\$1,318,989	\$981,695	19,537	2	504	0
BEXLEY 2Y	183	\$333,415	\$794,682	\$461,267	16,268	1	505	0
NEGLEY 1X	184	\$332,963	\$1,864,660	\$1,531,697	41,486	3	508	0
EAST PROCTORVILLE 1X	185	\$323,044	\$873,053	\$550,009	10,426	1	509	0
CIRCLEVILLE 2X	186	\$318,246	\$1,731,614	\$1,413,368	27,588	3	512	0
S.CAMBRID 3X	187	\$316,938	\$1,221,927	\$904,990	20,212	1	513	0
PACKARD 1X	188	\$316,538	\$1,966,564	\$1,650,026	28,980	3	516	0
HAVILAND 2X	189	\$305,155	\$1,210,144	\$904,990	14,326	1	517	0
RARDEN 2X	190	\$303,714	\$972,052	\$668,338	14,207	1	518	0
BEAVER 1X	191	\$302,739	\$1,481,642	\$1,178,904	17,030	2	520	0
SOUTH GRANVILLE 1X	192	\$296,872	\$1,396,890	\$1,100,017	28,490	2	522	0
COOLVILLE 2X	193	\$296,825	\$846,834	\$550,009	10,992	1	523	0
E.FREMONT 1X	194	\$290,246	\$1,390,263	\$1,100,017	24,303	2	525	0
WAKEFIELD 1X	195	\$288,643	\$1,467,546	\$1,178,904	17,690	2	527	0
DELPHOS 2X	196	\$278,629	\$828,638	\$550,009	12,587	1	528	0
BLISSPARK 1X	197	\$276,132	\$1,855,177	\$1,579,044	27,889	3	531	2
BUCYRUS 1X	198	\$272,647	\$1,851,691	\$1,579,044	30,945	3	534	0
S.FINDLAY 2X	199	\$267,886	\$1,225,914	\$958,028	23,374	2	536	1
SCIOTOVIL 1X	200	\$266,557	\$1,445,460	\$1,178,904	16,925	2	538	0
DENNISON 4X	201	\$266,401	\$934,739	\$668,338	14,519	1	539	1
PARK 1X	202	\$266,280	\$1,366,298	\$1,100,017	25,450	2	541	0
NORTH END FOSTORIA 2X	203	\$258,743	\$1,311,439	\$1,052,696	17,350	2	543	0
PITTSBURGH AVENUE (#4204) 1X 2X	204	\$256,040	\$1,787,737	\$1,531,697	23,335	3	546	0
18 ST.HTS 2X	205	\$251,868	\$801,876	\$550,009	10,306	1	547	0
PLEASANTS 2X	206	\$250,374	\$741,221	\$490,847	8,538	1	548	0
MARTINSFE 1X	207	\$248,082	\$1,348,099	\$1,100,017	19,467	2	550	1
BUCYRUSCT 2X	208	\$242,682	\$1,821,727	\$1,579,044	31,185	3	553	1
ROZELLE 1X	209	\$241,515	\$1,341,532	\$1,100,017	17,350	2	555	0
CORNERSTONE 1X	210	\$236,903	\$1,218,597	\$981,695	15,688	2	557	2

Candidate	Rank	NPV	PV Benefits	PV Costs	Reduced CO2	Circuits	Total	OHA
OERTELS 1X	211	\$234,690	\$1,413,593	\$1,178,904	16,042	2	559	0
BELPRE 1X	212	\$232,702	\$1,214,397	\$981,695	18,706	2	561	0
RENO 1X	213	\$232,475	\$1,332,493	\$1,100,017	27,363	2	563	0
SMITHFIEL 1X	214	\$225,892	\$1,130,881	\$904,990	13,458	1	564	0
SHAWNEE 1X	215	\$225,849	\$1,325,866	\$1,100,017	14,958	2	566	0
ROCKBRIDG 1X	216	\$224,706	\$1,403,610	\$1,178,904	17,391	2	568	0
LEXINGTON 1X	217	\$220,333	\$1,320,351	\$1,100,017	19,432	2	570	0
ST. CLAIR 3X	218	\$213,492	\$1,579,533	\$1,366,040	29,697	3	573	0
MINFORD 1X	219	\$212,925	\$1,391,829	\$1,178,904	17,699	2	575	0
EAST OTTAWA 1X	220	\$210,898	\$1,310,915	\$1,100,017	22,428	2	577	0
W.MILLERB 1X	221	\$207,350	\$1,112,339	\$904,990	18,866	1	578	0
W.NEWPHIL 3X	222	\$206,464	\$732,812	\$526,348	11,832	1	579	0
CALIFORNIA 1X	223	\$206,091	\$2,169,481	\$1,963,390	32,110	4	583	0
SLATE 1X	224	\$205,833	\$1,542,508	\$1,336,676	21,183	2	585	0
OAKWOOD 1X	225	\$205,193	\$2,202,401	\$1,997,208	33,007	4	589	0
N.SPENCVI 1X	226	\$196,851	\$1,296,868	\$1,100,017	20,028	2	591	0
EASTOWNRD 2X	227	\$195,854	\$1,609,222	\$1,413,368	24,225	3	594	1
ELK 1X	228	\$194,184	\$1,294,202	\$1,100,017	19,992	2	596	0
REEDURBAN 1X	229	\$187,466	\$2,150,856	\$1,963,390	33,767	4	600	0
SMYRNA 1X	230	\$187,376	\$855,713	\$668,338	10,351	1	601	0
CORNER 1X	231	\$185,530	\$1,764,574	\$1,579,044	22,691	3	604	0
WALNUT CR 1X	232	\$179,317	\$847,655	\$668,338	16,173	1	605	0
MCCOMB 1X	233	\$177,307	\$635,287	\$457,979	8,515	1	606	0
SUMMERHIL 1X	234	\$170,978	\$1,270,995	\$1,100,017	21,454	2	608	0
RIO 2X	235	\$170,347	\$680,912	\$510,566	11,527	1	609	0
GINGER 1X	236	\$169,689	\$1,269,706	\$1,100,017	15,878	2	611	0
BERLIN 1X	237	\$164,190	\$1,343,094	\$1,178,904	23,649	2	613	0
BILLIAR 1X	238	\$161,621	\$751,073	\$589,452	11,588	1	614	0
ST.CLAIRA 1X	239	\$159,792	\$1,738,837	\$1,579,044	22,031	3	617	1
MADISONBURG 2X	240	\$155,466	\$1,687,163	\$1,531,697	27,758	3	620	1
SUPERIOR 1X	241	\$153,213	\$821,551	\$668,338	10,826	1	621	0
MONROESTR 1X	242	\$149,301	\$1,680,998	\$1,531,697	22,422	3	624	1
WEST PHILO 1X	243	\$149,173	\$817,511	\$668,338	10,455	1	625	0
CROOKSVILLE 3X	244	\$147,378	\$815,715	\$668,338	10,860	1	626	0
NEFFS 1X	245	\$142,699	\$811,037	\$668,338	10,067	1	627	0
BLENDON 1Y	246	\$141,149	\$1,193,846	\$1,052,696	15,136	2	629	0
PLY.HGTS. 1X	247	\$136,926	\$805,264	\$668,338	12,625	1	630	0
BLOOM ROAD 1X	248	\$131,978	\$800,316	\$668,338	11,953	1	631	0
N.WOOSTER 1X	249	\$123,079	\$791,416	\$668,338	10,391	1	632	1
NORTH BALTIMORE 1X	250	\$119,171	\$1,455,846	\$1,336,676	19,946	2	634	0
CADIZ 1X	251	\$119,124	\$1,219,141	\$1,100,017	17,028	2	636	1
COSHOCTON 1X	252	\$116,331	\$1,648,028	\$1,531,697	20,777	3	639	1
E.SPARTA 2X	253	\$115,623	\$665,632	\$550,009	9,391	1	640	0

Candidate	Rank	NPV	PV Benefits	PV Costs	Reduced CO2	Circuits	Total	OHA
ROSEMOUNT 1X	254	\$110,321	\$699,773	\$589,452	9,624	1	641	0
S.CANTON 2X	255	\$108,596	\$776,934	\$668,338	11,391	1	642	0
TORONTO 1X	256	\$106,653	\$1,443,329	\$1,336,676	20,379	2	644	0
N.IRONTON 1X	257	\$104,127	\$772,465	\$668,338	9,905	1	645	0
MAHONINGR 1X	258	\$103,972	\$1,683,017	\$1,579,044	26,794	3	648	0
S.GREENWI 1X	259	\$98,132	\$766,470	\$668,338	10,275	1	649	0
FOREST 3X	260	\$94,336	\$762,674	\$668,338	8,877	1	650	0
W.LAFAYET 1X	261	\$93,577	\$1,272,480	\$1,178,904	16,213	2	652	0
MILL ST 1X	262	\$92,095	\$997,085	\$904,990	17,834	1	653	0
COL.GROVE 1X	263	\$90,530	\$758,868	\$668,338	9,596	1	654	0
BELPRE 2X	264	\$87,306	\$1,069,001	\$981,695	15,687	2	656	0
MOUNT VERNON 1X	265	\$84,697	\$1,184,714	\$1,100,017	18,829	2	658	1
E.TIFFIN 1X	266	\$84,672	\$1,263,575	\$1,178,904	19,222	2	660	0
MOUNT STERLING 1X	267	\$81,823	\$750,161	\$668,338	8,425	1	661	0
MCCOMB 2X	268	\$81,421	\$539,400	\$457,979	16,307	1	662	0
MINERVA 1X	269	\$76,823	\$1,608,520	\$1,531,697	26,164	3	665	0
IDAHO 1X	270	\$74,246	\$1,253,150	\$1,178,904	16,580	2	667	0
GAMBIER 1X	271	\$70,524	\$1,170,542	\$1,100,017	17,405	2	669	0
FREMONTCT 2X	272	\$68,182	\$736,520	\$668,338	11,190	1	670	0
S.FINDLAY 1X	273	\$58,725	\$1,495,767	\$1,437,042	24,495	3	673	0
CLARK STREET 1X	274	\$50,774	\$1,474,908	\$1,424,134	29,764	3	676	1
E.LANCAST 1X	275	\$45,911	\$635,363	\$589,452	8,436	1	677	0
CAMBRIDGE 1X	276	\$45,816	\$1,224,720	\$1,178,904	18,310	2	679	0
TILTONSVI 2X	277	\$41,181	\$1,377,857	\$1,336,676	20,812	2	681	0
ADAMS 2X	278	\$40,604	\$1,377,280	\$1,336,676	18,023	2	683	0
ROBERTSVI 1X	279	\$35,472	\$703,810	\$668,338	9,257	1	684	0
SAVANNAH AVENUE 4X	280	\$34,272	\$1,134,290	\$1,100,017	15,871	2	686	0
HOWARD 3X	281	\$32,351	\$1,132,369	\$1,100,017	13,508	2	688	0
OAKLAND 1X	282	\$27,220	\$1,606,264	\$1,579,044	22,978	3	691	0
E.N.CONC. 1X	283	\$19,089	\$1,119,107	\$1,100,017	18,835	2	693	0
AUGLAIZE 1X	284	\$6,917	\$556,926	\$550,009	5,970	1	694	0
W.ALIKANN 1X	285	\$766	\$905,755	\$904,990	13,328	1	695	0
COLERAIN 1X	286	(\$6,301)	\$898,688	\$904,990	11,274	1	696	0
FINDLAY CENTER 2X	287	(\$12,047)	\$656,290	\$668,338	8,729	1	697	0
DRESDEN 1X	288	(\$14,178)	\$1,085,839	\$1,100,017	14,398	2	699	0
CENTERBURG 1Y	289	(\$14,641)	\$511,707	\$526,348	6,634	1	700	0
DELANO 1Y	290	(\$15,121)	\$1,516,576	\$1,531,697	37,267	3	703	2
MADISON 1X	291	(\$17,252)	\$1,319,423	\$1,336,676	27,917	2	705	0
MEIGS 2X	292	(\$17,957)	\$532,051	\$550,009	6,155	1	706	0
SOUTH BELMONT 1X	293	(\$30,427)	\$1,069,591	\$1,100,017	13,674	2	708	0
CRIDERSVI 1X	294	(\$36,769)	\$1,063,248	\$1,100,017	14,359	2	710	1
PAYNE 1X	295	(\$45,999)	\$1,054,018	\$1,100,017	13,491	2	712	0
SOUTH SOMERSET 1X	296	(\$46,414)	\$621,924	\$668,338	8,174	1	713	0

Candidate	Rank	NPV	PV Benefits	PV Costs	Reduced CO2	Circuits	Total	OHA
WEST CANTON 1X	297	(\$49,583)	\$1,866,473	\$1,916,056	29,520	4	717	0
N.FREMONT 1X	298	(\$51,894)	\$1,479,803	\$1,531,697	24,600	3	720	0
W.HICKSVI 1X	299	(\$54,611)	\$613,727	\$668,338	8,317	1	721	0
LEESVILLE 2X	300	(\$56,890)	\$611,448	\$668,338	6,788	1	722	0
DILLONVAL 1X	301	(\$57,310)	\$847,680	\$904,990	10,652	1	723	0
COPELAND 1X	302	(\$58,496)	\$1,473,201	\$1,531,697	20,042	3	726	1
TORREY 5X	303	(\$65,748)	\$1,034,270	\$1,100,017	16,094	2	728	0
AUGLAIZE 2X	304	(\$66,755)	\$483,254	\$550,009	6,715	1	729	0
CENTERBURG 1X	305	(\$73,774)	\$978,922	\$1,052,696	23,461	2	731	0
ST. CLAIR 2Y	306	(\$76,603)	\$1,289,437	\$1,366,040	25,078	3	734	0
HILLVIEW 1X	307	(\$78,252)	\$1,021,766	\$1,100,017	14,811	2	736	0
BIGPRAIRI 1X	308	(\$79,526)	\$588,812	\$668,338	7,214	1	737	0
HEMLOCK 1X	309	(\$79,968)	\$1,098,935	\$1,178,904	14,612	2	739	0
DERWENT 1X	310	(\$83,628)	\$584,710	\$668,338	7,559	1	740	0
ASHLEY 1X	311	(\$87,610)	\$1,091,293	\$1,178,904	13,105	2	742	0
ROSEFARM 1X	312	(\$89,089)	\$579,249	\$668,338	6,588	1	743	0
PENNSVILL 1X	313	(\$89,760)	\$1,010,257	\$1,100,017	10,879	2	745	0
EAST WILLARD 2X	314	(\$94,769)	\$573,569	\$668,338	13,748	1	746	0
POSTON 3X	315	(\$96,376)	\$571,961	\$668,338	10,054	1	747	0
BATEVILL 1X	316	(\$96,830)	\$808,160	\$904,990	9,312	1	748	0
N.WELSVIL 1X	317	(\$97,045)	\$1,081,859	\$1,178,904	13,837	2	750	0
HIGHLAND TERRACE 1X	318	(\$104,049)	\$800,941	\$904,990	9,144	1	751	0
S.MAR.FER 1X	319	(\$106,414)	\$1,425,284	\$1,531,697	19,300	3	754	0
APPLECREE 1X	320	(\$107,077)	\$561,261	\$668,338	9,461	1	755	0
CORWIN 2X	321	(\$107,103)	\$403,462	\$510,566	5,539	1	756	0
STANTONST 2X	322	(\$117,918)	\$982,099	\$1,100,017	13,626	2	758	0
LANSING 1X	323	(\$120,593)	\$547,745	\$668,338	6,261	1	759	0
NORTH WALDO 2X	324	(\$123,608)	\$976,410	\$1,100,017	13,037	2	761	0
E BUCYRUS 1X	325	(\$134,552)	\$1,044,352	\$1,178,904	14,322	2	763	0
PEKIN 2X	326	(\$134,677)	\$533,660	\$668,338	8,524	1	764	0
WILKESVILLE 1X	327	(\$136,238)	\$532,099	\$668,338	6,228	1	765	0
FRIENSHIP 1X	328	(\$139,131)	\$1,039,772	\$1,178,904	12,771	2	767	0
CARROLLTON 1X	329	(\$140,786)	\$959,231	\$1,100,017	13,535	2	769	0
18 ST.HTS 1X	330	(\$140,792)	\$409,217	\$550,009	8,409	1	770	0
CAIRO 1X	331	(\$141,044)	\$763,946	\$904,990	10,560	1	771	0
FINDLAY 1X	332	(\$142,105)	\$879,026	\$1,021,131	13,595	2	773	0
E.MT.CORY 1X	333	(\$146,594)	\$521,744	\$668,338	6,144	1	774	0
KALIDA 3X	334	(\$157,862)	\$1,178,813	\$1,336,676	23,008	2	776	0
SARDINIA 1X	335	(\$161,175)	\$938,843	\$1,100,017	12,463	2	778	0
SULPH.SPR 1X	336	(\$168,210)	\$1,010,694	\$1,178,904	12,059	2	780	0
TIFFINTAP 2X	337	(\$170,425)	\$1,166,251	\$1,336,676	21,327	2	782	0
LOCK 1X	338	(\$175,813)	\$1,160,863	\$1,336,676	15,407	2	784	0
S.VANLUE 1X	339	(\$176,692)	\$728,297	\$904,990	8,558	1	785	0

Candidate	Rank	NPV	PV Benefits	PV Costs	Reduced CO2	Circuits	Total	OHA
LAFAYETTE 1X	340	(\$178,085)	\$921,933	\$1,100,017	12,398	2	787	0
ARBOR ST 1X	341	(\$178,780)	\$921,237	\$1,100,017	13,182	2	789	1
COOPERMILL 2X	342	(\$186,642)	\$718,347	\$904,990	8,524	1	790	0
RACINE 1X	343	(\$194,280)	\$474,058	\$668,338	5,929	1	791	0
FULTON 1X	344	(\$196,121)	\$903,897	\$1,100,017	10,053	2	793	0
POMEROY 3X	345	(\$204,940)	\$895,077	\$1,100,017	11,134	2	795	0
W.MALTA 1X	346	(\$213,155)	\$886,862	\$1,100,017	10,317	2	797	0
BEXLEY 3X	347	(\$215,148)	\$246,118	\$461,267	7,036	1	798	0
N.CAMBRID 1X	348	(\$215,850)	\$452,487	\$668,338	8,559	1	799	1
BROKEN SWORD 1X	349	(\$218,793)	\$881,225	\$1,100,017	10,116	2	801	0
REYNOLDS 1X	350	(\$228,146)	\$1,108,530	\$1,336,676	16,215	2	803	0
BENTONVILLE 1X	351	(\$229,537)	\$870,481	\$1,100,017	13,242	2	805	0
W.TORONTO 1X	352	(\$235,149)	\$1,101,526	\$1,336,676	14,090	2	807	0
ANCHOR-HOCKING 2X	353	(\$238,235)	\$666,755	\$904,990	8,250	1	808	0
RAVEN 1X	354	(\$242,839)	\$936,064	\$1,178,904	12,363	2	810	0
AVONDALE 1X	355	(\$257,708)	\$292,300	\$550,009	3,296	1	811	0
BREMEN 1X	356	(\$259,169)	\$645,820	\$904,990	7,648	1	812	0
MILL CREEK 2X	357	(\$261,723)	\$206,368	\$468,091	8,946	1	813	1
W.OAKWOOD 1X	358	(\$262,377)	\$405,961	\$668,338	4,730	1	814	0
SHREVE 1X	359	(\$269,380)	\$909,524	\$1,178,904	12,491	2	816	0
NORTH HICKSVILLE 2X	360	(\$271,519)	\$710,176	\$981,695	9,904	2	818	1
OLDWASHIN 1X	361	(\$272,060)	\$396,278	\$668,338	4,733	1	819	0
RARDEN 3X	362	(\$276,804)	\$391,534	\$668,338	4,540	1	820	0
BROADACRE 1X	363	(\$280,007)	\$898,896	\$1,178,904	12,438	2	822	0
E.DELPHOS 1X	364	(\$280,587)	\$819,431	\$1,100,017	13,245	2	824	0
SHADYSIDE 1X	365	(\$281,618)	\$1,055,057	\$1,336,676	13,330	2	826	0
BEAVERDAM 1X	366	(\$285,505)	\$814,512	\$1,100,017	11,020	2	828	0
SO.MORRAL 1X	367	(\$287,554)	\$380,784	\$668,338	4,408	1	829	0
HOPEDALE 1X	368	(\$293,511)	\$611,479	\$904,990	7,474	1	830	0
WINTERSVI 1X	369	(\$299,023)	\$1,280,022	\$1,579,044	18,776	3	833	0
E.SPARTA 1X	370	(\$300,844)	\$799,174	\$1,100,017	11,439	2	835	0
PLEASANTV 1X	371	(\$301,843)	\$1,034,832	\$1,336,676	13,394	2	837	0
LEESVILLE 1X	372	(\$309,502)	\$358,836	\$668,338	4,312	1	838	0
CONTINETL 1X	373	(\$310,049)	\$789,968	\$1,100,017	9,715	2	840	0
BUCKSKIN 1X	374	(\$313,240)	\$1,336,786	\$1,650,026	16,451	3	843	0
NORTH END FOSTORIA 1X	375	(\$316,857)	\$209,491	\$526,348	4,755	1	844	0
E.LANCAST 2X	376	(\$321,550)	\$267,902	\$589,452	3,427	1	845	1
LEIPSIC 1X	377	(\$325,157)	\$727,539	\$1,052,696	9,302	2	847	0
ISLETA 1X	378	(\$325,188)	\$343,150	\$668,338	3,907	1	848	0
PROCTORVL 3X	379	(\$330,174)	\$1,006,502	\$1,336,676	12,524	2	850	0
OTWAY 1X	380	(\$330,319)	\$574,671	\$904,990	6,866	1	851	0
BELLAIRE 1X	381	(\$331,193)	\$768,824	\$1,100,017	12,043	2	853	1
E.HAVERHI 1X	382	(\$342,290)	\$757,727	\$1,100,017	10,315	2	855	0

Candidate	Rank	NPV	PV Benefits	PV Costs	Reduced CO2	Circuits	Total	OHA
S.CONVOY 1X	383	(\$346,840)	\$753,177	\$1,100,017	10,631	2	857	0
WILDCAT 1X	384	(\$350,587)	\$749,431	\$1,100,017	9,268	2	859	0
BROOM ROAD 1X	385	(\$358,378)	\$1,220,667	\$1,579,044	16,252	3	862	0
HIGHSTREE 1X	386	(\$364,629)	\$735,389	\$1,100,017	15,492	2	864	1
GLENWOOD 1X	387	(\$368,557)	\$731,461	\$1,100,017	8,076	2	866	0
DECLIFF 1X	388	(\$368,856)	\$810,047	\$1,178,904	9,796	2	868	0
BLOOMVILL 1X	389	(\$379,761)	\$525,228	\$904,990	5,790	1	869	0
STCLAIRSV 1X	390	(\$384,239)	\$284,098	\$668,338	3,359	1	870	0
SCIO 1X	391	(\$389,988)	\$946,688	\$1,336,676	11,986	2	872	0
STONYHOLL 1X	392	(\$393,170)	\$1,185,874	\$1,579,044	17,430	3	875	0
HILLNDALE 1X	393	(\$395,389)	\$783,515	\$1,178,904	11,141	2	877	0
CROTON 1X	394	(\$401,885)	\$266,453	\$668,338	2,964	1	878	0
SALINEVIL 1X	395	(\$403,879)	\$501,110	\$904,990	5,533	1	879	0
NEWCOMERS 1X	396	(\$404,012)	\$696,005	\$1,100,017	10,419	2	881	0
HARMAR HILL 1X	397	(\$404,385)	\$1,592,823	\$1,997,208	23,477	4	885	0
GEORGESRU 1X	398	(\$413,288)	\$923,388	\$1,336,676	12,259	2	887	0
PLEASANGR 1X	399	(\$421,216)	\$483,773	\$904,990	5,987	1	888	0
BRIDGEPORT 1X	400	(\$421,910)	\$678,108	\$1,100,017	8,901	2	890	0
N. CROWN CITY 1X	401	(\$427,435)	\$477,554	\$904,990	4,873	1	891	0
AMSTERDAM 1X	402	(\$428,081)	\$908,594	\$1,336,676	10,502	2	893	0
PANDORA 1X	403	(\$429,529)	\$670,488	\$1,100,017	10,059	2	895	0
CARROTHER 1X	404	(\$447,175)	\$457,815	\$904,990	5,032	1	896	0
ZOARVILLE 1X	405	(\$447,935)	\$888,741	\$1,336,676	10,360	2	898	0
NORTH HICKSVILLE 1X	406	(\$448,228)	\$533,466	\$981,695	7,366	2	900	1
MILL CREEK 3X	407	(\$454,539)	\$949,733	\$1,404,272	16,615	3	903	2
S.CADIZ 1X	408	(\$469,716)	\$198,622	\$668,338	3,168	1	904	1
N.MIDDLPT 1X	409	(\$471,555)	\$628,463	\$1,100,017	8,776	2	906	0
NEELYSVIL 1X	410	(\$483,584)	\$1,095,460	\$1,579,044	13,286	3	909	0
MUNGEN 1X	411	(\$486,029)	\$418,960	\$904,990	4,554	1	910	0
N.FREDERI 1X	412	(\$492,055)	\$607,962	\$1,100,017	8,474	2	912	0
ARLINGTON 1X	413	(\$494,983)	\$841,693	\$1,336,676	10,498	2	914	0
KILLBUCK 1X	414	(\$498,131)	\$406,859	\$904,990	5,306	1	915	0
PADEN CITY 2X	415	(\$507,180)	\$397,810	\$904,990	5,513	1	916	0
JONES CITY 1X	416	(\$514,471)	\$390,518	\$904,990	4,295	1	917	0
N.UPSANDU 1X	417	(\$516,380)	\$504,751	\$1,021,131	6,797	2	919	0
WARSAW 1X	418	(\$522,304)	\$656,600	\$1,178,904	6,988	2	921	0
FLUSHING 1X	419	(\$525,293)	\$574,724	\$1,100,017	6,358	2	923	0
WILLARD 1X	420	(\$526,701)	\$652,202	\$1,178,904	7,472	2	925	0
OTTOVILLE 1X	421	(\$535,746)	\$800,930	\$1,336,676	10,720	2	927	0
FOREST 2X	422	(\$544,621)	\$123,717	\$668,338	2,499	1	928	0
OHIOCITY 1X	423	(\$544,920)	\$123,417	\$668,338	1,418	1	929	0
FLAG CITY 1X	424	(\$566,663)	\$1,633,372	\$2,200,035	22,377	4	933	0
COALGROVE 1X	425	(\$581,311)	\$518,707	\$1,100,017	5,343	2	935	0

Candidate	Rank	NPV	PV Benefits	PV Costs	Reduced CO2	Circuits	Total	OHA
CONESVILL 1X	426	(\$603,207)	\$301,783	\$904,990	3,603	1	936	0
DUNKIRK 3X	427	(\$604,792)	\$731,884	\$1,336,676	8,195	2	938	0
BEARTOWN 1X	428	(\$614,801)	\$721,875	\$1,336,676	8,099	2	940	0
E.FINDLAY 1X	429	(\$615,312)	\$484,706	\$1,100,017	6,397	2	942	0
SENECAVILLE 1X	430	(\$626,754)	\$278,236	\$904,990	2,767	1	943	0
LATTY 1X	431	(\$628,127)	\$471,891	\$1,100,017	5,308	2	945	1
KIMBOLTON 1X	432	(\$629,141)	\$275,849	\$904,990	2,702	1	946	0
OTTAWA 1X	433	(\$649,661)	\$882,036	\$1,531,697	12,328	3	949	0
LOWELL 1X	434	(\$652,654)	\$526,250	\$1,178,904	6,011	2	951	0
MACKSBURG 2X	435	(\$671,907)	\$233,083	\$904,990	2,660	1	952	0
ANTWERP 1X	436	(\$701,906)	\$634,770	\$1,336,676	7,247	2	954	1
W.MOULTAN 1X	437	(\$716,658)	\$188,331	\$904,990	2,114	1	955	0
ROBYVILLE (#5007) 1X 2X	438	(\$726,712)	\$609,963	\$1,336,676	6,476	2	957	0
RUTLAND 1X	439	(\$762,895)	\$142,095	\$904,990	1,374	1	958	0
SHERWOOD 1X	440	(\$786,520)	\$550,155	\$1,336,676	6,070	2	960	0
WEST TRINWAY 1X	441	(\$808,843)	\$291,175	\$1,100,017	5,241	2	962	0
NEW MATAMORAS 1X	442	(\$816,892)	\$362,012	\$1,178,904	3,979	2	964	0
KOSSUTH 1X	443	(\$825,071)	\$79,918	\$904,990	328	1	965	0
RAY 1X	444	(\$923,432)	\$413,244	\$1,336,676	5,253	2	967	0
BLOOM 1X	445	(\$947,272)	\$702,754	\$1,650,026	8,318	3	970	0
MCDERMOTT 1X	446	(\$955,206)	\$381,469	\$1,336,676	3,862	2	972	0
E.SPRING 1X	447	(\$1,018,391)	\$318,285	\$1,336,676	2,958	2	974	0
COMMERCE 1X	448	(\$1,328,444)	\$713,818	\$2,042,263	13,636	4	978	0

6.3 Financial and Other Assumptions

Table 12
Financial Assumptions

Financial Evaluation Criteria		Value	
After-Tax Weighted Average Cost of Capital		7.80%	
Combined Federal & State Income Tax Rate		21.88%	
Local Property Tax Rate		3.05%	
Basis for Determining Property Tax		Net Book	
Depreciation of Capitalized Infrastructure		Tax Dep	SL Dep
Substation & Distribution (DACR and VVO)		SLD 30	SLD 30
Smart Meters (AMI)		SLD 15	SLD 15
Communication		SLD 5	SLD 5
Information Technology		SLD 5	SLD 5
Operations & Maintenance Category		Value	
T&D Infrastructure O&M - % of Plant:		3.0%	
Com Infrastructure O&M - % of Plant:		3.0%	
Info Tech Infrastructure O&M - % of Plant:		3.0%	
Annual Escalation Variables		Value	
Substation & Distribution Costs		1.5%	
Communication Costs		1.5%	
Information Technology Costs		1.5%	
Annual O&M Expenses		1.5%	
System Load Growth		1.0%	
Retail Power Costs		1.5%	
LBNL cost of interruptions		1.5%	

Other Assumptions and Notes:

1. Cisco™ field radios required for DACR and VVO installed is anticipated to be replaced every 10 years. Scheduled capital replacement of all Cisco™ field radios is included within all the DACR and VVO business cases.
2. All DACR and VVO business cases include capital costs and O&M costs associated Cisco's field network directory ("FND"). These costs may decrease if other AEP business units or operating companies choose to deploy Cisco's FND.
3. Silver Spring Networks™ ("SSN") field radio access points and relays required for AMI is assumed to be operated until they fail in-service. The cost to replace failed SSN access points and relays is

included within the AMI business case.

4. DACR controller hardware and software is anticipated to be replaced every 10 years. Scheduled capital replacement of this IT infrastructure is included within all the business cases for each DACR scheme candidate.
5. VVO controller hardware and software is anticipated to be replaced every 8 years. Scheduled capital replacement of this IT infrastructure is included within all the business cases for each VVO bus candidate.
6. The business case for each VVO bus candidate assumes that AMI is deployed and software licenses are purchased for the VVO vendor's AMI module, which enables voltage reduction be increased from 3 percent to 4 percent to achieve greater energy savings.
7. The business case for each DACR scheme candidate assumes that outage frequency (SAIFI) is reduced 15.8 percent.
8. Reduced CO₂ emissions over 15 years assume AEP Ohio's electricity CO₂ emission factor of 0.88 metric tons per MWh remains unchanged over the 15 year business case for each VVO bus candidate.
9. Reduced CO₂ emissions over 15 years associated with vehicles is based on the gasoline CO₂ emission factor of 19.60 lbs. of CO₂ per gallon.
10. The topology and baseline reliability of all distribution circuits and DACR scheme candidates remains unchanged over the 15 year study period.
11. The topology of distribution circuits and VVO bus candidates remains unchanged over the 15 year study period.

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Summary: Correspondence -in reference to Phase 3 Feasibility Study enclosed electronically filed by Mr. Steven T Nourse on behalf of Ohio Power Company