AMERICAN ELECTRIC POWER

BOUNDLESS ENERGY™

Legal Department

American Electric Power
1 Riverside Plaza
Columbus, OH 43215-2373
AEP.com

February 2, 2018

The Honorable Richard Bulgrin
Attorney Examiner
Public Utilities Commission of Ohio
180 East Broad Street
Columbus, Ohio 43215-3793

Steven T. Nourse
Chief Ohio Regulatory Counsel
(614) 716-1608 (P)
(614) 716-2014 (F)
stnourse@aep.com

Re: *In the Matter of the Implementation of the gridSMART Phase 2 Rider of Ohio Power Company;* Case No. 18-0203-EL-RDR

Dear Examiner Bulgrin:

Consistent with the Joint Stipulation and Recommendation filed in Case No. 13-1939-EL-RDR on April 7, 2016, and the Opinion and Order issued in that case on February 1, 2017, enclosed please find Ohio Power Company's gridSMART Phase 2 Feasibility and Selection Study Draft Report.

Sincerely,

/s/ Steven T. Nourse
Steven T. Nourse

cc: Parties of Record

AEP Ohio

Phase 2 Feasibility and Selection Study Draft Report

January 30, 2018

Phase 2 Feasibility and Selection Study Draft Report

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Phase 2 Feasibility and Selection Study Report

1 Executive Summary

American Electric Power's ("AEP") Ohio's 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. This 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 3 Full System Feasibility Study" is a benefit-cost analysis or business case justification of all future anticipated AMI, DACR, and VVO Phase 3 deployments within all remaining areas of AEP Ohio's service area. The Phase 3 Full System Feasibility Study will be presented in a separate report. AEP Ohio's planned Phase 2 deployment of AMI, DACR, and VVO has already been approved by the Commission subject to specific requirements described within the Commission's order. This document, the "Phase 2 Feasibility and Selection Study" report, fulfills one of these requirements by describing 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 2 of this report provides additional background on AEP Ohio's previous smart grid deployments and an overview of the regulatory process culminating in the Commission's final order. Objectives cited throughout the Commission's order applicable to both AEP Ohio's authorized Smart Grid Phase 2 and future anticipated Smart Grid Phase 3 deployments are summarized within Section 3 of this report. A common theme among all the objectives identified in Section 3 is to "maximize customer and company benefits." [1] The remainder of this Executive Summary is dedicated to providing an overview of the proposed prioritization and selection methodologies described in Sections 4.1 through 4.5 of this report that fulfill all AMI, DACR, and VVO objectives and deliver value for AEP Ohio and its retail customers.

1.1 Ranking DACR and VVO Candidates

Societal economic benefits to customers by improving electric service reliability are already well documented through research sponsored by the U.S. Department of Energy's Lawrence Berkley National Laboratory ("LBNL").[2] AEP Ohio applied the results of this LBNL sponsored research to estimate the societal economic benefits of improved distribution reliability achievable associated with its proposed DACR deployment that was recognized and approved by order of the Commission in February 2017. The Commission agreed with LBNL sponsored research findings that retail customers realize maximum societal economic benefits when AEP Ohio, and electric utilities generally, emphasize reducing

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

[2] 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."

customer-minutes of interruption (i.e. unserved kilowatt-hours or "kWh") and outage frequency or the System Average Interruption Frequency Index ("SAIFI") in their reliability improvement programs.

An obvious implication of the findings of this LBNL sponsored research is that reducing outage frequency or SAIFI and reducing customer-minutes of interruption ("CMI") represent two important criteria to fulfill AEP Ohio's DACR objectives of maximizing customer reliability benefits. However, AEP Ohio also uses a third criterion, the System Average Interruption Duration Index ("SAIDI"), to complement CMI and SAIFI and satisfy a Commission requirement to include poorly performing circuits (including worst performers) when prioritizing circuits for DACR deployment.[3] This objective data driven approach enables AEP Ohio to individually prioritize or rank the reliability of all circuits grouped into candidate DACR schemes in order from the lowest reliability to best using their equally weighted three-year reliability data for CMI, SAIFI, and SAIDI values.[4]

AEP Ohio's proposed VVO prioritization criteria is similar to DACR, but is based on load, not reliability. An objective data driven approach is to individually prioritize or rank all candidate VVO distribution bus loads (and their connected circuits) from greatest to least using their equally weighted megavolt-ampere ("MVA") demand and total megawatt-hours ("MWh") of energy delivered.

Sections 4.1 and 4.2 of this report provides an in-depth presentation, analysis, and several tables illustrating the prioritization methodology and criteria used to rank AEP Ohio's candidate DACR schemes and candidate VVO distribution buses. A comprehensive list of the top 43 ranked DACR scheme candidates (249 circuits) and the top 25 ranked VVO distribution bus candidates (157 circuits) is provided in Sections 5.1 and 5.2 of the Appendix respectively.

1.2 Business Case Analysis and Selection of DACR and VVO Candidates

All the prioritization criteria and methodologies presented in this Executive Summary (and Sections 4.1 and 4.2) to rank DACR scheme and VVO bus candidates also represent the metrics associated with benefits delivered to AEP Ohio and its customers. For example, the net change or reduction in CMI, SAIFI, and SAIDI that may be realized by deploying DACR are measures associated with improved reliability. Similarly, the net change or reduction in demand and energy that may be realized by deploying VVO are measures associated with improving energy efficiency. However, the criteria used to measure the benefits of improved reliability and energy efficiency do not by themselves represent the value delivered to AEP Ohio or its customers. The benefits achievable with DACR and VVO must be monetized because they do not randomly materialize nor are they free. Monetized benefits represent AEP Ohio operating savings, tangible customer savings, and societal economic impacts achieved as a result of AEP Ohio's direct investment in DACR and VVO technology.

AEP Ohio will prepare a benefit-cost analysis or "business case" for every ranked candidate DACR scheme and VVO distribution bus developed using the criteria and methodologies later presented in this

[3] Worst performing circuits are defined by Ohio administrative Rule 11 as circuits in the bottom 8 percent of distribution circuits with the poorest reliability.

[4] DACR schemes represent the combined CMI, SAIFI, and SAIDI values representing two or more interconnected distribution circuits.

report. A business case for each DACR and VVO candidate is essential to ensure that AEP Ohio is delivering the greatest monetized benefits minus the costs (i.e. ***net*** benefits) to procure, deploy, operate, and maintain the proposed DACR and VVO infrastructure.[5,6] (The benefit-cost analysis or business case model developed for the Phase 2 Feasibility and Selection Study is the same model that will be used for the Phase 3 Full System Feasibility Study.[7]) Preparing a business case for each DACR and VVO candidate will enable AEP Ohio to assemble a DACR portfolio and a VVO portfolio that may be prioritized and ranked according to the greatest net monetized benefits that may be realized by AEP Ohio and its customers.

Section 4.3 of this report provides an in-depth presentation, analysis, and several example tables and graphs illustrating how AEP Ohio's business case portfolio concept will be used to prioritize and rank DACR and VVO candidates for deployment.

The prioritization criteria, methodologies, and business case approach presented in this Executive Summary (and Sections 4.1 through 4.3) will provide AEP Ohio guidance throughout the planned Smart Grid Phase 2 (and possible Phase 3) deployment lifecycle. However, Section 4.4 of this report describes an annual prioritization and selection update process that will be used by AEP Ohio to revise all underlying data, rankings, and the business case portfolio model to ensure only DACR and VVO candidates delivering the greatest net monetized benefits to AEP Ohio and its customers are selected for deployment.

1.3 AMI Prioritization and Selection

AEP Ohio's AMI deployment strategy for the Smart Grid Phase 2 project is to deploy smart meters within the most densely populated cities of its Ohio service area to deliver maximum customer and utility benefits and minimize AMI communication infrastructure costs. Also, prioritizing AMI deployment to portions of the AEP Ohio service area with the greatest population density fulfills the AMI objectives (see Section 3) of making meter interval data available to the largest number of customers and CRES providers. In addition, AEP Ohio's AMI strategy retains a large proportion of the existing one-way AMR system in favor of replacing approximately 894,000 aging electromechanical meters in 43 cities across the AEP Ohio service area.[8] AEP Ohio has already prepared a variety of geospatial models, tools, and algorithms coupled with a review by the utility's subject matter experts to ensure the deployment area and boundary was optimized for each of the 43 cities within the Phase 2 AMI deployment area.

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[5] The monetized benefits associated with DACR include the societal economic benefits associated with improved reliability identified by research sponsored by LBNL (see Footnote 2) and AEP Ohio operational savings.

[6] The monetized benefits associated VVO include avoided AEP Ohio capacity and energy costs and reduced retail power costs to AEP Ohio customers. Reduction in greenhouse gas emissions are identified in the business case, but not monetized pending establishment of an incentivized U.S. cap-and-trade, tax credit, or other program.

[7] The Phase 3 Full System Feasibility Study includes an AMI business case, which is not required for the Phase 2 Feasibility and Selection Study or required for AEP Ohio's Smart Grid Phase 2 AMI deployment.

[8] The marginal benefit of replacing the existing 1-way AMR system with a new 2-way AMI system in unlikely to exceed the marginal cost.

The use of geospatial models, tools, and algorithms to prioritize AMI deployment within the most densely populated cities of AEP Ohio's service area is an effective approach to deliver customer and utility benefits and minimize communication infrastructure costs. However, identifying where AMI should be deployed does not necessarily equate to scheduling AMI deployment starting in the city with the most smart meters and ending in the city with the fewest smart meters. AEP Ohio's AMI deployment plan includes developing a trained workforce needed to support approximately 894,000 smart meters in 43 cities across Ohio, but with net fewer employees in traditional roles such as meter reading. Transitioning to a workforce trained in AMI operations with fewer employees requires that AEP Ohio: (1) retrain some employees for other positions, (2) anticipate normal attrition as some employees retire or pursue other opportunities, and (3) plan for involuntary separations of some employees from the company as a last resort. The realities associated with transitioning the workforce requires that AEP Ohio cannot deploy AMI strictly according to population density. AEP Ohio must plan its AMI deployment in areas where the greatest number of experienced personnel are available to assist with training and better adjust to employee retirements, attrition, or involuntary separations.

Maps illustrating the proposed AMI deployment areas using this geospatial approach to prioritizing AMI deployment for each of the 43 cities across the AEP Ohio service area is provided in Section 5.3 of the Appendix. In addition to these maps, Table 8 summarizes the total number of smart meters anticipated to be deployed within each city.

2 Background and Overview

Several operating companies of American Electric Power's ("AEP") eleven state system have completed, are planning to implement, or are presently deploying a variety of smart grid technologies to automate traditional electric utility distribution functions. For example, AEP's Ohio operating company ("AEP Ohio") received approval in 2009 from the Public Utilities Commission of Ohio ("Commission") to begin its Smart Grid Phase 1 deployment of various automation or smart grid technologies within a pilot area located in northeast Columbus, Ohio.[9] These smart grid technologies included: advanced metering infrastructure ("AMI"), distribution automation circuit reconfiguration ("DACR"), and Volt-VAR optimization ("VVO").

The experience gained by AEP Ohio staff and performance of these technologies encouraged AEP Ohio in 2014 to submit an application with the Commission seeking approval of its proposed "Smart Grid Phase 2" project to expand the deployment of AMI, DACR and VVO beyond northeast Columbus to additional locations throughout much of AEP Ohio's service area.

Many groups representing a variety of industry and consumer interests were granted status as interveners by the Commission allowing them to participate in all the Commission's proceedings involving AEP Ohio's application and case. AEP Ohio and these intervening groups eventually reached a settlement agreement in February 2016, the "GS2 Stipulation" and approved by order of the Commission in February 2017. [10, 11]

The GS2 Stipulation approved by order of the Commission requires AEP Ohio implement a metrics and verification program to formally evaluate benefits in lieu of developing additional business cases further justifying the utility's proposed Smart Grid Phase 2 deployment. Also, the GS2 Stipulation requires AEP Ohio prepare and submit to the Commission two engineering feasibility and selection studies within a year of the Commission's order. The "Phase 3 Full System Feasibility Study" is a benefit-cost analysis or business case justification of all future anticipated AMI, DACR, and VVO Phase 3 deployments within all remaining areas of AEP Ohio's service area. The Phase 3 Full System Feasibility Study will be presented in a separate report. AEP Ohio's planned Phase 2 deployment of AMI, DACR, and VVO has already been approved by the Commission subject to specific requirements described within the GS2 Stipulation and the Commission's order. This document, the "Phase 2 Feasibility and Selection Study" report, fulfills one of these requirements by describing how AEP Ohio will prioritize and select locations where AMI, DACR, and VVO will be deployed within the Smart Grid Phase 2 project area.

3 Feasibility and Selection Study Objectives

Objectives of the Phase 2 Feasibility and Selection Study are interspersed throughout the text of the GS2 Stipulation and within the Commission's order approving the GS2 Stipulation. Table 1 summarizes these objectives using specifics quotes from the GS2 Stipulation. Each of these objectives are applicable for

[9] AEP Ohio originally referenced its automation initiatives as "gridSMART", but has rebranded it as "Smart Grid."

[10] AEP Ohio Stipulation and Recommendation filing with the Commission dated February 29, 2016.

[11] Commission Opinion and Order dated February 1, 2017.

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 is to "maximize customer and company benefits for the technologies proposed." [12]

Table 1
Smart Grid Technology Objectives

DACR [13]	". . . prioritize those circuits that have been the worst performing in recent years and identify those circuits which will yield maximum customer reliability benefits . . ." [14] ". . . consider prioritizing those circuits that have a . . . history of appearing on the AEP Ohio Rule 11 Report (worst performing circuit list) in recent years." [15] ". . . prioritizing those circuits that have the greatest outage improvement opportunity " [16] ". . . fully document the circuit selection process including examination of the expected reliability considerations associated with DACR." [17]
VVO	". . . customer bill savings attributable to energy and capacity savings . . . " [18] ". . . quantify the air emission benefits from the program (resulting from any VVO efficiency gains . . .)" [19]
AMI	". . . 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" [20]

Section 4 of this Phase 2 Feasibility and Selection Study report will present specific prioritization and selection processes that fulfill all Table 1 objectives for AMI, DACR, and VVO. These prioritization and selection processes are intended to provide AEP Ohio guidance throughout the lifecycle of its planned

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

[13] The Commission Opinion and order dated February 1, 2017 in Section IV (D), Par. 24 identifies a criterion that these DACR objectives are fulfilled by ". . . achieving a 3-year average annual improvement of 15.8 percent, excluding major events, in . . . SAIFI, on the aggregated performance of DACR-installed circuits . . . " The GS2 Stipulation specifies a secondary criterion on DACR performance whenever the SAIFI target cannot be achieved, but this is outside the scope of the Phase 2 Feasibility and Selection Study and the Phase 3 Full System Feasibility Study.

[14] Commission Opinion and Order dated February 1, 2017, Section IV (B), Par. (22).

[15] GS2 Stipulation dated February 29, 2016, Section IV (1) (C) (i) (b), p. 5.

[16] Commission Opinion and Order dated February 1, 2017, Section V (B), Par. (57).

[17] GS2 Stipulation dated February 29, 2016, Section IV (1) (B) (iv), p. 4.

[18] Commission Opinion and Order dated February 1, 2017, Section V (B), Par. (52)

[19] Commission Opinion and Order dated February 1, 2017, Section IV (K), Par. (38).

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

Smart Grid Phase 2 deployments. Also, these prioritization and selection processes will be used during development of the Phase 3 Full System Feasibility Study and guide future Phase 3 deployments.

4 Prioritization and Selection

A common theme among all the objectives identified in Table 1 is to "maximize customer and company benefits." [21] AMI, DACR, and VVO are smart grid technologies gaining wide acceptance because they enable utilities including AEP Ohio to deliver tangible and intangible value or benefits to both utility operations and retail customers. The value or benefit streams enabled by each of these technologies differ because they're chiefly aimed at automating specific utility tasks, functions, and processes traditionally performed by utility personnel.

AMI is primarily aimed at automating traditional meter reading, billing, and connect-disconnect related functions, DACR automates traditional outage detection, response, switching, and fault isolation functions, and VVO is most frequently viewed as automating distribution feeder voltage profiles to optimize energy consumption and efficiency.[22] Because AMI, DACR, and VVO technologies are aimed at automating different traditional tasks, functions, or processes, the prioritization methodologies and criteria for maximizing benefits will also necessarily differ.

The proposed prioritization methodologies and criteria required to fulfill Table 1 objectives of AMI, DACR, and VVO are developed and presented within Sections 4.1 through 4.5 of this report.

4.1 Ranking DACR Candidates

Societal economic benefits to customers by improving electric service reliability are already well documented through research sponsored by the U.S. Department of Energy's Lawrence Berkley National Laboratory ("LBNL").[23] The results of this research on the societal economic benefits of improved electric service reliability has been referenced in numerous studies and by other electric utilities to justify their proposed smart grid programs. Similarly, AEP Ohio referenced results of this research within its original 2014 Smart Grid Phase 2 application to the Commission. Also, the relevance of applying the findings of this LBNL sponsored research to estimate societal economic benefits of improved distribution reliability for AEP Ohio retail customers was recognized by all signatory parties to the SG2 Stipulation that was approved by the Commission within its February 2017 order and opinion. LBNL sponsored research determined that retail customers realize maximum societal economic benefits when AEP Ohio, and electric utilities generally, emphasize reducing customer-minutes of interruption (i.e. unserved kilowatt-hours or "kWh") and outage frequency or the System Average Interruption Frequency Index ("SAIFI") in

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

[22] Each of these smart grid technologies present some overlaps (e.g. both DACR and AMI offer outage detection capabilities), but these overlaps are largely complimentary and generally not regarded as competing technologies.

[23] 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."

their reliability improvement programs. Another closely related finding of this research is that a "reduction in outage duration is less valuable than a reduction of outage frequency when the reduction in unserved kWh is equal." [15]

An obvious implication of the findings of this LBNL sponsored research is that reducing outage frequency or SAIFI and reducing customer-minutes of interruption ("CMI") represent two important criteria to fulfill AEP Ohio's DACR objectives of maximizing customer reliability benefits previously identified in Table 1. However, Table 1 also identifies prioritizing worst performing distribution circuits including circuits where AEP Ohio has the greatest opportunity to improve reliability. Relying solely on CMI and SAIFI will likely capture many of the "worst performing circuits"; however, these criteria alone are insufficient to capture all circuits with poorer reliability generally, much less circuits among the worst performing group.[24]

The reason why prioritizing distribution circuits for DACR using only CMI and SAIFI is unlikely to identify all circuits with poor reliability is illustrated by AEP Ohio's distribution reliability data. Figures 1, 2, and 3 on pages 8-9 represent three x-y scatter plots of AEP Ohio reliability data over the same three year period ending June 2016 that excludes major events and transmission outages. Figures 1 and 2 illustrate there are wide variances in SAIFI and the System Average Interruption Duration Index ("SAIDI") respectively for a given value in CMI.[25]

[24] Worst performing circuits are defined by Ohio administrative Rule 11 as circuits in the bottom 8 percent of distribution circuits with the poorest reliability.

[25] Distribution circuits with "high" CMI values may include longer, infrequent outages or shorter, more frequent outages for a given number of customers.

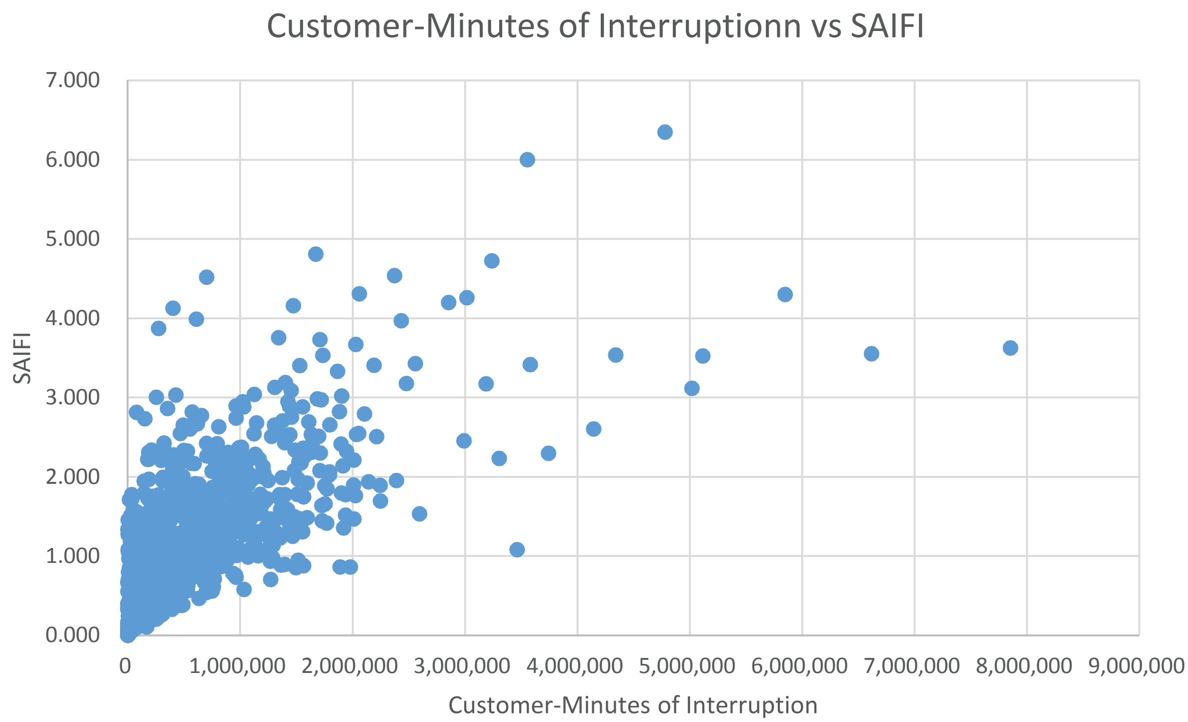

Figure 1: Scatter plot of customer-minutes of interruption versus SAIFI

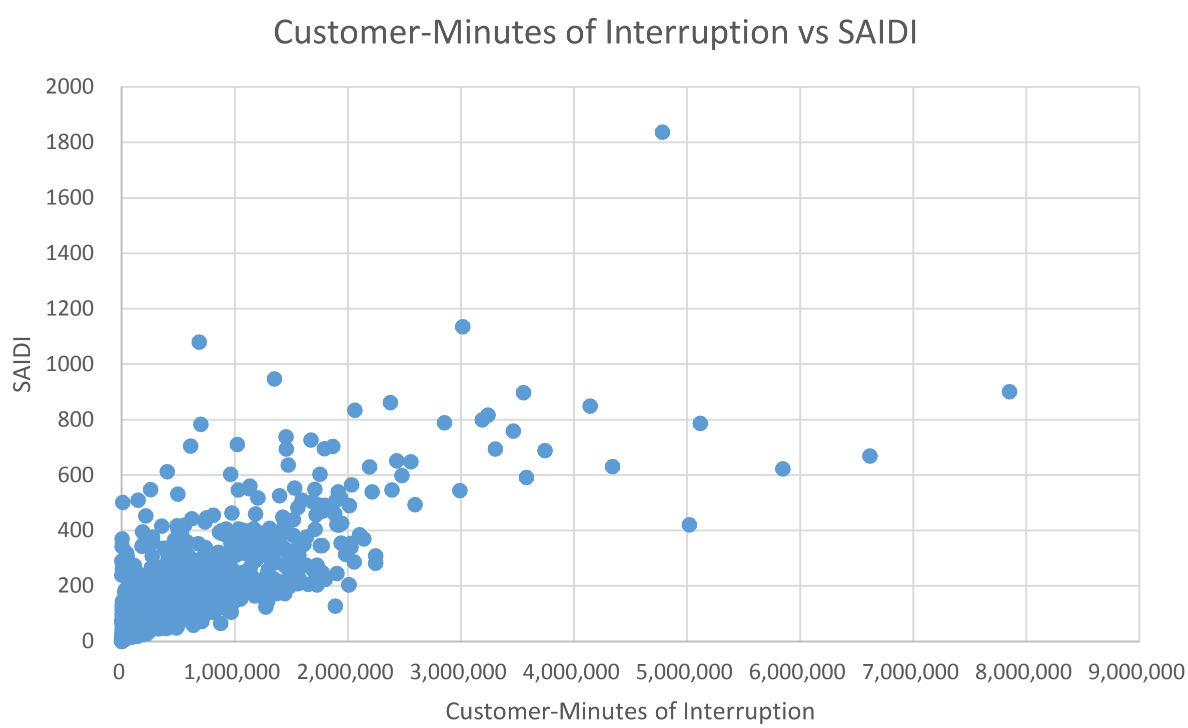

Figure 2: Scatter plot of customer-minutes of interruption versus SAIDI.

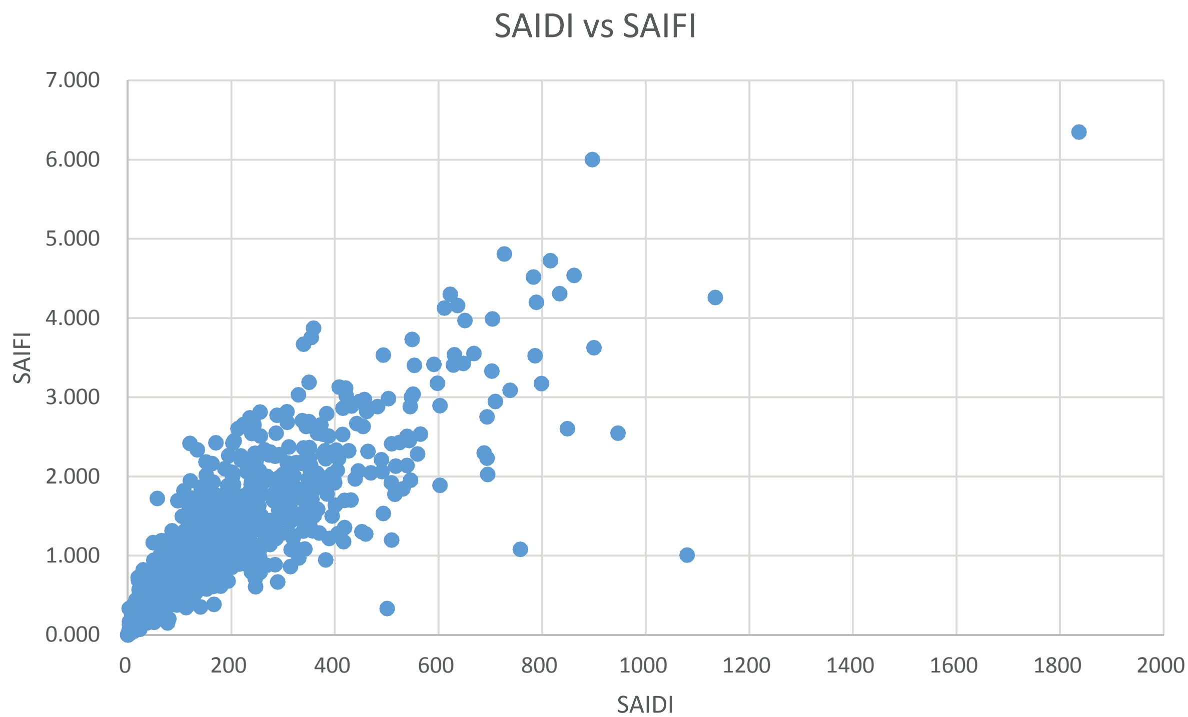

Figure 3: Scatter plot of SAIDI versus SAIFI.

Prioritizing circuits or groupings of circuits into candidate DACR schemes based solely on reducing CMI will include circuits with both lower and higher SAIFI and SAIDI values. However, one of the Table 1 DACR objectives is to prioritize circuits where the greatest opportunity exists to improve reliability, which are circuits with higher SAIFI and SAIDI values. Similarly, Figure 3 illustrates there are wide variances in SAIFI for a given value in SAIDI. Prioritizing circuits for DACR based solely on their SAIDI value will include circuits with both lower and higher SAIFI values.

AEP Ohio concludes from its reliability data that a third criterion, SAIDI, is needed to complement CMI and SAIFI to identify poorly performing circuits (including worst performers) and prioritize circuits for DACR deployment. CMI and SAIFI are required to be consistent with the findings of LBNL sponsored research. However, using CMI, SAIFI, and SAIDI as prioritization criteria is necessary to:

1. Avoid the obvious limitations of missing some poorly performing circuits and schemes by only using only CMI and SAIFI in the prioritization process, and
2. Fulfill all Table 1 DACR objectives to deliver maximum benefits by prioritizing circuit schemes with a history of poor reliability performance (including many Rule 11 circuits) that also serve a larger number of customers.

An objective data driven approach is to individually prioritize or rank the reliability of all DACR scheme and circuit candidates in order from the lowest reliability to best using their equally weighted three-year reliability data for CMI, SAIFI, and SAIDI values.[26] Table 2 on page 11 identifies the top 3 ranked circuit

[26] DACR schemes represent the combined CMI, SAIFI, and SAIDI values representing two or more interconnected

schemes (and their respective substations and distribution circuits) where DACR may be deployed using this methodology and approach to fulfill all Table 1 DACR objectives. This objective data driven approach to rank candidate DACR schemes on the basis of poor reliability will by definition include many circuits presently identified on AEP Ohio's Rule 11 report. For example, a comprehensive listing of the top 43 ranked circuit schemes involving 249 circuits where DACR may be deployed is provided in Section 5.1 of the Appendix. Also, this comprehensive listing identifies 53 distribution circuits that have appeared 2 or more times on AEP Ohio's annual Rule 11 reports for the 5 year period ending August 31, 2016. However, AEP Ohio must specifically "consider prioritizing those circuits that have a . . . history of appearing on the AEP Ohio Rule 11 Report." [27] Section 4.4 of this report describes how these Rule 11 circuits will influence the schedule of DACR deployment.

4.2 Ranking VVO Candidates

AEP Ohio's proposed VVO prioritization criteria is similar to DACR, but is based on load, not reliability. An objective data driven approach is to individually prioritize or rank all candidate VVO distribution bus loads (and their connected circuits) from greatest to least using their equally weighted megavolt-ampere ("MVA") demand and total megawatt-hours ("MWh") of energy delivered. Table 3 on page 12 identifies the top 3 ranked substation distribution buses (and their respective distribution circuits) where VVO may be deployed using this methodology and approach to fulfill all Table 1 VVO objectives. This objective data driven approach to rank VVO candidates based on their demand and total energy delivered will likely include many circuits serving Ohio Hospital Association ("OHA") members. For example, a comprehensive view of the top 25 ranked distribution buses involving 157 circuits where VVO may be deployed is provided in Section 5.2 of the Appendix. Also, this comprehensive listing identifies 8 distribution circuits that serve OHA members. However, AEP Ohio must "work with Staff and OHA members to prioritize the Company's VVO deployment." [28] Section 4.4 of this report describes how the location of OHA members will influence the schedule of VVO deployment.

Table 2
Sample DACR Prioritization Results

Rank	Scheme/Substation/Circuit	Rule 11	CMI	SAIDI	SAIFI
1	**CRC416**		**15,673,151**	**722.73**	**3.362**
	CLINTON		15,673,151	722.73	3.362
	0002904	No	1,204,276	393.04	1.998
	0002908	No	7,852,537	900.11	3.626
	0002910	Yes	6,616,338	668.45	3.551
2	**CRC035**		**15,253,749**	**598.94**	**3.088**
	CLARK STREET		4,022,332	620.06	3.325
	0022903	Yes	1,166,979	406.90	2.221
	0022904	Yes	2,855,353	788.99	4.200

distribution circuits.

[27] GS2 Stipulation dated February 29, 2016, Section IV (1) (C) (i) (b), p. 5.

[28] Commission Opinion and Order dated February 1, 2017, Section IV (E), Par. (27).

Rank	Scheme/Substation/Circuit	Rule 11	CMI	SAIDI	SAIFI
	ELLIOT		7,920,974	611.89	3.479
	0011301	Yes	4,341,032	630.51	3.536
	0011302	Yes	3,579,942	590.75	3.413
	LEE		3,310,443	548.45	1.994
	0011001	No	1,516,625	438.97	1.969
	0011002	No	1,793,818	695.01	2.026
3	**CRC029**		**12,139,403**	**470.85**	**3.077**
	ADDISON		403,957	179.14	1.196
	0013203	No	403,957	179.14	1.196
	BASHAN		1,528,643	553.46	3.402
	0012902	No	1,528,643	553.46	3.402
	COOLVILLE		2,012,242	489.48	2.212
	0013101	No	2,012,242	489.48	2.212
	HEMLOCK		68,065	70.75	1.185
	0038802	No	68,065	70.75	1.185
	MEIGS		5,659,088	599.48	4.137
	0017002	No	2,104,671	384.20	2.791
	0017001	Yes	3,554,417	897.13	5.999
	POMEROY		1,974,826	466.64	2.975
	7409602	Yes	1,719,612	456.61	2.972
	7409603	Yes	255,214	547.67	3.002
	RACINE		492,582	243.85	2.651
	7730001	No	492,582	243.85	2.651

Table 3
Sample VVO Prioritization Results

Rank	Substation Bus	OHA Members	Circuit No.	MVA NCP	MWh
1	POLARIS (#0094) 1X 2X			62.39	230,330
		No	0009431	11.26	36,118
		No	0009432	14.21	69,444
		No	0009433	12.53	39,688
		No	0009434	9.70	26,599
		No	0009435	14.70	58,481
2	TRABUE (#0036) 1X 2X			69.01	206,611
		No	0003601	8.34	8,790
		No	0003602	9.15	36,302
		No	0003603	5.57	7,071
		No	0003604	7.84	29,731
		No	0003605	6.65	22,797
		No	0003606	5.10	22,543
		No	0003607	10.19	22,224
		No	0003608	8.47	27,599
		No	0003609	7.71	29,556
3	BETHEL ROAD (#0026) 1Y 2Y			62.22	223,282
		No	0002603	6.73	38,585
		No	0002604	8.20	30,794
		No	0002605	7.06	18,779

Rank	Substation Bus	OHA Members	Circuit No.	MVA NCP	MWh
		No	0002606	6.74	20,774
		No	0002608	7.22	25,372
		No	0002613	7.14	23,770
		No	0002614	5.36	17,823
		No	0002615	5.21	16,724
		Yes	0002617	8.56	30,660

4.3 DACR and VVO Benefit-Cost Analysis

This Phase 2 Feasibility and Selection Study report has presented two objective data driven approaches describing how AEP Ohio will rank DACR scheme and VVO bus candidates. Section 4.1 presented the prioritization criteria and methodology to rank and order all candidate DACR schemes from the least reliable to the most reliable. Likewise, Section 4.2 presented the prioritization criteria and methodology to rank and order all candidate VVO distribution buses with the highest demand and energy to the least.

All the prioritization criteria and methodologies presented in Sections 4.1 and 4.2 of this report to rank DACR scheme and VVO bus candidates respectively also represent the metrics associated with benefits delivered to AEP Ohio and its customers. For example, the net change or reduction in CMI, SAIFI, and SAIDI that may be realized by deploying DACR are measures associated with improved reliability. Similarly, the net change or reduction in demand and energy that may be realized by deploying VVO are measures associated with improving energy efficiency. However, the criteria used to measure the benefits of improved reliability and energy efficiency do not by themselves represent the value delivered to AEP Ohio or its customers. The benefits achievable with DACR and VVO must be monetized because they do not randomly materialize nor are they free. Monetized benefits represent AEP Ohio operating savings, tangible customer savings, and societal economic impacts achieved as a result of AEP Ohio's direct investment in DACR and VVO technology.

AEP Ohio will prepare a benefit-cost analysis or "business case" for every ranked candidate DACR scheme and VVO distribution bus developed using the criteria and methodologies presented in this report. A business case for each DACR and VVO candidate is essential to ensure that AEP Ohio is delivering the greatest monetized benefits minus the costs (i.e. *net* benefits) to procure, deploy, operate, and maintain the proposed DACR and VVO infrastructure.[29,30] (The benefit-cost analysis or business case model developed for the Phase 2 Feasibility and Selection Study is the same model that will be used for the Phase 3 Full System Feasibility Study.[31]) Preparing a business case for each DACR and

[29] The monetized benefits associated with DACR include the societal economic benefits associated with improved reliability identified by research sponsored by LBNL (see Footnote 23) and AEP Ohio operational savings.

[30] The monetized benefits associated VVO include avoided AEP Ohio capacity and energy costs and reduced retail power costs to AEP Ohio customers. Reduction in greenhouse gas emissions are identified in the business case, but not monetized pending establishment of an incentivized U.S. cap-and-trade, tax credit, or other program.

[31] The Phase 3 Full System Feasibility Study includes an AMI business case, which is not required for the Phase 2 Feasibility and Selection Study or required for AEP Ohio's Smart Grid Phase 2 AMI deployment.

VVO candidate will enable AEP Ohio to assemble a DACR portfolio and a VVO portfolio that may be prioritized and ranked according to the greatest net monetized benefits that may be realized by AEP Ohio and its customers.

AEP Ohio's business case portfolio concept to prioritize and rank DACR and VVO candidates for deployment is best illustrated using two examples. Table 4 on page 14 illustrates an example portfolio consisting of 25 circuit scheme candidates numbered 1 through 25 where DACR may be deployed.[32] Assume for this example portfolio that a business case to deploy DACR has been prepared for each candidate scheme and the summarized results posted to Table 4. Each of the candidates within this table are identified by a numbering scheme in column 2 and columns 3 through 5 summarizes the estimated benefits, costs, and ***net*** benefits, i.e. benefits minus costs for all distribution circuits within the scheme.[33] This table is arranged to list all 25 DACR candidates in descending order of priority from candidates with the highest net benefits to candidates with the lowest (or most negative) net benefits and ranked 1 through 25 in column 1. The bar chart in Figure 4 on page 17 illustrates the same ranking of DACR candidates based on their net benefits.

Table 4
Example Business Case Portfolio of DACR Candidates (Thousands, $000s)

Rank	Candidate No.	Benefits	Costs	Net Benefits
1	11	$975	$38	$937
2	21	$946	$302	$644
3	25	$730	$148	$582
4	20	$668	$200	$468
5	10	$476	$11	$465
6	13	$528	$102	$426
7	4	$772	$374	$398
8	12	$393	$120	$273
9	6	$546	$296	$250
10	8	$363	$127	$236
11	14	$763	$550	$213
12	15	$451	$261	$190
13	7	$334	$193	$141
14	3	$265	$226	$39
15	2	$971	$950	$21

[32] 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.

[33] The business case prepared for each candidate is anticipated to represent the cumulative net present value of annual net monetized benefit cash flows over a 15-year period discounted at AEP Ohio's after-tax weighted average cost of capital.

16	23	$843	$829	$14
17	19	$883	$937	($54)
18	24	$740	$797	($57)
19	1	$263	$321	($58)
20	18	$480	$741	($261)
21	16	$98	$364	($266)
22	5	$65	$356	($291)
23	17	$253	$640	($387)
24	22	$183	$627	($444)
25	9	$125	$641	($516)

Similar to the DACR portfolio, Table 5 on page 15 illustrates an example portfolio of 25 distribution bus candidates numbered 1 through 25 where VVO may be deployed.[34] Also, assume for this example portfolio that a business case to deploy VVO has been prepared for each candidate distribution bus and the summarized results posted to Table 5. Each of the candidates within this table are identified by a numbering scheme in column 2 and columns 3 through 5 summarizes the estimated benefits, costs, and net benefits for all distribution circuits connected to the distribution bus.[25] Similar to Table 4, this table is also arranged to list all 25 VVO candidates in descending order of priority from candidates with the highest net benefits to the lowest and ranked 1 through 25 in column 1. Finally, similar to Figure 4, the bar chart in Figure 5 on page 17 illustrates the same ranking of VVO candidates based on their net benefits.

Table 5
Example Business Case Portfolio of VVO Candidates (Thousands, $000s)

Rank	Candidate No.	Benefits	Costs	Net Benefits
1	20	$984	$46	$938
2	14	$758	$36	$722
3	15	$986	$320	$666
4	18	$920	$258	$662
5	23	$896	$244	$652
6	13	$990	$470	$520
7	2	$967	$491	$476
8	21	$863	$530	$333
9	10	$386	$93	$293
10	11	$768	$534	$234
11	19	$447	$225	$222
12	4	$890	$671	$219
13	3	$835	$638	$197
14	22	$649	$536	$113

[34] Each VVO bus candidate includes one or more distribution circuits connected to the same low-side distribution bus and power transformer(s) within the substation.

15	12	$770	$694	$76
16	6	$14	$19	($5)
17	1	$828	$955	($127)
18	7	$666	$801	($135)
19	8	$295	$485	($190)
20	9	$410	$653	($243)
21	25	$285	$532	($247)
22	5	$611	$936	($325)
23	17	$132	$676	($544)
24	16	$345	$960	($615)
25	24	$297	$946	($649)

An inspection of the business cases within the two example portfolios illustrates that several of the DACR and VVO candidates are estimated to have postive net benefits. Candidates with positive net benefits are economically attractive for DACR and VVO deployment because their estimated benefits exceed their costs. DACR and VVO candidates are ideally prioritized based on their respective net benefits. Assuming there are no budget constraints or regulatory limitations on the number of DACR and VVO deployments, DACR and VVO may be deployed on all candidates with a positive business case regardless of priority. However, resources are not unlimited and this scenario is unrealistic.

Table 6 on page 18 provides an example illustrating a more realistc scenario that emphasizes the importance of prioritizing candidates with the highest beneftis whenever there are constraints or limits on proposed DACR and VVO deployments. Table 6 provides a side-by-side comparison of the same prioritized DACR and VVO business case portfolios previously presented in Tables 4 and 5 respectively. Assume in this latest example, however, that the regulatory authorities has approved an electric utility's budgeted cost to deploy 12 DACR candidates and 10 VVO candidates delivering the highest net benefits to the utility and its retail customers. A line drawn through the two prioritized business case portfolios illustrates the partition between the budgeted top 12 DACR candidates and top 10 VVO candidates with the highest net benefits and all the other candidates that fall below these regulatory criteria.[35] Similar to the Table 6, AEP Ohio will also prioritize its DACR and VVO business case portfolio and deploy DACR and VVO on up to 250 and 160 distribution circuits respectively that will deliver "maximum customer and company benefits" within a budgeted cost (that is recoverable by AEP Ohio through a retail rate mechanism).[36] In other words, DACR and VVO candidates must include no more than 250 DACR circuits and 160 VVO circuits respectively delivering the highest prioritized net benefits without exceeding a budgeted cost authorized by the Commission. Section 4.4 of this report presents how AEP Ohio will

[35] Most of the DACR and VVO candidates within the two portfolios rank below the top 12 DACR candidates and the top 10 VVO candidates with the highest net benefits. Also, these candidates exceed the approved budget. Some of the lower ranking DACR and VVO candidates below the partition line have positive business cases while other candidates have negative business cases where the estimated cost of deployment exceeds the estimated benefits.

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

temporarily defer and reconsider at a future date any DACR and VVO candidates within the respective business case portfolios that fall below the constraints specified by the Commission.

Also, Table 6 illustrates a special circumstance whenever DACR and VVO candidates geographically overlap on one or more distribution circuits that are common to both candidates. In most cases, DACR and VVO candidates are mutually exclusive within their respective business case portfolios and there is no overlap on one or more distribution circuits common to both candidates. In other words, DACR and VVO candidates are independent of each other and there are no additional net benefits to be realized by jointly deploying DACR and VVO candidates together. However, there are occassions when DACR and VVO candidates within their respective business case portfolios do overlap and there exists one or more distribution circuits that are common to both candidates. Under these circumstances, DACR and VVO candidates within their respective business case portofolios are not mutually exclusive or independent of each other; there are additional ***qualitative*** (not quantitative) benefits to be realized by joint deploying overalpping DACR and VVO candidates together.[37] Table 6 identifies with a double-side arrow DACR and VVO candidates highlighted in yellow where overlap occurs on one or more distribution circuits. Section 4.4 of this reports presents how AEP Ohio will administer its final prioritization and selection process to realize all quantitative and qualitative benefits associated with overlapping, highly ranked DACR and VVO candidates that fall within the constraints specified by the Commission.

[37] DACR and VVO candidates are individually defined and developed (see footnotes 24 and 26). A business case to deploy each DACR and VVO candidate is prepared, not individual distribution circuits, and the summarized results are summarized within their DACR and VVO busienss case portfolios respectively. For this reason, it is arithmetically impractical to quantitatively estimate the combined net benefits where DACR and VVO candidates overlap on one or more distribution circuits. However, there are qualitative benefits associated with the joint deployment of overlapping DACR and VVO candidates that are presented in Section 4.4 of this report.

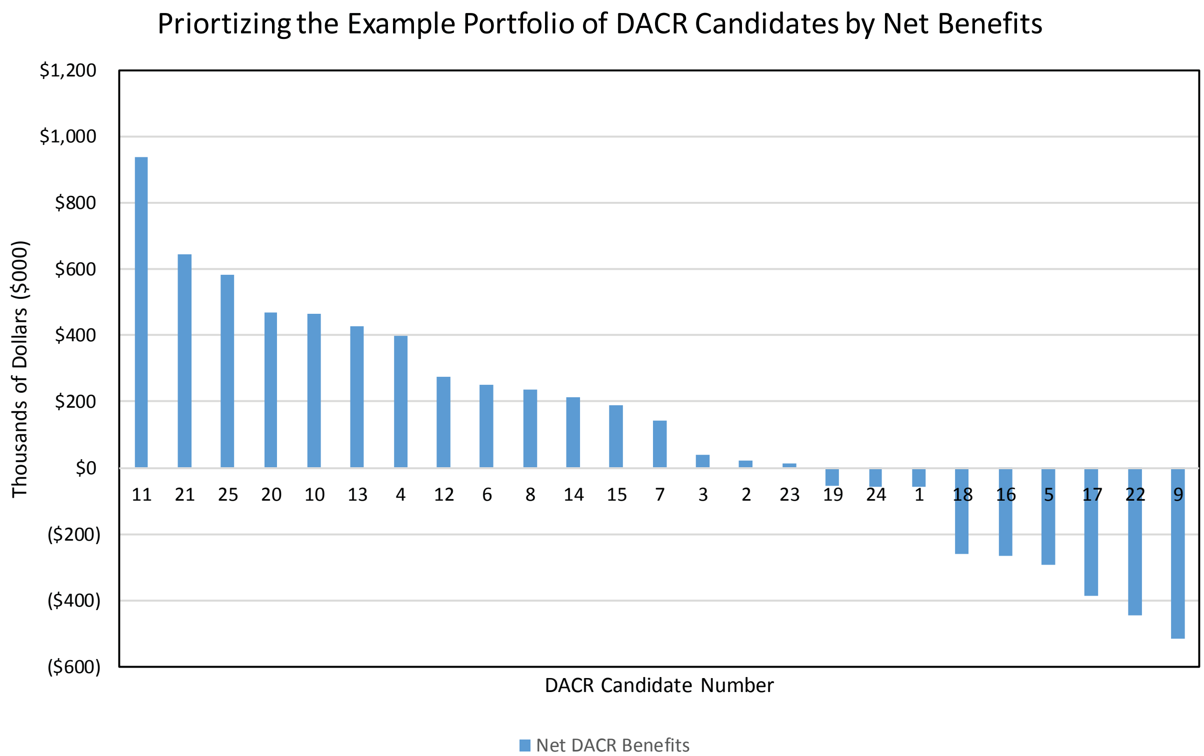

Figure 4: Sample Net Benefits Ranking of DACR Candidates

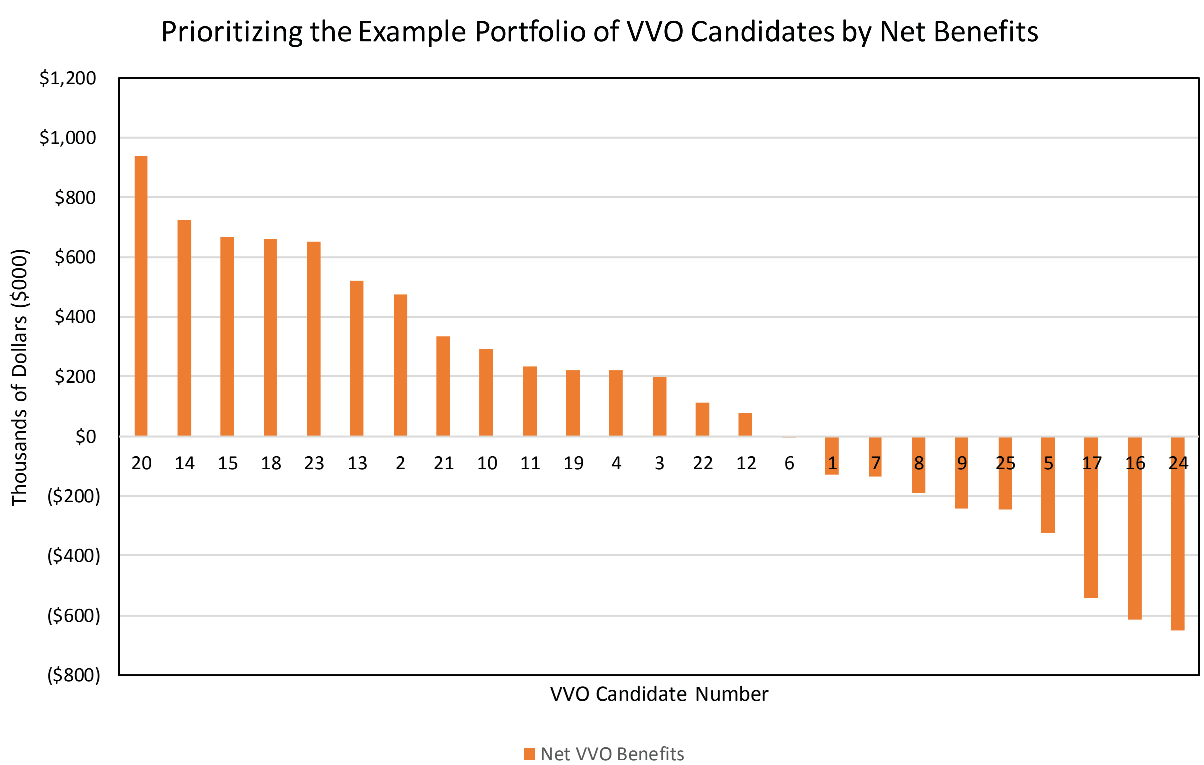

Figure 5: Sample Net Benefits Ranking of VVO Candidates

Table 6
Side-by-Side Comparison of Example DACR and VVO Business Case Portfolios (Thousands, $000s)

Business Case Portfolio of DACR Candidates

Rank	Candidate No.	Benefits	Costs	Net Benefits
1	11	$975	$38	$937
2	21	$946	$302	$644
3	25	$730	$148	$582
4	20	$668	$200	$468
5	10	$476	$11	$465
6	13	$528	$102	$426
7	4	$772	$374	$398
8	12	$393	$120	$273
9	6	$546	$296	$250
10	8	$363	$127	$236
11	14	$763	$550	$213
12	15	$451	$261	$190
13	7	$334	$193	$141
14	3	$265	$226	$39
15	2	$971	$950	$21
16	23	$843	$829	$14
17	19	$883	$937	($54)
18	24	$740	$797	($57)
19	1	$263	$321	($58)
20	18	$480	$741	($261)
21	16	$98	$364	($266)
22	5	$65	$356	($291)
23	17	$253	$640	($387)
24	22	$183	$627	($444)
25	9	$125	$641	($516)

Business Case Portfolio of VVO Candidates

Rank	Candidate No.	Benefits	Costs	Net Benefits
1	20	$984	$46	$938
2	14	$758	$36	$722
3	15	$986	$320	$666
4	18	$920	$258	$662
5	23	$896	$244	$652
6	13	$990	$470	$520
7	2	$967	$491	$476
8	21	$863	$530	$333
9	10	$386	$93	$293
10	11	$768	$534	$234
11	19	$447	$225	$222
12	4	$890	$671	$219
13	3	$835	$638	$197
14	22	$649	$536	$113
15	12	$770	$694	$76
16	6	$14	$19	($5)
17	1	$828	$955	($127)
18	7	$666	$801	($135)
19	8	$295	$485	($190)
20	9	$410	$653	($243)
21	25	$285	$532	($247)
22	5	$611	$936	($325)
23	17	$132	$676	($544)
24	16	$345	$960	($615)
25	24	$297	$946	($649)

4.4 Final Review Process for Selecting DACR and VVO Candidates

The prioritization criteria, methodologies, and business case portfolio approach previously presented in this report will provide AEP Ohio guidance throughout the planned Smart Grid Phase 2 (and possible Phase 3) deployment lifecycle. However, Table 7 describes how AEP Ohio will annually update all underlying data, rankings, and the business case portfolio model to ensure only DACR and VVO candidates delivering the greatest net monetized benefits to AEP Ohio and its customers are selected for deployment.

Table 7
Annual Prioritization and Selection Update Process

1. AEP Ohio will annually update all underlying data with new information for the calendar year ending the previous calendar year, i.e. December 31 before prioritizing and selecting circuits for DACR and VVO deployment:

   a) Update all distribution circuit number, scheme, and substation (including distribution buses) information to reflect new distribution plant recently placed into service, plant retired, or changes in configuration, switching, etc.

   b) Update reliability data for each distribution circuit in Item 1(a) above needed to rank the reliability of all candidate DACR schemes and circuits. The minimum data required to calculate the most current three-year moving average for SAIFI and SAIDI include: (1) the number of customers served, (2) the number of customers interrupted, and (3) CMI. This includes changes in distribution circuits added or removed to AEP Ohio's Rule 11 list.[38]

   c) Update the summarized number of customers and MWh sales data by rate class for each distribution circuit in Item 1(a) above needed to update the business case portfolio for each candidate DACR scheme.

   d) Update peak MVA demand and total MWh delivered for each distribution circuit in Item 1(a) needed to rank the loading of all candidate VVO distribution buses and connected circuits. This includes revisions or changes associated with any OHA members.

   e) Update the summarized revenue (minus customer charges and fixed costs) data by rate class for each distribution circuit in Item 1(a) above needed to update the business case portfolio for each VVO distribution bus.

   f) Update the DACR and VVO business case approach as necessary with revised capital costs, O&M costs, and assumptions, etc. for all distribution, substation, communication, and information technology infrastructure associated with proposed DACR and VVO deployments.

[38] AEP Ohio's annual reporting to satisfy all Rule 11 requirements will be amended to identify any Rule 11 circuits that have been prioritized and selected for DACR deployment. The reporting requirements for Rule 11 circuits not prioritized and selected for DACR deployment is assumed to remain unchanged.

2. After completing Item 1, AEP Ohio will annually update the rankings and reprioritize the business case portfolio to identify the group of DACR candidates and the group of VVO candidates that are estimated to deliver the greatest net monetized benefits to customers and AEP Ohio.

3. Upon completion of Item 2, AEP Ohio will prepare engineering studies on the highest priority DACR and VVO candidates.

   The purpose of these engineering studies includes, but is not necessarily limited to:

   a) Review the adequacy of substation, distribution, and communication infrastructure to accommodate the proposed DACR and VVO deployments,

   b) Provide cost estimates to upgrade or improve substation, distribution, or communication infrastructure that may be required for any proposed DACR and VVO deployments,

   c) Examine the impact of other proposed or planned AEP Ohio substation or distribution projects, and

   d) Review any changing operating circumstances or requirements that may affect proposed or existing DACR and VVO deployments.

   The engineering studies may confirm that some DACR and VVO candidates will be impractical to deploy because the existing substation, distribution, or communication infrastructure is wholly inadequate to support DACR and VVO respectively. These DACR and VVO candidates will generally have prohibitively high costs and no supporting business case to justify infrastructure upgrades and improvements.[39,40] Any DACR and VVO candidates confirmed by engineering studies to be impractical for deployment will be classified as "inactive" and removed from their respective DACR and VVO business case portfolios.

   In contrast, the engineering studies may confirm that other DACR and VVO candidates are practical, but the costs associated with deployment, including necessary infrastructure updates or improvements, are higher or lower than originally anticipated. Under these circumstances, AEP Ohio will update the business cases for these DACR and VVO candidates and reprioritize their respective business case portfolios. DACR and VVO candidates within their reprioritized portfolios delivering the greatest net benefits will be selected for deployment and placed in the construction queue (see Item 4). However, other DACR and VVO candidates with an updated

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[39] Examples of candidates (and their connected circuits) classified as "inactive" include, but are not limited to: AEP Ohio's legacy 4 kV distribution system, network circuits, distribution circuits with no or very limited intertie connections, and circumstances where there is inadequate distribution conductor or power transformer capacity.

[40] Candidates (and their connected circuits) classified as "inactive" also include circumstances where the costs for necessary updates or improvements to substation, distribution, or other infrastructure is outside the scope of AEP Ohio's budget approved by the Commission or cannot be funded with AEP Ohio's distribution improvement rider.

business case may still deliver positive net benefits, but they have dropped within their respective business case portfolio rankings and are not selected for the current year's construction queue. These DACR and VVO candidates will not be classified as "inactive" and removed from their respective portfolio, only temporarily deferred for reconsideration when the next annual prioritization and selection update is scheduled (see Item 5).

4. Next, the AEP Ohio Smart Grid Phase 2 project team will submit the final selection list of DACR and VVO candidates passing the final review described in Item 3 to other AEP staff responsible for the next stages of design, construction, testing, and final transition to normal operations.

   AEP Ohio will initially proceed early in the Smart Grid Phase 2 project with the joint deployment of DACR and VVO candidates that overlap on one or more distribution circuits, pass their final review, and are estimated to deliver the highest ranked net benefits within the Commission's approved constraints and limits. Proceeding with the joint deployment of overlapping DACR and VVO candidates provides AEP Ohio a variety of qualitative benefits such as leveraging limited construction resources to shorten the schedule duration, reduce costs, and delivering benefits to customers within these geographic areas sooner than otherwise anticipated. AEP Ohio's preference to initially proceed with the joint deployment of any overlapping DACR and VVO candidates is consistent with delivering "maximum customer and company [quantitative and qualitative] benefits" as previously presented in Section 4.3 of this report.[41] After completing the joint deployment of overlapping DACR and VVO candidates, AEP Ohio intends to proceed with deployment of DACR and VVO circuits passing their final reviews in approximately the same proportion as the total number of DACR and VVO circuits authorized by the Commission.

   Also, AEP Ohio will exercise preference in deploying DACR or VVO first on selected candidates that are presently classified as Rule 11 circuits, impact OHA members respectively, or are necessary to fulfill changing operating requirements or circumstances.[42] However, all selected DACR and VVO deployments are subject to a variety of constraints that may include, but are not limited to: procurement lead time delays from vendors, resource availability, coordinating schedules with other priority AEP projects, the need to develop detailed designs and costs, or delays in obtaining necessary rights-of-way, Commission approvals, etc.

5. This annual update process described in Items 1 through 4 will be scheduled before prioritizing and selecting next year's group of DACR and VVO candidates (and their connected circuits) for deployment. AEP Ohio may advance or delay this annual update process up to 6 months as necessary for a variety of reasons including, but not limited to:

   a) The actual schedule of DACR and VVO deployments leads or lags the planned baseline

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

[42] AEP Ohio may choose to deploy DACR or VVO in specific circumstances that are beyond the scope of the Phase 2 Feasibility and Selection Study or the Phase 3 Full System Feasibility Study. For example, DACR may be required in specific cases to improve reliability regardless of business case outcomes. Similarly, VVO may be required in specific case to provide AEP Ohio additional options within its emergency load shed program.

schedule,

b) Any updated data described in Item 1 materially influences the prioritization and selection of DACR and VVO candidates for deployment, and

c) Additional DACR and VVO candidates need to be prioritized and selected for deployment because the number of candidates (and their connected circuits) that are classified as "inactive" or are temporarily deferred described in Item 3 is higher than anticipated.

AEP Ohio anticipates that the number of DACR and VVO candidates (and their connected circuits) selected and scheduled for deployment may vary from year-to-year. However, these deployments will cumulatively approximate the top 250 DACR circuits and top 160 VVO circuits delivering the highest net benefits approved by the Commission.

4.5 AMI Prioritization and Selection

AEP Ohio's AMI deployment strategy for the Smart Grid Phase 2 project is to deploy smart meters within the most densely populated cities of its Ohio service area to deliver maximum customer and utility benefits and minimize AMI communication infrastructure costs. Also, prioritizing AMI deployment to portions of the AEP Ohio service area with the greatest population density fulfills the Table 1 AMI objective of making meter interval data available to the largest number of customers and CRES providers. In addition, AEP Ohio's AMI strategy retains a large proportion of the existing one-way AMR system in favor of replacing approximately 894,000 aging electromechanical meters in 43 cities across the AEP Ohio service area.[43] AEP Ohio has already prepared a variety of geospatial models, tools, and algorithms coupled with a review by the utility's subject matter experts to ensure the deployment area and boundary was optimized for each of the 43 cities within the Phase 2 AMI deployment area.

Figure 6 on page 23 provides an example illustrating AEP Ohio's geospatial approach to prioritize AMI deployment in the more densely populated areas of Buckeye Lake in Millersport, Ohio while retaining a very large portion of the existing one-way AMR system. This figure clearly illustrates the more densely populated areas as purple-colored points where AMI deployment is planned to leverage the anticipated communication infrastructure and improve benefits. Customer locations depicted as green-color points indicate where the existing one-way AMR system is deployed. Leveraging the anticipated AMI communication infrastructure to support the maximum number of smart meters enables AEP Ohio to replace a few one-way AMR endpoints; these locations are shown at the green-colored customer locations within the anticipated black-colored AMI deployment boundary for Buckeye Lake. Maps illustrating the proposed AMI deployment areas using this geospatial approach to prioritizing AMI deployment for each of the 43 cities across the AEP Ohio service area is provided in Section 5.3 of the Appendix. In addition to these maps, Table 8 summarizes the total number of smart meters anticipated to be deployed within each city.

The use of geospatial models, tools, and algorithms to prioritize AMI deployment within the most densely populated cities of AEP Ohio's service area is an effective approach to deliver customer and

[43] The marginal benefit of replacing the existing 1-way AMR system with a new 2-way AMI system in unlikely to exceed the marginal cost.

utility benefits and minimize communication infrastructure costs. However, identifying where AMI should be deployed does not necessarily equate to scheduling AMI deployment starting in the city with the most smart meters and ending in the city with the fewest smart meters. AEP Ohio's AMI deployment plan includes developing a trained workforce needed to support approximately 894,000 smart meters in 43 cities across Ohio, but with net fewer employees in traditional roles such as meter reading. Transitioning to a workforce trained in AMI operations with fewer employees requires that AEP Ohio: (1) retrain some employees for other positions, (2) anticipate normal attrition as some employees retire or pursue other opportunities, and (3) plan for involuntary separations of some employees from the company as a last resort.

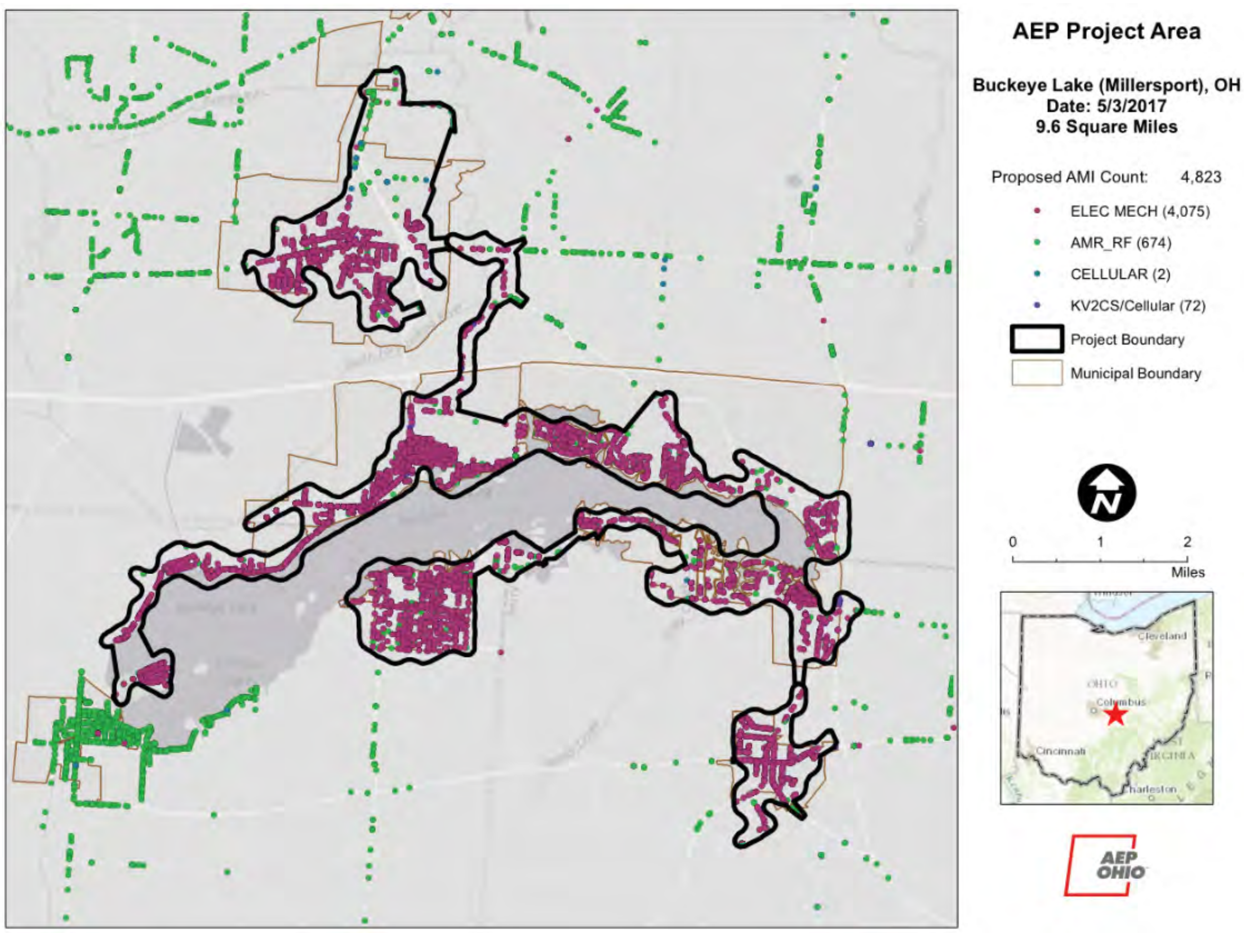

Figure 6: Planned AMI Deployment Area for Buckeye Lake, Millersport, Ohio

The realities associated with transitioning the workforce requires that AEP Ohio cannot deploy AMI strictly according to population density. AEP Ohio must plan its AMI deployment in areas where the greatest number of experienced personnel are available to assist with training and better adjust to employee retirements, attrition, or involuntary separations. Figure 50 in Section 5.4 of the Appendix provides a high-level Gantt chart illustrating how AEP Ohio's workforce transition plan to achieve operating efficiencies will impact the schedule of AMI deployment within each of the 43 cities of the

Smart Grid Phase 2 deployment area.

5 Appendix

5.1 DACR Scheme Rankings

Rank	Scheme	Substation	Rule 11	Circuit No.	Circuit Count	CMI	SAIDI	SAIFI
1								
	CRC416				**3**	**15,673,151**	**722.73**	**3.362**
		CLINTON			3	15,673,151	722.73	3.362
			No					
				0002904	1	1,204,276	393.04	1.998
				0002908	1	7,852,537	900.11	3.626
			Yes					
				0002910	1	6,616,338	668.45	3.551
2								
	CRC035				**6**	**15,253,749**	**598.94**	**3.088**
		CLARK STREET			2	4,022,332	620.06	3.325
			Yes					
				0022903	1	1,166,979	406.90	2.221
				0022904	1	2,855,353	788.99	4.200
		ELLIOT			2	7,920,974	611.89	3.479
			Yes					
				0011301	1	4,341,032	630.51	3.536
				0011302	1	3,579,942	590.75	3.413
		LEE			2	3,310,443	548.45	1.994
			No					
				0011001	1	1,516,625	438.97	1.969
				0011002	1	1,793,818	695.01	2.026
3								
	CRC029				**9**	**12,139,403**	**470.85**	**3.077**
		ADDISON			1	403,957	179.14	1.196
			No					
				0013203	1	403,957	179.14	1.196
		BASHAN			1	1,528,643	553.46	3.402
			No					
				0012902	1	1,528,643	553.46	3.402
		COOLVILLE			1	2,012,242	489.48	2.212
			No					
				0013101	1	2,012,242	489.48	2.212
		HEMLOCK			1	68,065	70.75	1.185
			No					
				0038802	1	68,065	70.75	1.185
		MEIGS			2	5,659,088	599.48	4.137
			No					
				0017002	1	2,104,671	384.20	2.791
			Yes					
				0017001	1	3,554,417	897.13	5.999
		POMEROY			2	1,974,826	466.64	2.975
			Yes					
				7409602	1	1,719,612	456.61	2.972
				7409603	1	255,214	547.67	3.002
		RACINE			1	492,582	243.85	2.651
			No					

Rank	Scheme	Substation	Rule 11	Circuit No.	Circuit Count	CMI	SAIDI	SAIFI
				7730001	1	492,582	243.85	2.651
4								
	CRC233				**5**	**11,019,887**	**657.94**	**2.299**
		E.LOGAN			2	385,723	123.71	0.813
			No					
				7432901	1	15,384	67.77	0.216
				7432902	1	370,339	128.10	0.860
		S.E.LOGAN			1	3,187,038	798.76	3.171
			Yes					
				7424301	1	3,187,038	798.76	3.171
		W.LOGAN			2	7,447,126	772.44	2.418
			Yes					
				7424201	1	4,143,563	849.09	2.601
				7424202	1	3,303,563	693.88	2.230
5								
	CRC024				**6**	**9,558,540**	**542.24**	**2.416**
		HANERS			1	533,444	133.63	0.970
			No					
				0013803	1	533,444	133.63	0.970
		JEFFERSON			1	2,061,002	833.74	4.308
			Yes					
				0014502	1	2,061,002	833.74	4.308
		RIO			3	3,947,717	464.16	1.968
			No					
				0013601	1	864,782	393.62	2.029
				0013603	1	1,184,976	459.12	1.275
			Yes					
				0013602	1	1,897,959	509.25	2.413
		WILKESVILLE			1	3,016,377	1,134.40	4.260
			Yes					
				0012401	1	3,016,377	1,134.40	4.260
	CRC032				**6**	**10,714,361**	**453.75**	**2.470**
		CLARK STREET			2	1,717,711	183.03	1.782
			No					
				0022901	1	349,708	245.41	2.291
				0022902	1	1,368,003	171.86	1.691
		COOLVILLE			1	5,117,310	786.19	3.523
			Yes					
				0013102	1	5,117,310	786.19	3.523
		STROUDS RUN			3	3,879,340	502.57	2.418
			No					
				0023001	1	1,145,792	355.28	1.708
			Yes					
				0023002	1	2,033,407	564.84	2.532
				0023004	1	700,141	783.16	4.518
7								
	CRC018				**4**	**7,566,035**	**618.44**	**2.377**
		CENTER STREET			1	715,144	302.77	1.673
			No					
				7410101	1	715,144	302.77	1.673

Rank	Scheme	Substation	Rule 11	Circuit No.	Circuit Count	CMI	SAIDI	SAIFI
		E.HAVERHI			1	4,781,253	1,836.82	6.347
			Yes					
				7411501	1	4,781,253	1,836.82	6.347
		N.IRONTON			1	475,007	114.87	0.629
			No					
				7425401	1	475,007	114.87	0.629
		PLY.HGTS.			1	1,594,631	508.82	1.918
			No					
				7434101	1	1,594,631	508.82	1.918
8								
	CRC034				**7**	**10,488,073**	**369.58**	**2.532**
		CLARK STREET			1	1,009,605	186.00	1.739
			No					
				0022906	1	1,009,605	186.00	1.739
		KIMBERLY			2	2,822,923	293.20	2.736
			Yes					
				0011805	1	1,340,848	354.25	3.754
				0011806	1	1,482,075	253.65	2.076
		POSTON			1	483,583	200.49	1.590
			No					
				0003501	1	483,583	200.49	1.590
		STROUDS RUN			1	3,237,965	816.02	4.724
			Yes					
				0023003	1	3,237,965	816.02	4.724
		TRIMBLE			2	2,933,997	422.64	1.945
			No					
				0011202	1	1,482,134	297.92	1.494
			Yes					
				0011201	1	1,451,863	738.11	3.087
9								
	CRC007				**6**	**9,551,141**	**482.14**	**2.102**
		BUCKSKIN			1	1,473,066	636.59	4.157
			Yes					
				0012601	1	1,473,066	636.59	4.157
		HIGHLAND			5	8,078,075	461.71	1.830
			No					
				0015401	1	1,919,420	418.63	1.354
				0015403	1	3,743,232	688.22	2.297
				0015404	1	923,088	405.57	1.277
				0015405	1	491,009	416.46	1.177
			Yes					
				0015402	1	1,001,326	249.27	2.245
10								
	CRC226				**6**	**5,676,575**	**401.74**	**2.887**
		HEATH			2	607,953	331.13	1.796
			No					
				7403203	1	109,569	183.23	0.689
			Yes					
				7403202	1	498,384	402.57	2.331
		NORTH HEBRON			2	46,279	226.86	0.980

Rank	Scheme	Substation	Rule 11	Circuit No.	Circuit Count	CMI	SAIDI	SAIFI
			No					
				7430101	1	4,499	61.63	0.548
				7430102	1	41,780	318.93	1.221
		WEST HEBRON			2	5,022,343	415.41	3.084
			No					
				7423601	1	1,894	13.43	0.340
				7423602	1	5,020,449	420.16	3.117
11								
	CRC434				**7**	**7,454,432**	**362.60**	**2.142**
		N.MCCONNE			1	1,486,450	263.79	2.336
			No					
				7421602	1	1,486,450	263.79	2.336
		NEELYSVIL			2	752,112	187.65	1.537
			No					
				7421801	1	468,064	365.96	2.544
				7421802	1	284,048	104.09	1.065
		PENNSVILL			2	3,352,565	561.19	2.204
			Yes					
				7421701	1	962,595	602.75	2.894
				7421702	1	2,389,970	546.03	1.953
		W.MALTA			2	1,863,305	377.11	2.335
			No					
				7407201	1	1,441,597	415.09	2.528
				7407202	1	421,708	287.27	1.877
12								
	CRA984				**5**	**6,228,319**	**583.07**	**2.074**
		BELLAIRE			2	1,426,063	648.80	2.027
			No					
				7511001	1	74,508	96.76	1.069
				7511004	1	1,351,555	946.47	2.544
		MONROESTR			3	4,802,256	566.04	2.086
			No					
				7511101	1	1,915,311	539.37	2.138
				7511102	1	1,753,401	602.96	1.886
				7511103	1	1,133,544	559.77	2.283
13								
	CRA985				**3**	**3,568,329**	**555.73**	**3.019**
		FLUSHING			2	1,011,039	408.50	2.370
			No					
				7501801	1	737,149	430.83	1.700
				7501802	1	273,890	358.49	3.872
		SMYRNA			1	2,557,290	648.07	3.427
			No					
				7515001	1	2,557,290	648.07	3.427
14								
	CRC415				**7**	**11,610,160**	**278.21**	**2.055**
		CLINTON			7	11,610,160	278.21	2.055
			No					
				0002905	1	766,716	136.43	1.141
				0002913	1	793,844	146.71	1.487

Rank	Scheme	Substation	Rule 11	Circuit No.	Circuit Count	CMI	SAIDI	SAIFI
				0002915	1	276,577	67.10	0.825
				0002916	1	263,726	53.22	0.446
			Yes					
				0002903	1	2,142,061	370.09	1.936
				0002907	1	1,520,654	236.05	2.186
				0002909	1	5,846,582	622.44	4.301
15								
	CRC006				**5**	**5,959,890**	**341.56**	**2.399**
		IDAHO			1	1,022,846	709.82	2.946
			No					
				0024802	1	1,022,846	709.82	2.946
		ROZELLE			1	1,078,027	382.41	2.221
			Yes					
				0027802	1	1,078,027	382.41	2.221
		WAVERLY			3	3,859,017	292.59	2.378
			No					
				0024701	1	472,525	164.36	1.927
				0024702	1	953,161	144.97	1.671
			Yes					
				0024704	1	2,433,331	650.80	3.968
16								
	CRC514				**5**	**6,327,569**	**338.72**	**2.037**
		GAHANNA			5	6,327,569	338.72	2.037
			No					
				0004501	1	1,372,498	372.86	1.989
				0004503	1	1,211,799	365.66	2.042
				0004504	1	1,111,149	397.69	1.971
				0004506	1	730,295	166.70	1.106
			Yes					
				0004505	1	1,901,828	421.60	3.017
17								
	CRC019				**8**	**6,742,713**	**290.97**	**1.856**
		CENTER STREET			2	2,309,459	379.22	2.057
			No					
				7410102	1	1,126,049	551.17	3.040
				7410103	1	1,183,410	292.42	1.561
		COALGROVE			2	813,495	344.56	2.428
			No					
				7411601	1	410,388	241.12	1.771
				7411602	1	403,107	611.69	4.126
		PLEASANTS			3	1,428,592	127.12	1.145
			No					
				7410201	1	867,744	236.96	2.073
				7410203	1	296,241	81.97	0.995
				7410204	1	264,607	66.79	0.424
		SUPERIOR			1	2,191,167	628.92	3.408
			Yes					
				0016602	1	2,191,167	628.92	3.408

Rank	Scheme	Substation	Rule 11	Circuit No.	Circuit Count	CMI	SAIDI	SAIFI
18								
	CRA116				**4**	**4,821,150**	**303.68**	**2.177**
		BOLIVAR			2	3,320,565	375.80	2.397
			Yes					
				7122601	1	1,710,046	404.17	2.076
				7122602	1	1,610,519	349.73	2.691
		STRASBURG			2	1,500,585	213.15	1.901
			No					
				7360601	1	769,257	245.30	2.290
				7360602	1	731,328	187.33	1.589
19								
	CRC431				**8**	**6,363,491**	**247.15**	**2.285**
		ACADEMIA			2	976,893	99.71	2.192
			No					
				7420801	1	180,506	57.18	1.723
			Yes					
				7420802	1	796,387	119.94	2.415
		GAMBIER			2	1,123,003	337.44	2.333
			No					
				7424401	1	810,150	454.63	2.630
				7424402	1	312,853	202.36	1.991
		MILLWOOD			3	3,944,298	405.88	2.720
			No					
				7407401	1	428,057	329.53	3.030
				7407403	1	1,633,344	376.78	2.534
			Yes					
				7407402	1	1,882,897	461.04	2.820
		MOUNT VERNON			1	319,297	109.91	1.084
			No					
				7401107	1	319,297	109.91	1.084
20								
	CRC037				**10**	**7,532,763**	**281.98**	**1.626**
		BELPRE			4	2,040,609	150.58	1.126
			No					
				0033471	1	172,692	51.95	0.716
				0033472	1	176,220	44.14	0.496
				0033473	1	808,534	200.88	1.652
				0033474	1	883,163	399.44	1.919
		CORNER			2	2,648,675	409.88	1.327
			No					
				0030473	1	54,252	45.06	0.429
			Yes					
				0030471	1	2,594,423	493.42	1.533
		HARMAR HILL			1	987,669	350.86	2.364
			No					
				0031071	1	987,669	350.86	2.364
		LAYMAN			1	1,673,121	726.81	4.809
			Yes					
				0033672	1	1,673,121	726.81	4.809
		PORTERFIELD			2	182,689	115.41	1.193

Rank	Scheme	Substation	Rule 11	Circuit No.	Circuit Count	CMI	SAIDI	SAIFI
			No					
				0031872	1	144,925	239.55	1.944
				0031873	1	37,764	38.61	0.728
	CRC994				**5**	**6,658,478**	**266.77**	**1.846**
		ASTOR			2	1,475,989	189.96	1.492
			No					
				0004602	1	683,414	167.13	1.302
				0004612	1	792,575	215.32	1.703
		EAST BROAD STREET			3	5,182,489	301.48	2.006
			No					
				0001406	1	1,713,132	268.14	2.300
				0001407	1	1,945,690	426.50	2.322
				0001409	1	1,523,667	244.22	1.472
22								
	CRC232				**8**	**7,326,618**	**272.27**	**1.723**
		E.LANCAST			1	2,615	3.69	0.076
			No					
				7404202	1	2,615	3.69	0.076
		LANCASTER			5	4,082,910	197.37	1.444
			No					
				7401501	1	331,669	130.53	0.527
				7401502	1	1,506,564	258.95	1.779
				7415701	1	1,038,700	204.91	1.655
				7415702	1	640,936	118.14	1.070
				7415704	1	565,041	308.09	2.171
		QUARRY RD			1	866,647	314.34	1.429
			No					
				7432401	1	866,647	314.34	1.429
		ROCKBRIDG			1	2,374,446	861.56	4.536
			Yes					
				7406502	1	2,374,446	861.56	4.536
23								
	CRC011				**2**	**2,456,900**	**538.68**	**2.843**
		BENTONVILLE			1	1,866,776	703.12	3.329
			Yes					
				0017702	1	1,866,776	703.12	3.329
		RAVEN			1	590,124	309.61	2.165
			No					
				0010701	1	590,124	309.61	2.165
24								
	CRC004				**3**	**3,408,174**	**346.82**	**2.077**
		GINGER			2	2,040,423	359.61	2.484
			No					
				0017901	1	1,439,044	432.28	2.888
				0017902	1	601,379	256.45	1.910
		VIGO			1	1,367,751	329.34	1.522
			No					
				0018701	1	1,367,751	329.34	1.522

Rank	Scheme	Substation	Rule 11	Circuit No.	Circuit Count	CMI	SAIDI	SAIFI
25								
	CRA987				**5**	**4,317,017**	**359.15**	**1.684**
		BRIDGEPORT			1	491,368	166.40	0.383
			No					
				7510003	1	491,368	166.40	0.383
		LANSING			1	769,980	258.73	0.876
			No					
				7501001	1	769,980	258.73	0.876
		NEFFS			1	2,478,032	598.13	3.178
			No					
				7500901	1	2,478,032	598.13	3.178
		SUMMERHIL			2	577,637	296.53	1.710
			No					
				7516701	1	539,096	300.33	1.726
				7516702	1	38,541	251.90	1.523
	CRC435				**13**	**9,684,868**	**243.17**	**1.568**
		LINDEN AVENUE			3	3,934,684	325.77	1.472
			No					
				7429401	1	1,540,411	324.98	2.175
				7429403	1	1,361,868	284.20	0.885
			Yes					
				7429405	1	1,032,405	405.50	1.268
		MOUNT STERLING			1	1,777,378	469.58	2.046
			No					
				7416101	1	1,777,378	469.58	2.046
		NORTH ZANESVILLE			4	1,945,856	177.41	1.540
			No					
				7421402	1	510,469	144.94	1.660
				7421403	1	420,462	101.07	0.997
				7421404	1	395,769	209.85	1.675
			Yes					
				7421401	1	619,156	442.25	2.668
		POWELSON			2	928,184	185.27	1.669
			No					
				7431401	1	573,469	137.99	1.423
				7431402	1	354,715	415.36	2.862
		ZANESVILLE			3	1,098,766	137.57	1.460
			No					
				7401801	1	665,198	150.91	1.609
				7401802	1	433,308	121.37	1.280
				7401803	1	260	28.89	0.556
27								
	CRC985				**3**	**3,016,650**	**330.56**	**2.457**
		BIXBY			3	3,016,650	330.56	2.457
			No					
				0007102	1	237,023	156.66	1.502
				0007106	1	1,071,560	238.07	1.898
			Yes					
				0007103	1	1,708,067	548.86	3.729

Rank	Scheme	Substation	Rule 11	Circuit No.	Circuit Count	CMI	SAIDI	SAIFI
28								
	CRC432				**2**	**2,767,117**	**480.90**	**2.153**
		FREDERICKTOWN			2	2,767,117	480.90	2.153
			No					
				7402101	1	1,794,300	490.92	2.061
				7402103	1	972,817	463.47	2.314
29								
	CRC021				**3**	**4,540,597**	**272.58**	**1.851**
		EAST PROCTORVILLE			1	1,563,135	232.61	0.876
			No					
				7429501	1	1,563,135	232.61	0.876
		SOUTH POINT			2	2,977,462	299.60	2.510
			No					
				7409502	1	1,696,761	255.81	2.511
			Yes					
				7409504	1	1,280,701	387.50	2.508
	CRC036				**4**	**3,437,084**	**306.80**	**2.025**
		LAYMAN			1	1,067,208	247.96	2.204
			No					
				0033671	1	1,067,208	247.96	2.204
		LOWELL			1	110,235	86.39	0.686
			No					
				0031272	1	110,235	86.39	0.686
		WOLF CREEK			2	2,259,641	401.86	2.192
			No					
				0029501	1	1,396,762	524.90	2.427
				0029502	1	862,879	291.32	1.980
	CRC402				**4**	**3,941,496**	**245.45**	**2.341**
		BETHEL ROAD			1	936,092	306.71	1.944
			No					
				0002601	1	936,092	306.71	1.944
		KENNY ROAD			3	3,005,404	231.08	2.434
			No					
				0000305	1	498,967	105.38	1.280
				0000307	1	477,594	208.56	1.588
			Yes					
				0000303	1	2,028,843	339.21	3.671
32								
	CRC016				**3**	**2,929,847**	**316.84**	**2.372**
		FRIENSHIP			1	1,454,581	693.65	2.754
			Yes					
				7423701	1	1,454,581	693.65	2.754
		SUGARHILL			2	1,475,266	206.33	2.260
			No					
				7426101	1	705,107	194.57	2.262
				7426102	1	770,159	218.42	2.258
33								
	CRA126				**7**	**9,267,793**	**450.22**	**1.162**
		HOWARD			2	2,156,889	422.51	1.531
			No					

Rank	Scheme	Substation	Rule 11	Circuit No.	Circuit Count	CMI	SAIDI	SAIFI
				7202301	1	220,223	163.25	0.851
				7202302	1	1,936,666	515.62	1.775
		N.WILLARD			3	5,427,638	521.34	0.977
			No					
				7228601	1	1,516,793	382.35	0.947
				7228602	1	3,462,688	758.20	1.080
				7228603	1	448,157	238.76	0.792
		S.GREENWI			1	1,098,846	320.18	1.105
			No					
				7231601	1	1,098,846	320.18	1.105
		WILLARD			1	584,420	357.01	1.313
			No					
				7205302	1	584,420	357.01	1.313
34								
	CRC200				**8**	**5,577,853**	**224.56**	**1.948**
		MARION ROAD			8	5,577,853	224.56	1.948
			No					
				0000704	1	348,511	189.72	1.636
				0000706	1	399,247	187.62	2.098
				0000708	1	593,279	307.72	2.683
				0000709	1	435,431	101.83	0.837
				0000712	1	895,741	265.48	2.306
				0000718	1	1,552,479	272.65	2.270
			Yes					
				0000702	1	697,297	209.52	1.551
				0000711	1	655,868	288.42	2.771
	CRC437				**7**	**4,550,193**	**261.01**	**1.695**
		BRIDGEVILLE			2	1,140,113	320.35	1.471
			No					
				7422402	1	644,880	245.48	1.338
			Yes					
				7422403	1	495,233	531.37	1.844
		EAST POINT			2	657,921	185.43	1.269
			No					
				7439001	1	40	3.33	0.167
				7439002	1	657,881	186.05	1.273
		OAKLAND			2	1,912,118	288.49	2.225
			No					
				7408401	1	605,163	176.74	1.378
				7408402	1	1,306,955	407.91	3.129
		WEST PHILO			1	840,041	227.16	1.368
			No					
				7409101	1	840,041	227.16	1.368
36								
	CRC023				**2**	**2,006,693**	**473.28**	**3.318**
		ASHLEY			1	1,734,396	493.15	3.530
			No					
				0013402	1	1,734,396	493.15	3.530
		BLOOM			1	272,297	376.62	2.285
			Yes					

Rank	Scheme	Substation	Rule 11	Circuit No.	Circuit Count	CMI	SAIDI	SAIFI
				0013503	1	272,297	376.62	2.285
37								
	CRA109				**11**	**9,178,811**	**226.56**	**1.428**
		3STREET			1	194,313	106.65	1.072
			No					
				7100116	1	194,313	106.65	1.072
		BLISSPARK			2	1,201,150	223.14	1.609
			No					
				7119502	1	929,564	231.12	1.665
				7119504	1	271,586	199.55	1.441
		MILES AVE			3	3,125,753	221.17	1.225
			No					
				7128201	1	976,871	183.55	1.353
				7128202	1	752,299	323.43	1.862
				7128203	1	1,396,583	215.36	0.893
		REEDURBAN			2	3,210,122	470.35	2.279
			No					
				7108901	1	218,976	165.64	1.561
				7108904	1	2,991,146	543.55	2.452
		SCHROYER			2	1,101,069	154.30	1.438
			No					
				7116401	1	970,356	174.93	1.634
				7116402	1	130,713	82.26	0.755
		STADIUMPA			1	346,404	66.44	0.783
			No					
				7108604	1	346,404	66.44	0.783
38								
	CRC207				**2**	**3,595,030**	**259.63**	**1.835**
		GALLOWAY			2	3,595,030	259.63	1.835
			No					
				0007204	1	1,350,375	205.26	1.774
				0007206	1	2,244,655	308.84	1.890
39								
	CRC227				**11**	**9,065,794**	**185.25**	**1.484**
		EAST NEWARK			3	1,881,262	162.75	1.358
			No					
				7404401	1	390,033	105.24	1.494
				7404403	1	678,188	153.61	0.681
				7404404	1	813,041	236.49	2.083
		NORTH NEWARK			3	2,774,629	167.34	2.053
			No					
				7405104	1	1,647,545	205.35	2.447
				7405105	1	427,165	83.69	1.184
			Yes					
				7405102	1	699,919	202.64	2.422
		SHARON VALLEY			3	2,353,282	179.59	0.834
			No					
				7423301	1	1,033,041	152.37	0.578
				7423302	1	701,221	274.34	1.141
				7423303	1	619,020	164.28	1.087

Rank	Scheme	Substation	Rule 11	Circuit No.	Circuit Count	CMI	SAIDI	SAIFI
		UTICA			2	2,056,621	267.34	1.553
			No					
				7436201	1	1,754,547	345.25	1.657
				7436202	1	302,074	115.69	1.352
40								
	CRC040				**12**	**6,627,809**	**200.44**	**1.600**
		DUCK CREEK			3	1,687,603	278.99	1.961
			No					
				0034071	1	339,556	163.48	0.794
				0034072	1	14,311	140.30	0.353
				0034073	1	1,333,736	344.63	2.629
		HARMAR HILL			2	1,629,309	318.54	1.384
			No					
				0031072	1	1,276,925	351.00	1.386
				0031075	1	352,384	238.58	1.381
		MILL CREEK			6	1,907,642	106.62	1.183
			No					
				0031671	1	74,762	218.60	1.275
				0031672	1	30,272	18.44	0.127
				0031673	1	301,705	92.07	1.081
				0031674	1	595,316	145.88	1.513
				0031675	1	393,764	108.47	1.820
				0031676	1	511,823	104.03	0.854
		RENO			1	1,403,255	349.85	3.190
			No					
				0031971	1	1,403,255	349.85	3.190
41								
	CRC425				**3**	**2,236,060**	**289.38**	**2.519**
		DELAWARE			3	2,236,060	289.38	2.519
			No					
				0024031	1	2,055,142	286.11	2.545
				0024032	1	177,625	342.91	2.220
				0024034	1	3,293	126.65	1.269
42								
	CRA999				**7**	**6,061,399**	**206.01**	**1.563**
		MARION ROAD			5	3,647,983	187.79	1.803
			No					
				0000705	1	296,900	218.63	2.207
				0000707	1	750,281	218.55	1.606
				0000715	1	1,399,075	196.61	1.773
				0000716	1	150,830	242.49	2.733
				0000717	1	1,050,897	152.37	1.768
		PARSONS			2	2,413,416	241.41	1.096
			No					
				0005702	1	1,938,497	354.00	1.515
				0005703	1	474,919	105.05	0.588
43								
	CRC020				**2**	**2,188,498**	**289.14**	**2.214**
		PLEASANTS			1	1,687,662	503.33	2.984
			Yes					

Rank	Scheme	Substation	Rule 11	Circuit No.	Circuit Count	CMI	SAIDI	SAIFI
				7410205	1	1,687,662	503.33	2.984
		SOUTH POINT			1	500,836	118.79	1.602
			No					
				7409503	1	500,836	118.79	1.602
44								
	CRC428				**6**	**2,812,923**	**288.21**	**1.626**
		FULTON			2	1,446,915	375.24	1.673
			No					
				7217701	1	529,748	359.88	1.502
				7217702	1	917,167	384.72	1.779
		NORTH WALDO			2	1,164,279	296.41	2.054
			No					
				7228001	1	633,034	249.91	1.905
				7228002	1	531,245	380.82	2.323
		WALDO			2	201,729	102.09	0.683
			No					
				7228801	1	158,365	125.39	0.785
				7228802	1	43,364	60.82	0.504
Total					**253**	**291,903,433**	**340.77**	**2.059**

5.2 VVO Bus Rankings

Rank	Substation Bus	OHA Members	Circuit No.	Circuit Count	MVA NCP	MWh
1						
	POLARIS (#0094) 1X 2X			**5**	**62.39**	**230,330**
		No				
			0009431	1	11.26	36,118
			0009432	1	14.21	69,444
			0009433	1	12.53	39,688
			0009434	1	9.70	26,599
			0009435	1	14.70	58,481
2						
	TRABUE (#0036) 1X 2X			**9**	**69.01**	**206,611**
		No				
			0003601	1	8.34	8,790
			0003602	1	9.15	36,302
			0003603	1	5.57	7,071
			0003604	1	7.84	29,731
			0003605	1	6.65	22,797
			0003606	1	5.10	22,543
			0003607	1	10.19	22,224
			0003608	1	8.47	27,599
			0003609	1	7.71	29,556
3						
	BETHEL ROAD (#0026) 1Y 2Y			**9**	**62.22**	**223,282**
		No				
			0002603	1	6.73	38,585
			0002604	1	8.20	30,794
			0002605	1	7.06	18,779
			0002606	1	6.74	20,774
			0002608	1	7.22	25,372
			0002613	1	7.14	23,770
			0002614	1	5.36	17,823
			0002615	1	5.21	16,724
		Yes				
			0002617	1	8.56	30,660
4						
	BEATTY ROAD (#0074) 5Y 6X			**8**	**58.33**	**196,953**
		No				
			0007401	1	7.42	23,340
			0007402	1	9.16	25,540
			0007403	1	10.82	22,372
			0007404	1	8.24	32,242
			0007405	1	6.17	26,602
			0007406	1	2.74	9,134
			0007408	1	11.04	33,927
		Yes				
			0007407	1	2.74	23,796

Rank	Substation Bus	OHA Members	Circuit No.	Circuit Count	MVA NCP	MWh
5						
	MCCOMB (#0075) 1Y 2Y			**8**	**56.11**	**179,584**
		No				
			0007501	1	6.59	18,395
			0007502	1	7.25	25,333
			0007503	1	8.12	27,885
			0007504	1	10.96	36,180
			0007505	1	6.49	21,208
			0007506	1	3.06	9,858
			0007507	1	5.93	9,305
			0007508	1	7.70	31,420
6						
	CANAL STREET (#0013) 1X 2X			**8**	**47.80**	**182,192**
		No				
			0001301	1	9.08	23,018
			0001303	1	7.19	26,256
			0001304	1	8.07	23,646
			0001306	1	5.33	24,851
			0001310	1	6.48	31,613
		Yes				
			0001313	1	3.35	14,815
			0001315	1	1.62	9,104
			0001318	1	6.68	28,888
	HALL (#0027) 1X 2X			**8**	**55.18**	**172,460**
		No				
			0002701	1	8.16	24,487
			0002702	1	8.15	27,907
			0002703	1	7.25	30,939
			0002704	1	3.36	2,632
			0002705	1	6.78	20,030
			0002706	1	5.89	15,703
			0002707	1	7.38	19,803
			0002708	1	8.21	30,959
8						
	HUNTLEY (#0012) 3X 5X			**8**	**50.76**	**175,161**
		No				
			0001201	1	7.63	32,074
			0001202	1	2.81	9,837
			0001204	1	4.57	21,974
			0001206	1	6.49	18,862
			0001207	1	8.22	23,227
			0001210	1	7.76	27,647
			0001211	1	6.84	11,614
			0001212	1	6.44	29,924
9						
	DUBLIN (#0023) 2X 3X			**8**	**54.45**	**171,170**
		No				
			0002302	1	0.10	484
			0002306	1	10.23	34,958
			0002308	1	6.29	9,609

Rank	Substation Bus	OHA Members	Circuit No.	Circuit Count	MVA NCP	MWh
			0002309	1	8.52	22,782
			0002310	1	9.70	29,411
			0002312	1	8.50	33,176
		Yes				
			0002304	1	8.11	36,529
			0002311	1	3.00	4,222
	GENOA (#0039) 4X 5X			**3**	**52.29**	**172,179**
		No				
			0003931	1	16.98	48,821
			0003932	1	16.48	67,104
			0003933	1	18.83	56,255
11						
	BETHEL ROAD (#0026) 1X 2X			**8**	**47.33**	**177,896**
		No				
			0002601	1	4.00	20,602
			0002602	1	5.05	19,598
			0002607	1	8.10	28,115
			0002609	1	6.31	21,975
			0002610	1	9.28	35,197
			0002611	1	6.13	23,651
			0002612	1	7.36	28,513
			0002616	1	1.10	245
	MIFFLIN (#0042) 1X 2X			**8**	**48.16**	**172,926**
		No				
			0004201	1	6.44	28,208
			0004202	1	4.81	15,354
			0004203	1	7.51	28,859
			0004204	1	7.27	24,485
			0004205	1	7.75	35,783
			0004206	1	1.96	457
			0004207	1	6.16	15,907
			0004208	1	6.26	23,873
13						
	MALISZEWSKI 5X			**3**	**47.70**	**173,116**
		No				
			0009231	1	21.02	68,159
			0009232	1	14.18	55,474
			0009233	1	12.50	49,483
14						
	LINWORTH (#0048) 2X 3Y			**8**	**51.60**	**164,523**
		No				
			0004801	1	8.80	28,135
			0004802	1	8.40	28,391
			0004803	1	7.20	19,265
			0004804	1	4.40	14,092
			0004805	1	7.50	21,136
			0004806	1	4.90	17,317
			0004807	1	6.90	22,202
			0004808	1	3.50	13,984

Rank	Substation Bus	OHA Members	Circuit No.	Circuit Count	MVA NCP	MWh
15						
	ROSS (#0226) 1Y 2Y			**7**	**47.07**	**169,319**
		No				
			0022601	1	6.05	20,371
			0022602	1	9.82	37,794
			0022603	1	9.20	28,353
			0022604	1	7.50	29,501
			0022605	1	5.40	17,583
			0022606	1	4.64	17,103
			0022607	1	4.46	18,615
16						
	KARL ROAD (#0009) 1Y 2Y			**7**	**44.08**	**140,036**
		No				
			0000901	1	6.99	21,920
			0000905	1	6.30	23,309
			0000909	1	3.76	14,924
			0000910	1	6.94	19,747
			0000911	1	6.80	18,755
			0000912	1	5.90	17,137
			0000913	1	7.38	24,245
17						
	BLENDON 2X			**2**	**40.48**	**135,486**
		No				
			0005631	1	20.65	70,102
			0005632	1	19.84	65,384
	MORSE ROAD (#0058) 1Y 2Y			**6**	**42.27**	**131,718**
		No				
			0005801	1	5.69	18,642
			0005803	1	7.18	23,316
			0005805	1	6.80	22,955
			0005809	1	6.52	26,028
			0005812	1	9.84	26,801
			0005813	1	6.25	13,976
19						
	MORSE ROAD (#0058) 2X 3Y			**8**	**44.51**	**123,286**
		No				
			0005802	1	5.58	17,209
			0005804	1	3.58	10,269
			0005806	1	5.92	21,423
			0005807	1	3.39	13,266
			0005808	1	9.42	8,435
			0005811	1	4.70	11,914
			0005814	1	6.03	20,201
			0005815	1	5.88	20,569
20						
	ASTOR (#0046) 1X 2X			**7**	**41.60**	**124,944**
		No				
			0004601	1	6.33	17,590
			0004602	1	7.30	21,264
			0004605	1	3.83	12,498

Rank	Substation Bus	OHA Members	Circuit No.	Circuit Count	MVA NCP	MWh
			0004609	1	8.22	23,017
			0004610	1	6.31	19,815
			0004613	1	3.75	12,586
			0004614	1	5.86	18,173
	SAWMILL 3X			**2**	**40.69**	**125,976**
		No				
			0003132	1	18.58	62,722
			0003133	1	22.11	63,254
22						
	HESS STREET (#0054) 1X 2X			**6**	**37.32**	**128,898**
		No				
			0005401	1	7.15	21,835
			0005405	1	4.64	17,679
			0005408	1	3.81	23,547
			0005410	1	8.73	30,586
			0005415	1	4.52	14,605
			0005419	1	8.47	20,646
23						
	CORRIDOR 3X			**2**	**35.00**	**133,112**
		No				
			0000531	1	16.01	18,709
		Yes				
			0000532	1	18.99	114,403
24						
	ASTOR (#0046) 1Y 2Y			**6**	**33.99**	**132,875**
		No				
			0004603	1	2.80	9,910
			0004604	1	5.53	17,337
			0004607	1	8.99	42,609
			0004608	1	6.58	23,646
			0004611	1	5.49	24,203
			0004612	1	4.60	15,171
25						
	SAWMILL 2X			**2**	**36.41**	**124,157**
		No				
			0003131	1	13.57	45,571
			0003134	1	22.84	78,586
26						
	KARL ROAD (#0009) 1X 2X			**7**	**37.38**	**119,723**
		No				
			0000902	1	6.88	20,057
			0000903	1	6.00	18,346
			0000904	1	8.37	31,918
			0000906	1	5.16	14,429
			0000907	1	2.91	8,019
			0000908	1	5.09	15,677
			0000916	1	2.97	11,278
	MOUND (#0030) 1X 2Y			**6**	**38.51**	**113,814**
		No				
			0003002	1	7.93	28,543

Rank	Substation Bus	OHA Members	Circuit No.	Circuit Count	MVA NCP	MWh
			0003004	1	5.82	21,941
			0003007	1	5.19	16,068
		Yes				
			0003001	1	3.11	16,180
			0003003	1	8.86	24,185
			0003005	1	7.60	6,896
Total				**169**	**1282.65**	**4,301,726**

5.3 AMI Deployment Maps

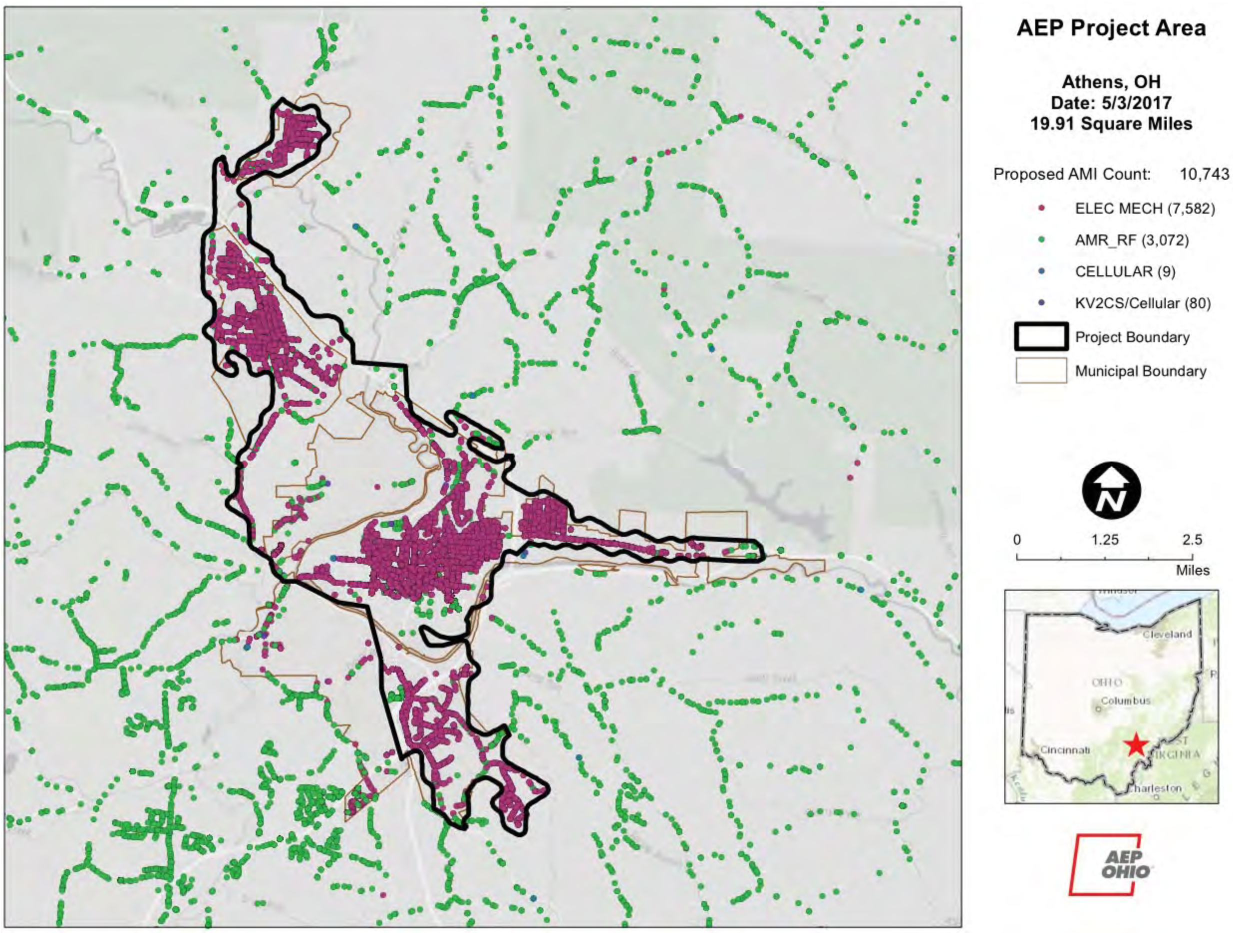

Figure 7: Planned AMI Deployment Area for Athens, Ohio

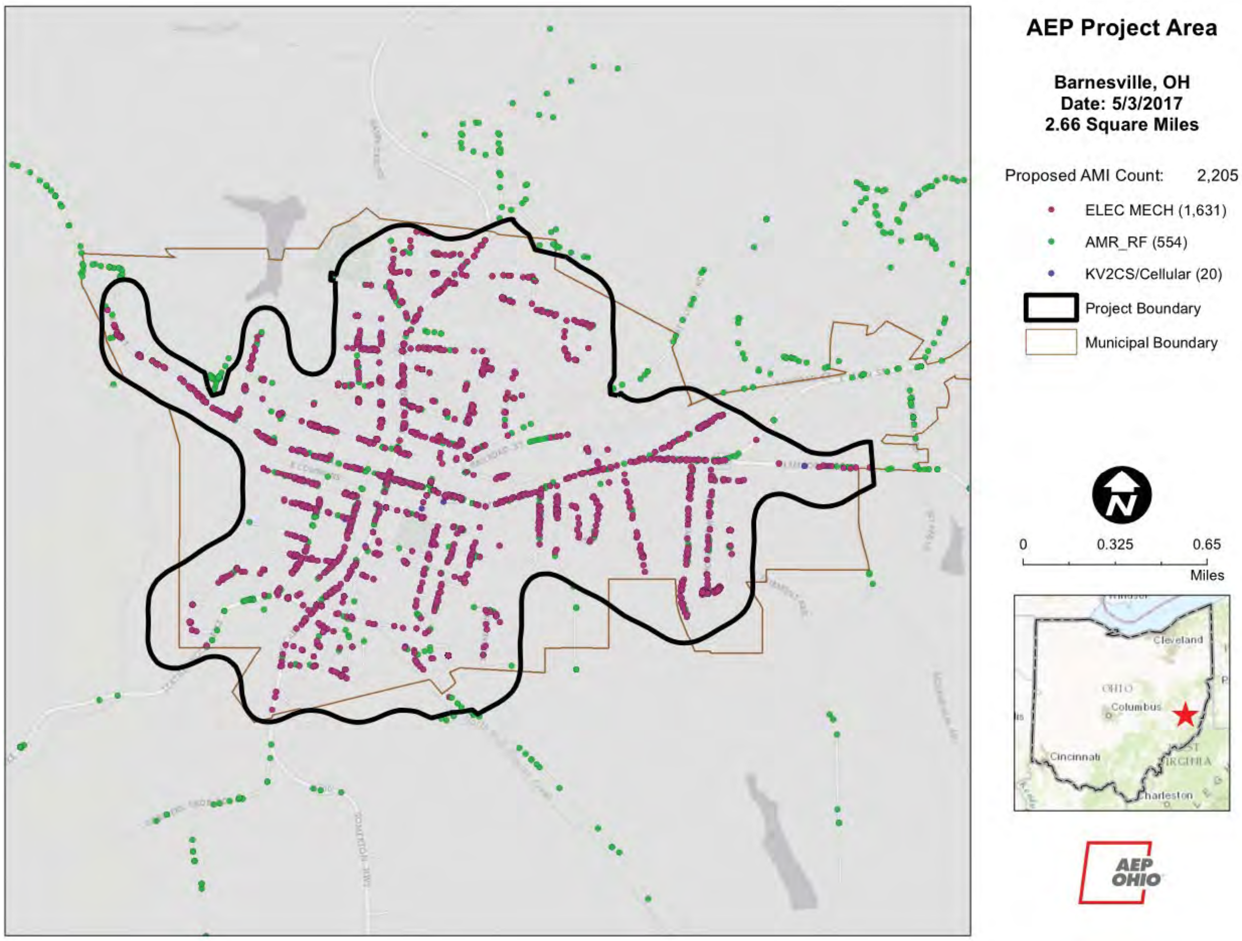

Figure 8: Planned AMI Deployment for Barnesville, Ohio

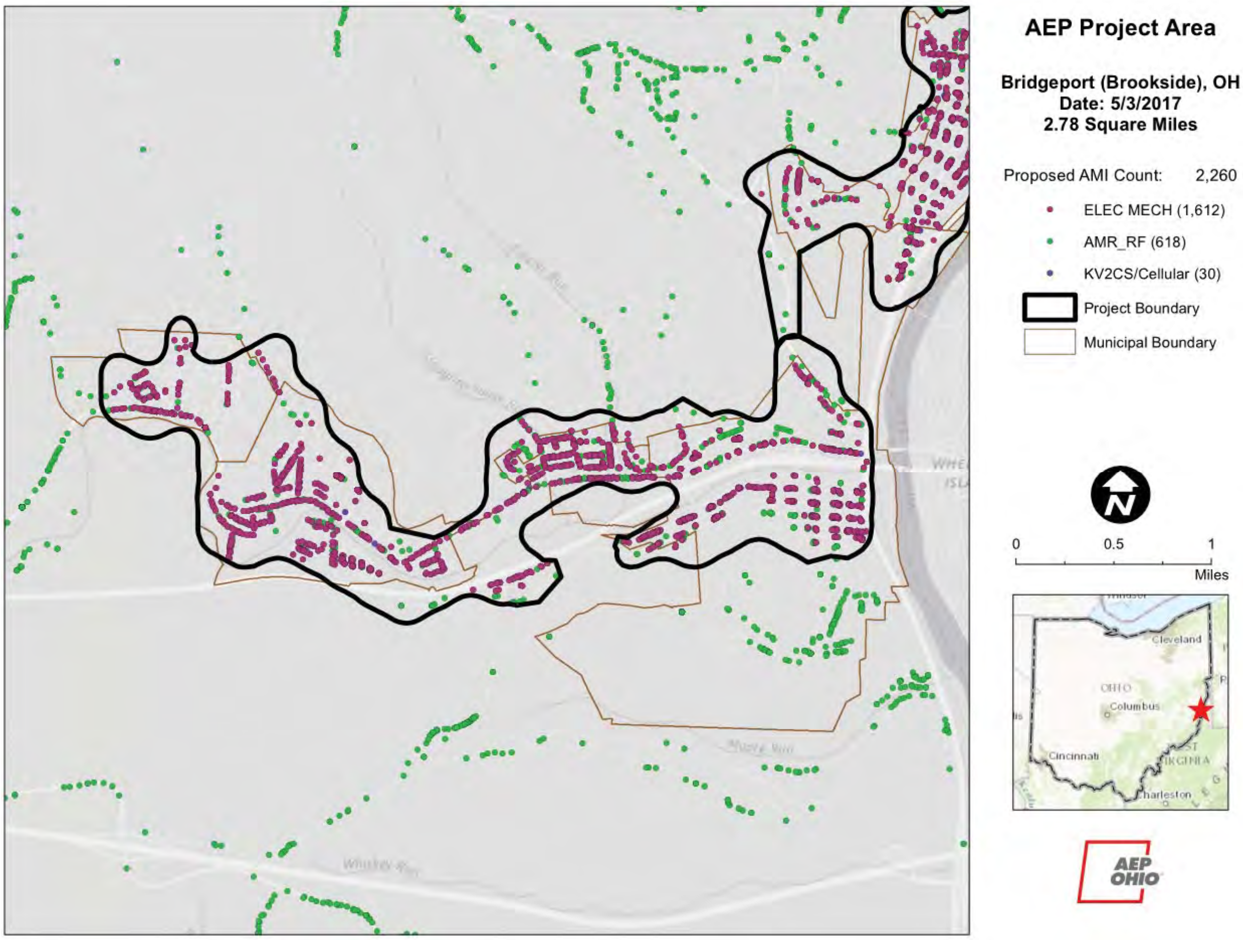

Figure 9: Planned AMI Deployment Area for Bridgeport (Brookside), Ohio

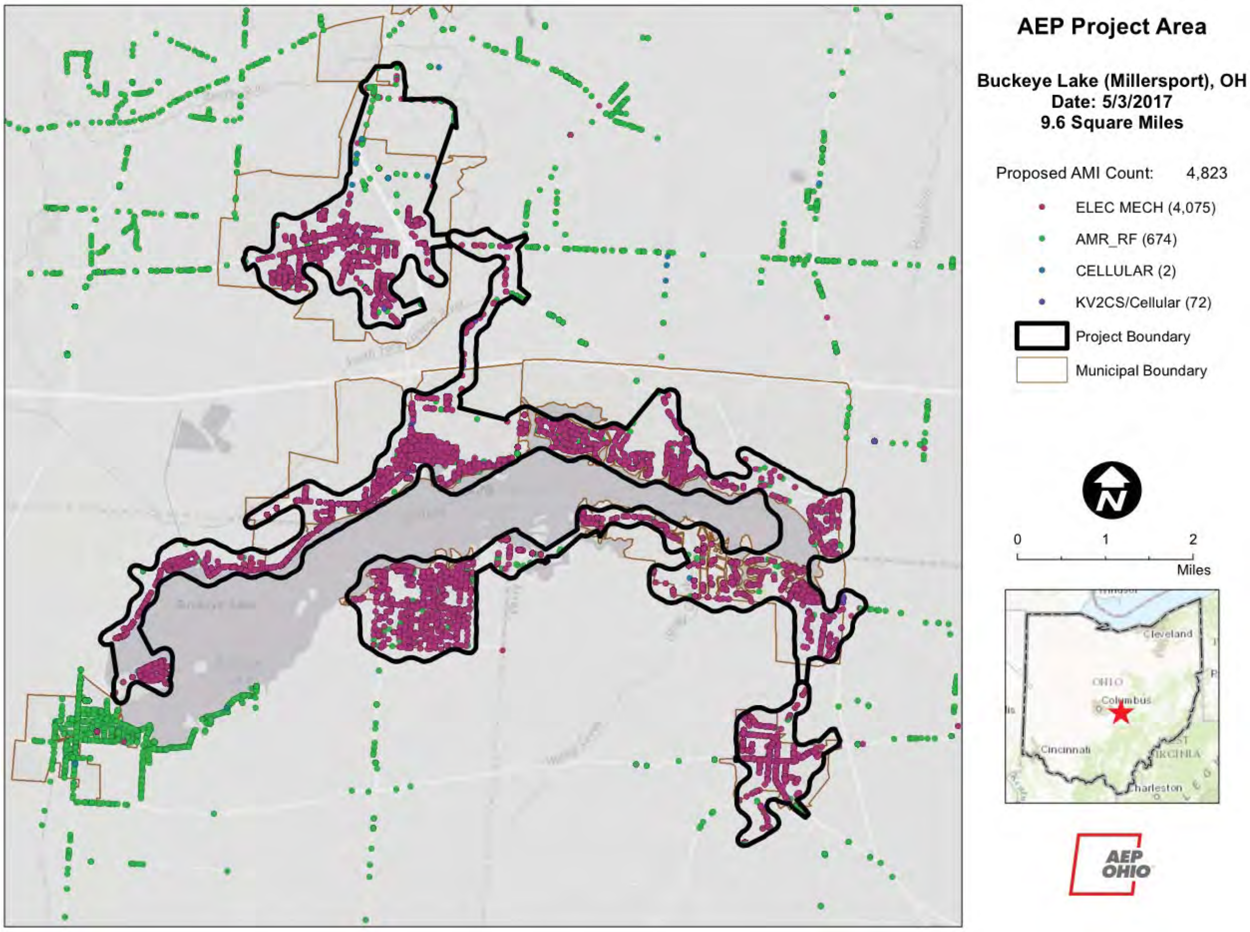

Figure 10: Planned AMI Deployment Area for Buckeye Lake (Millersport), Ohio

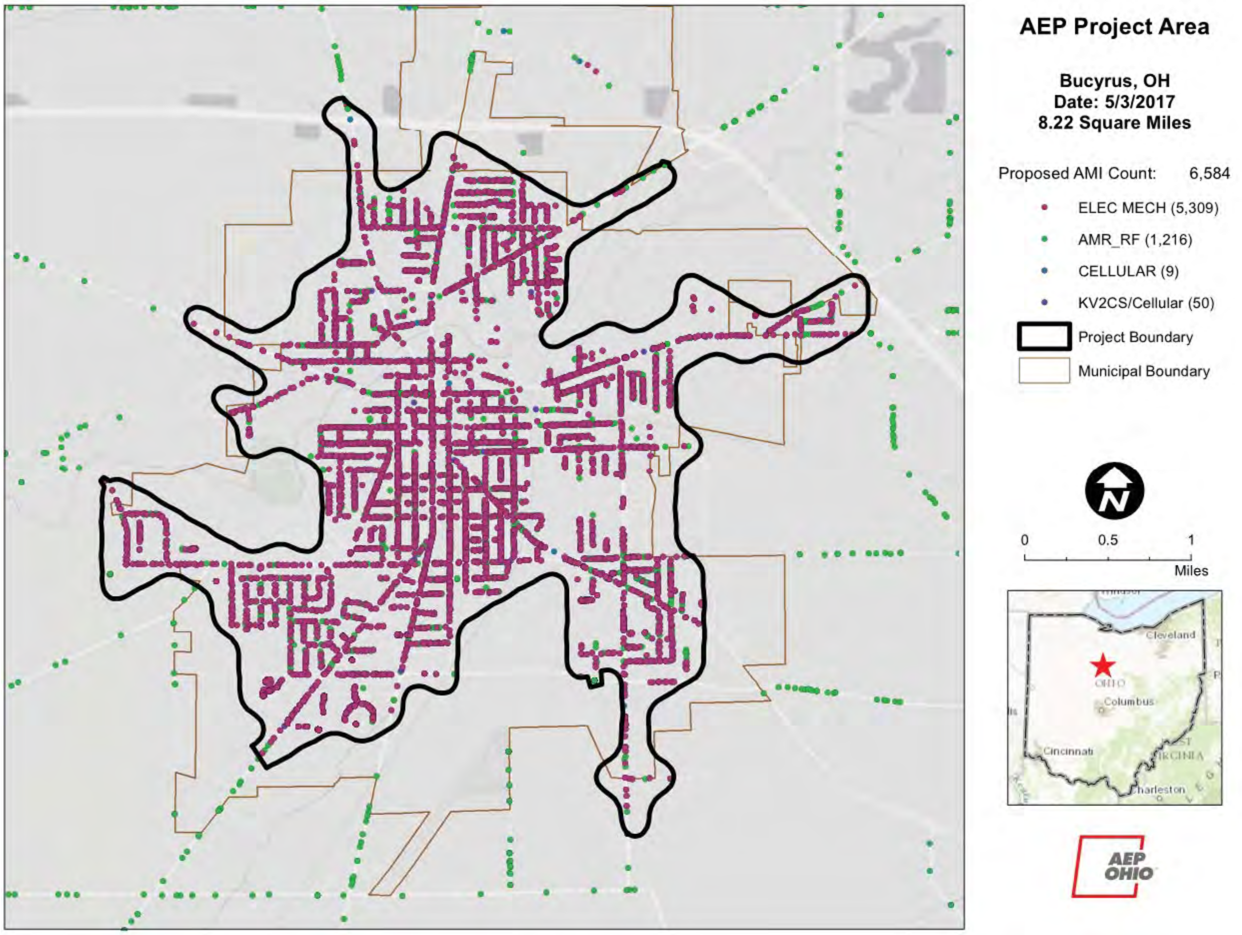

Figure 11: Planned AMI Deployment Area for Bucyrus, Ohio

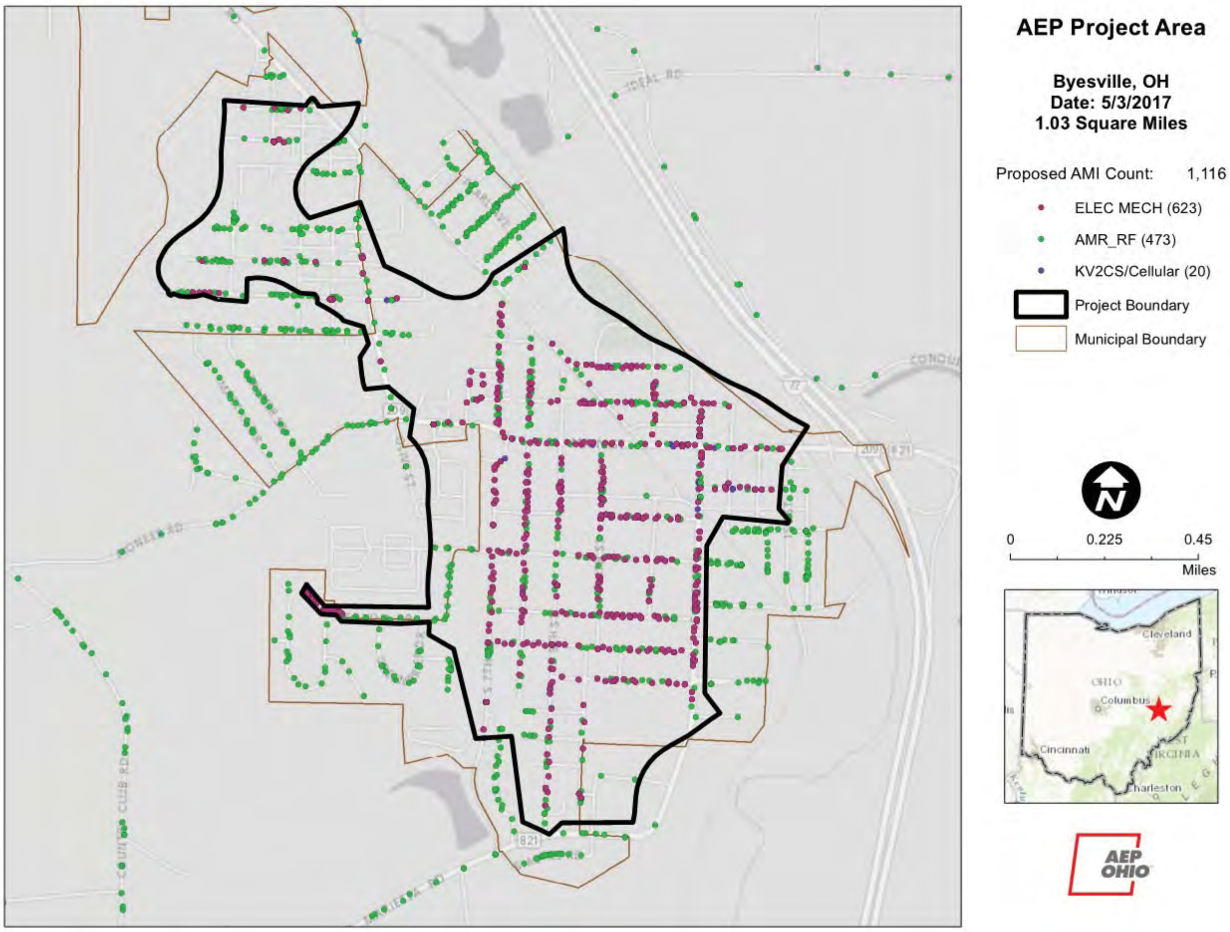

Figure 12: Planned AMI Deployment Area for Byesville, Ohio

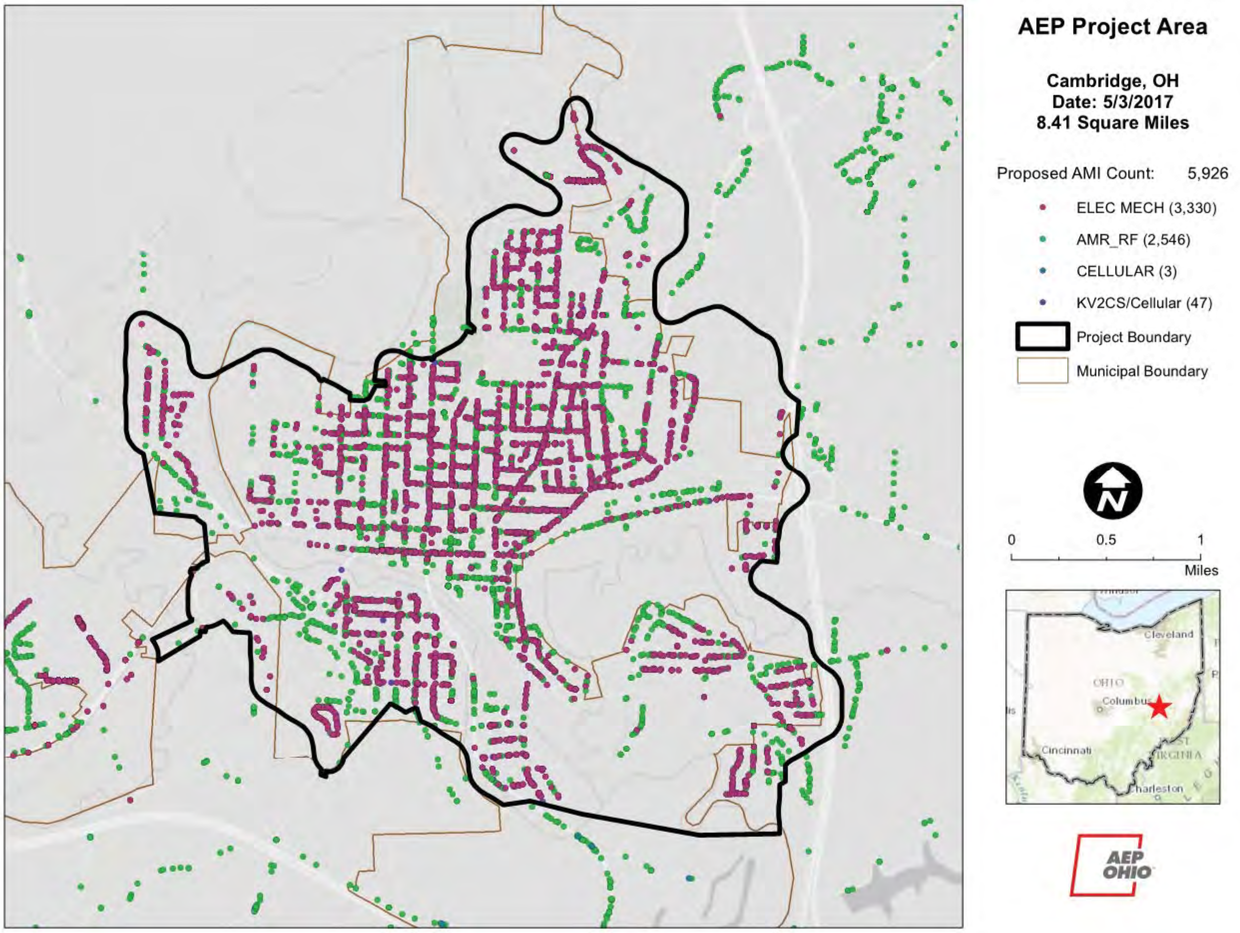

Figure 13: Planned AMI Deployment Area for Cambridge, Ohio

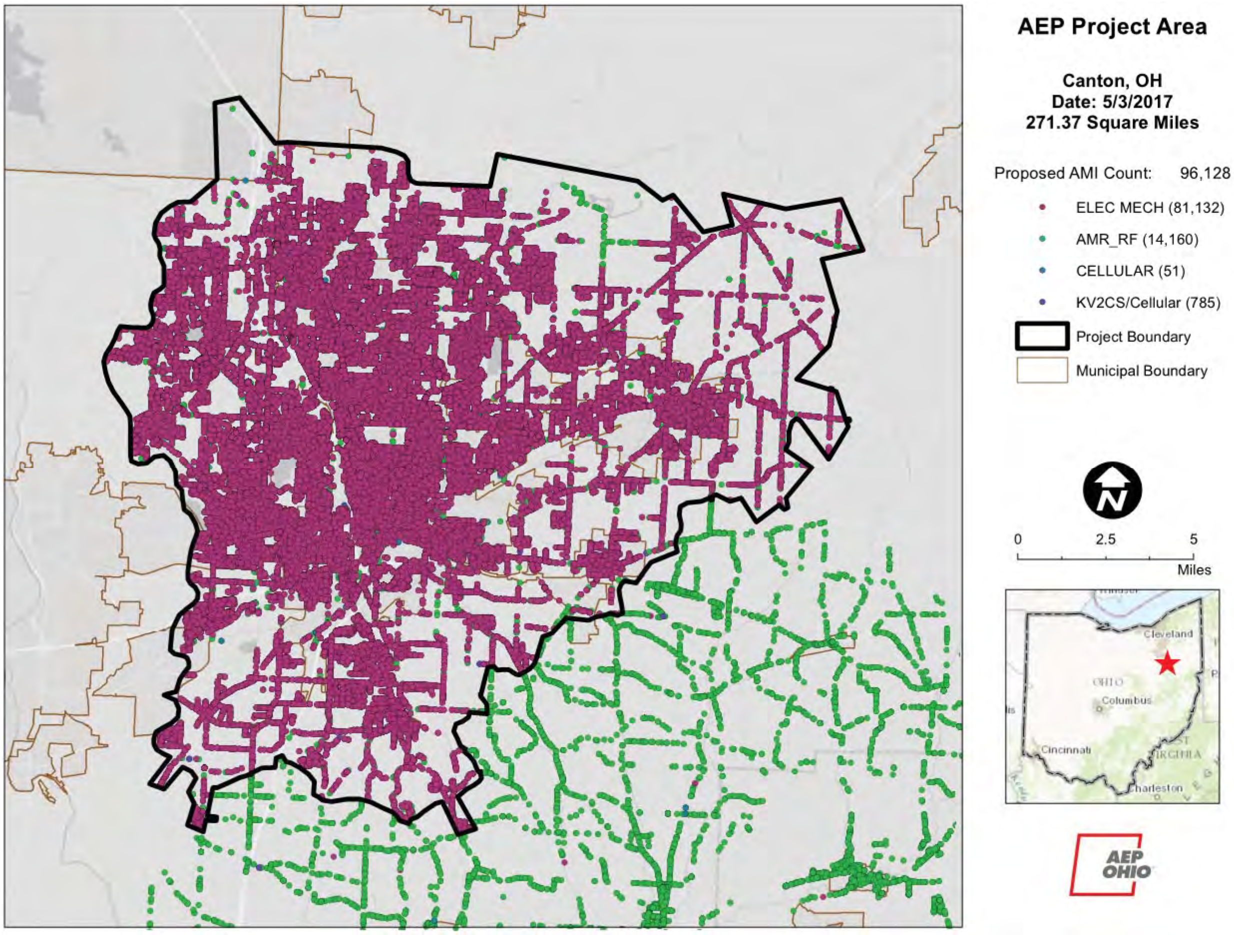

Figure 14: Planned AMI Deployment Area for Canton, Ohio

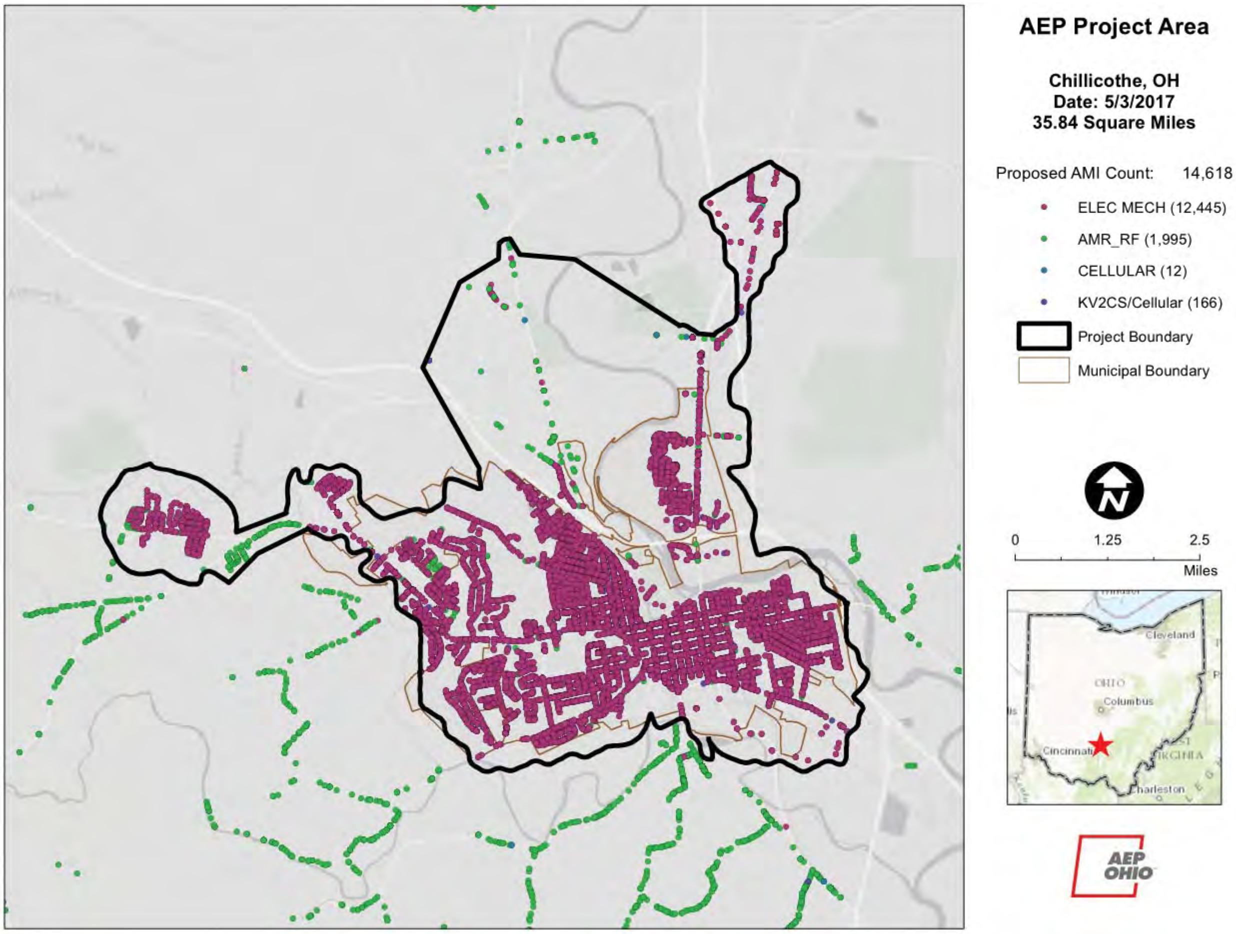

Figure 15: Planned AMI Deployment Area for Chillicothe, Ohio

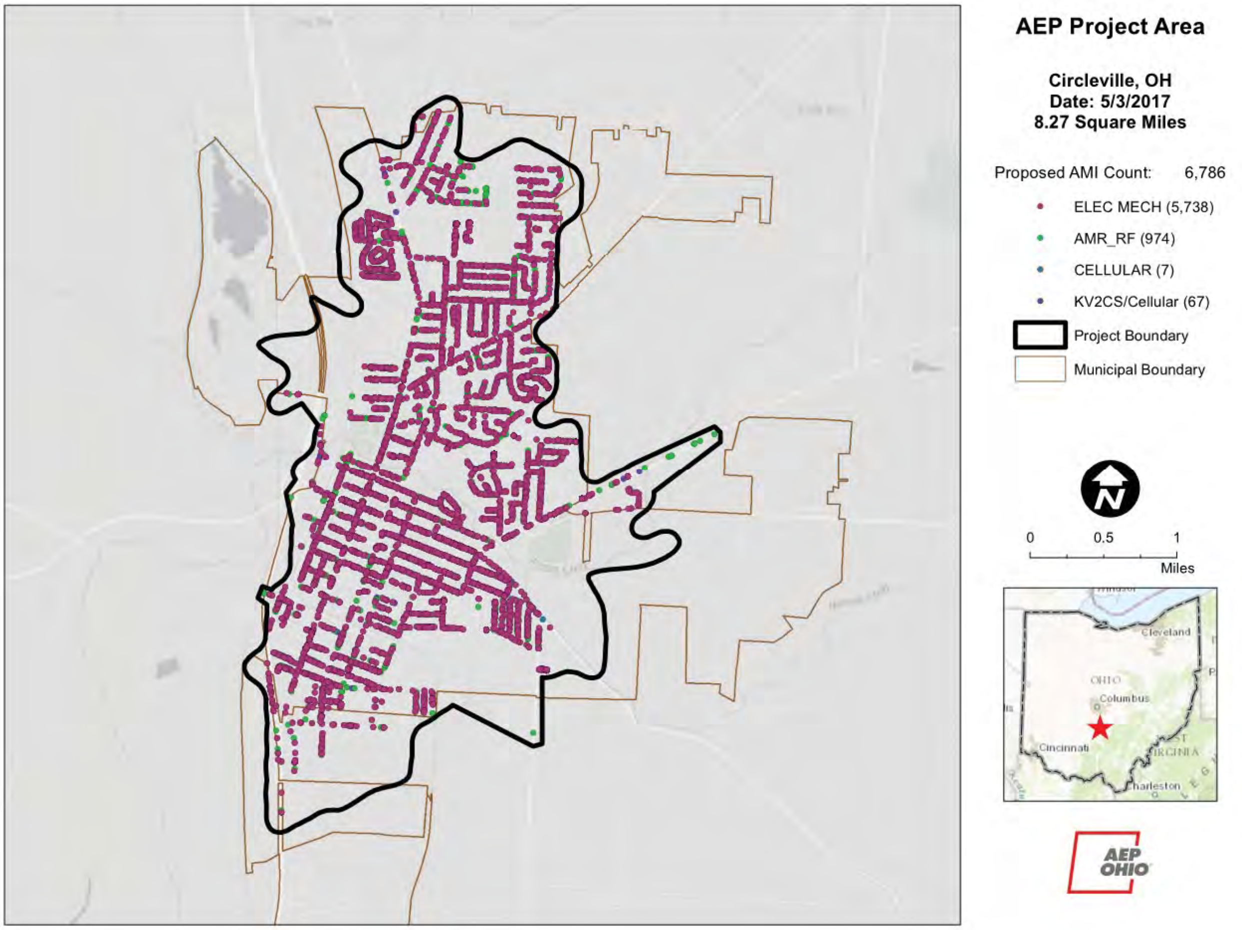

Figure 16: Planned AMI Deployment Area for Circleville, Ohio

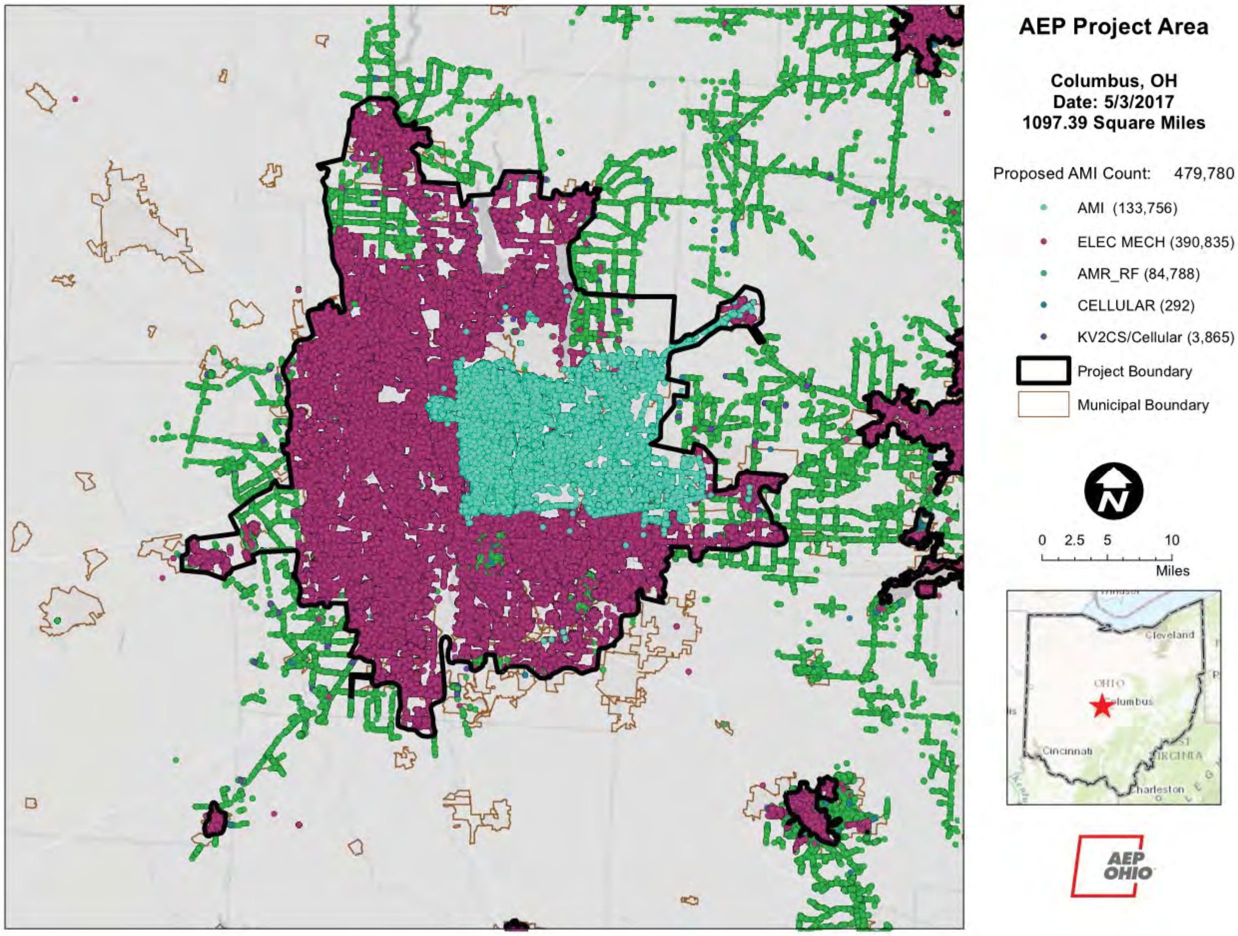

Figure 17: Planned AMI Deployment Area for Columbus, Ohio

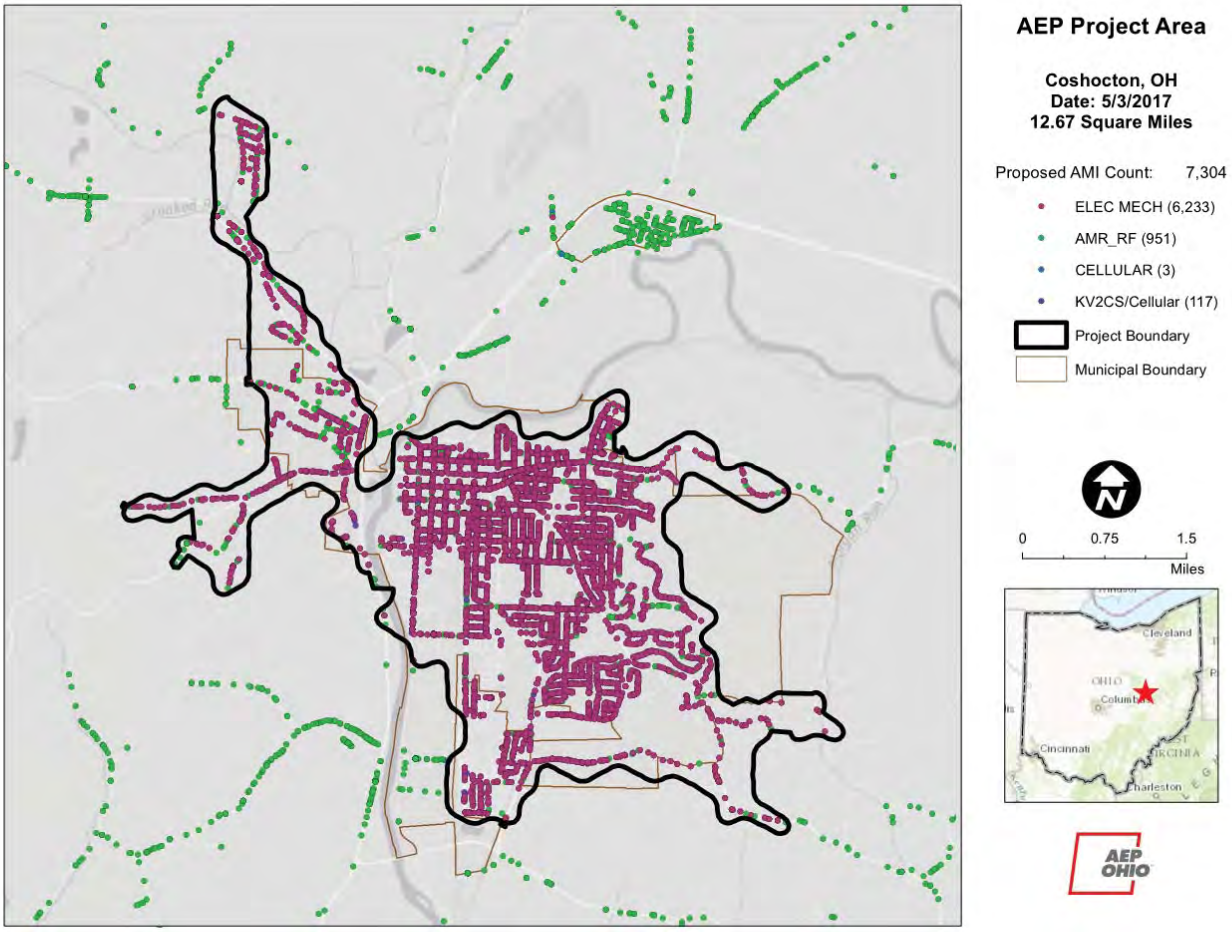

Figure 18: Planned AMI Deployment Area for Coshocton, Ohio

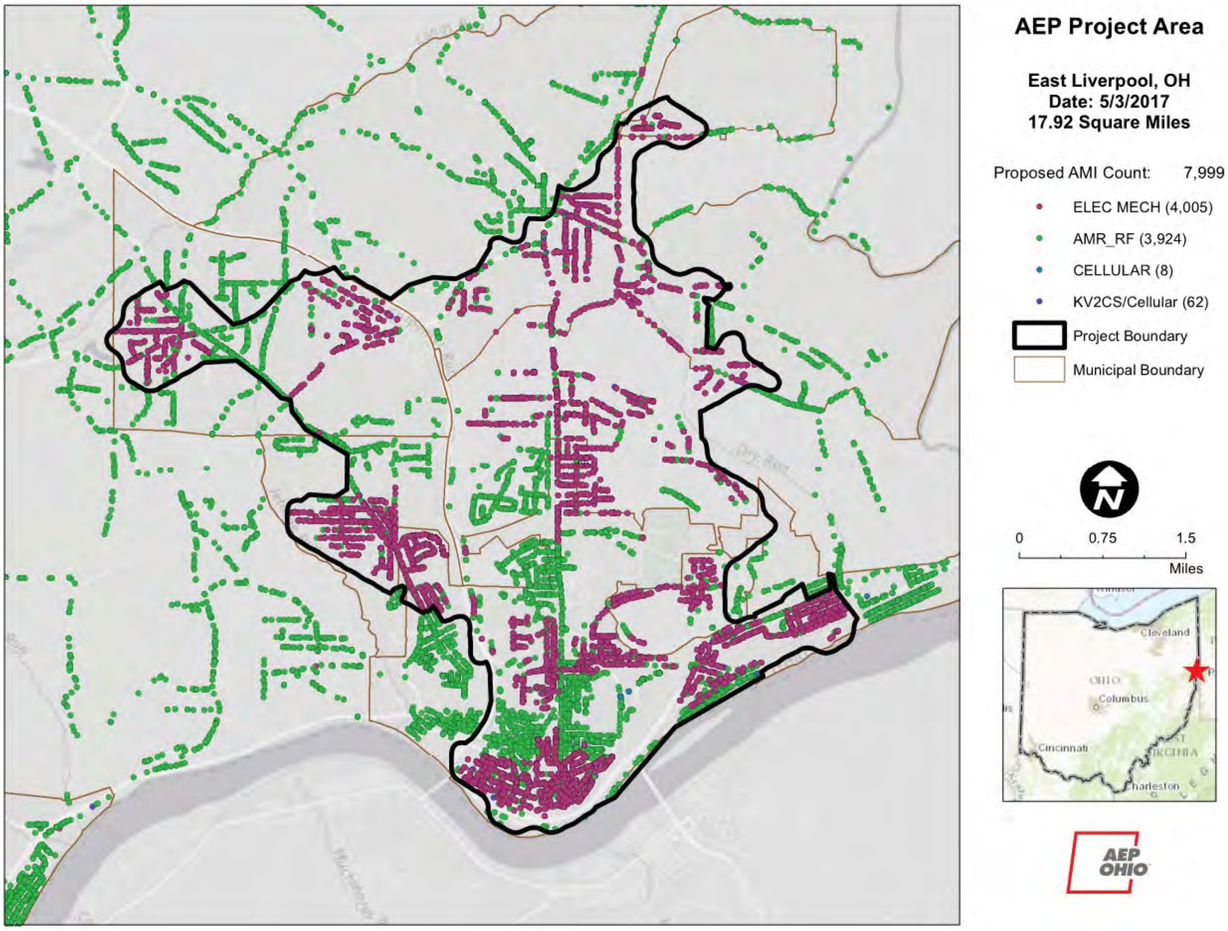

Figure 19: Planned AMI Deployment Area for East Liverpool, Ohio

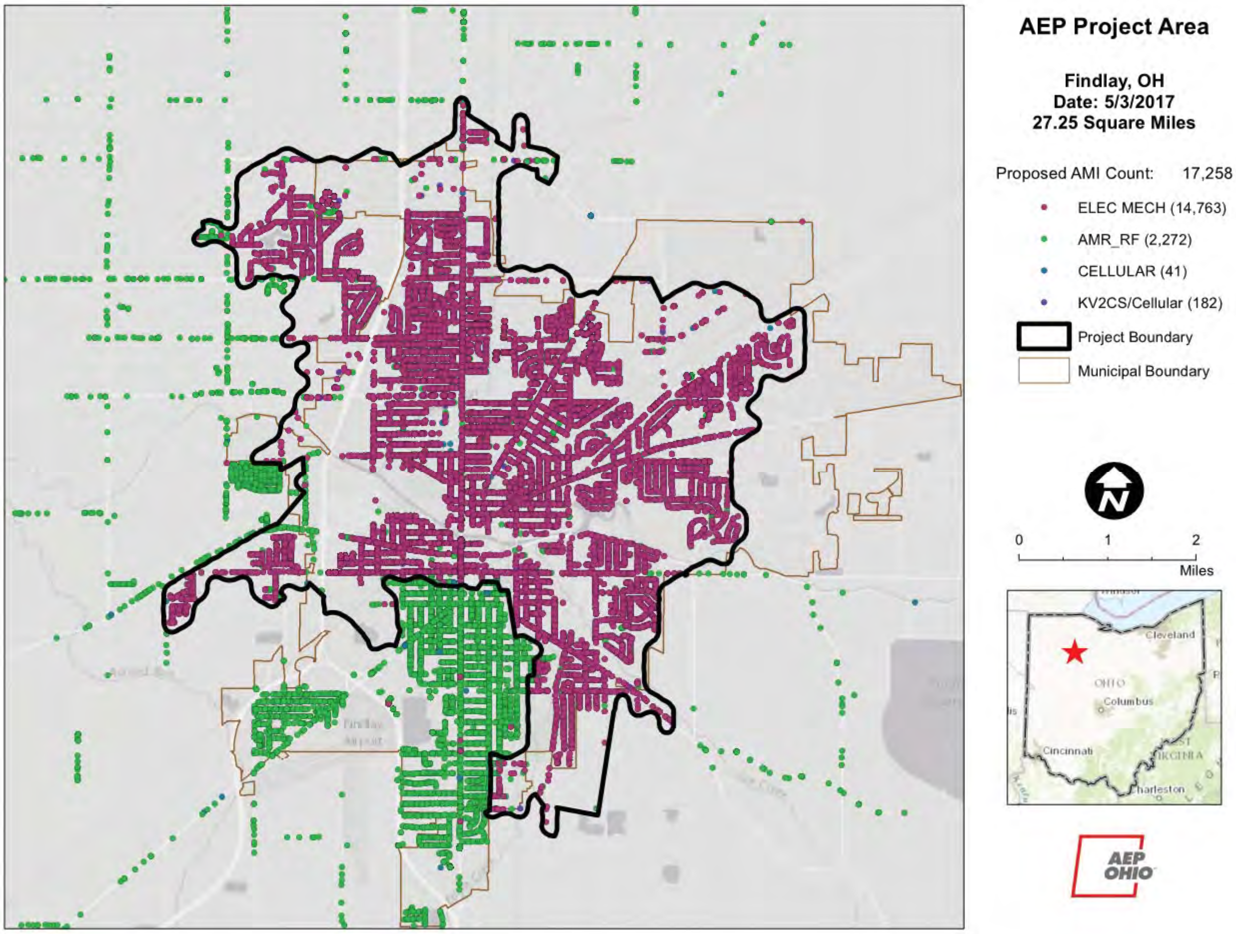

Figure 20: Planned AMI Deployment Area for Findlay, Ohio

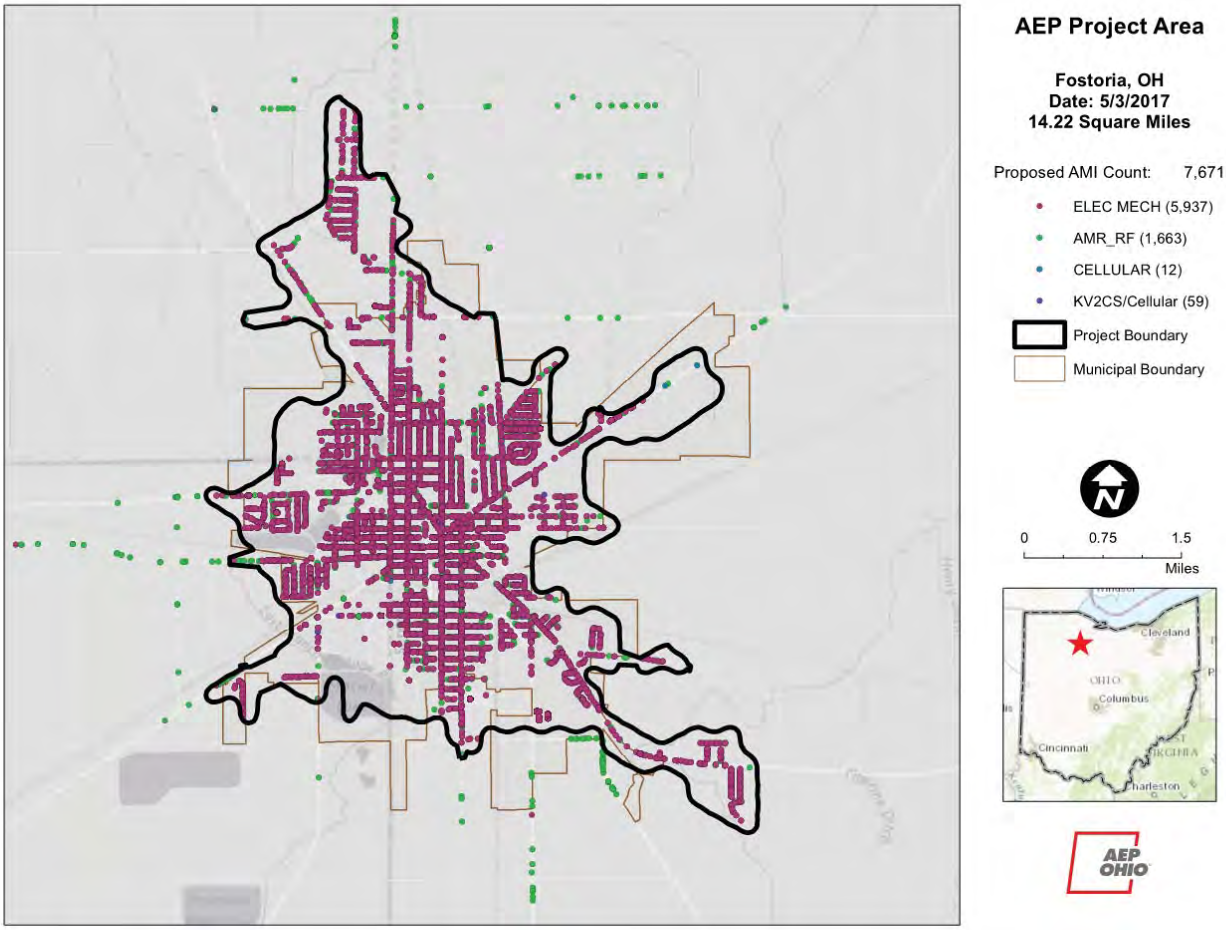

Figure 21: Planned AMI Deployment Area for Fostoria, Ohio

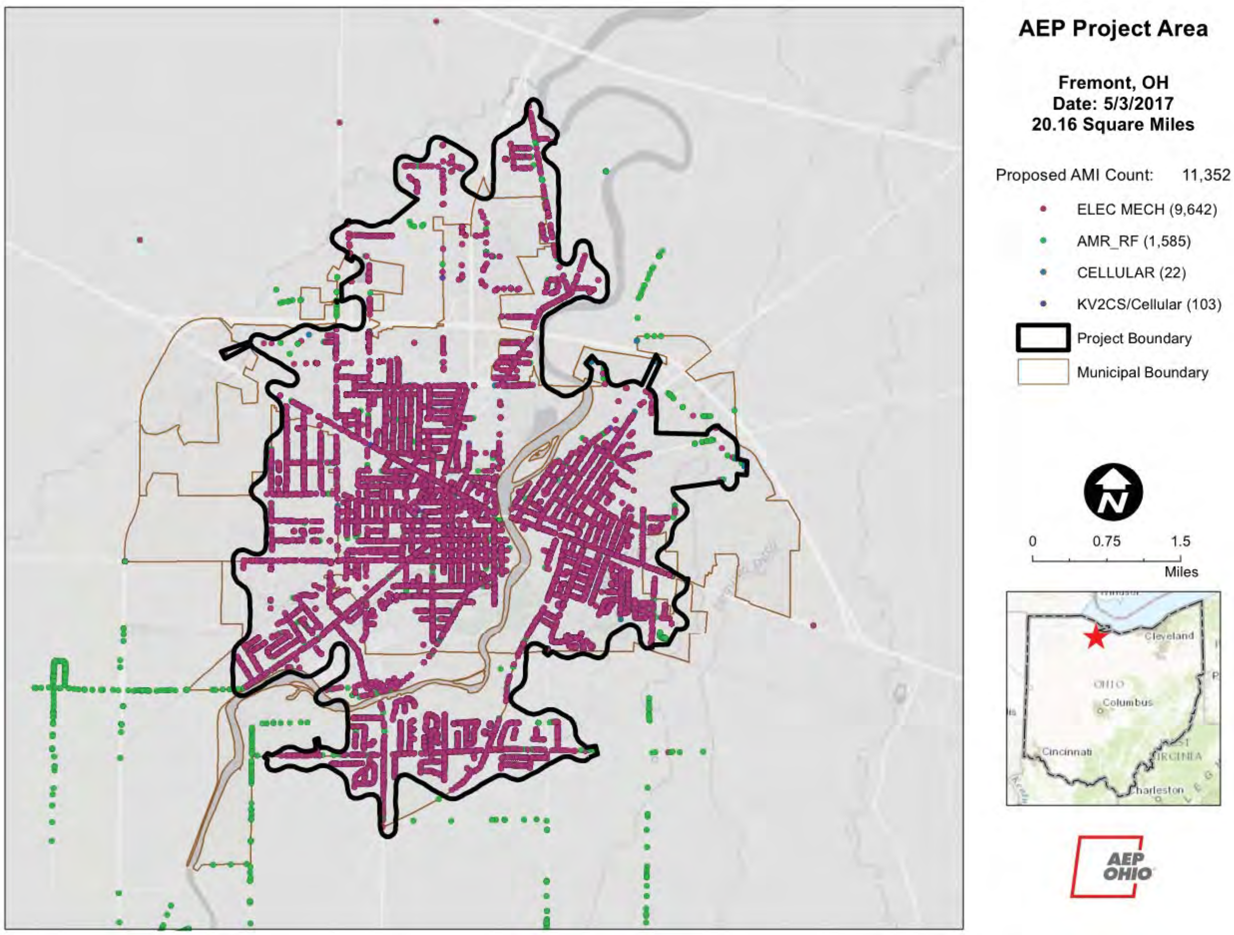

Figure 22: Planned AMI Deployment Area for Fremont, Ohio

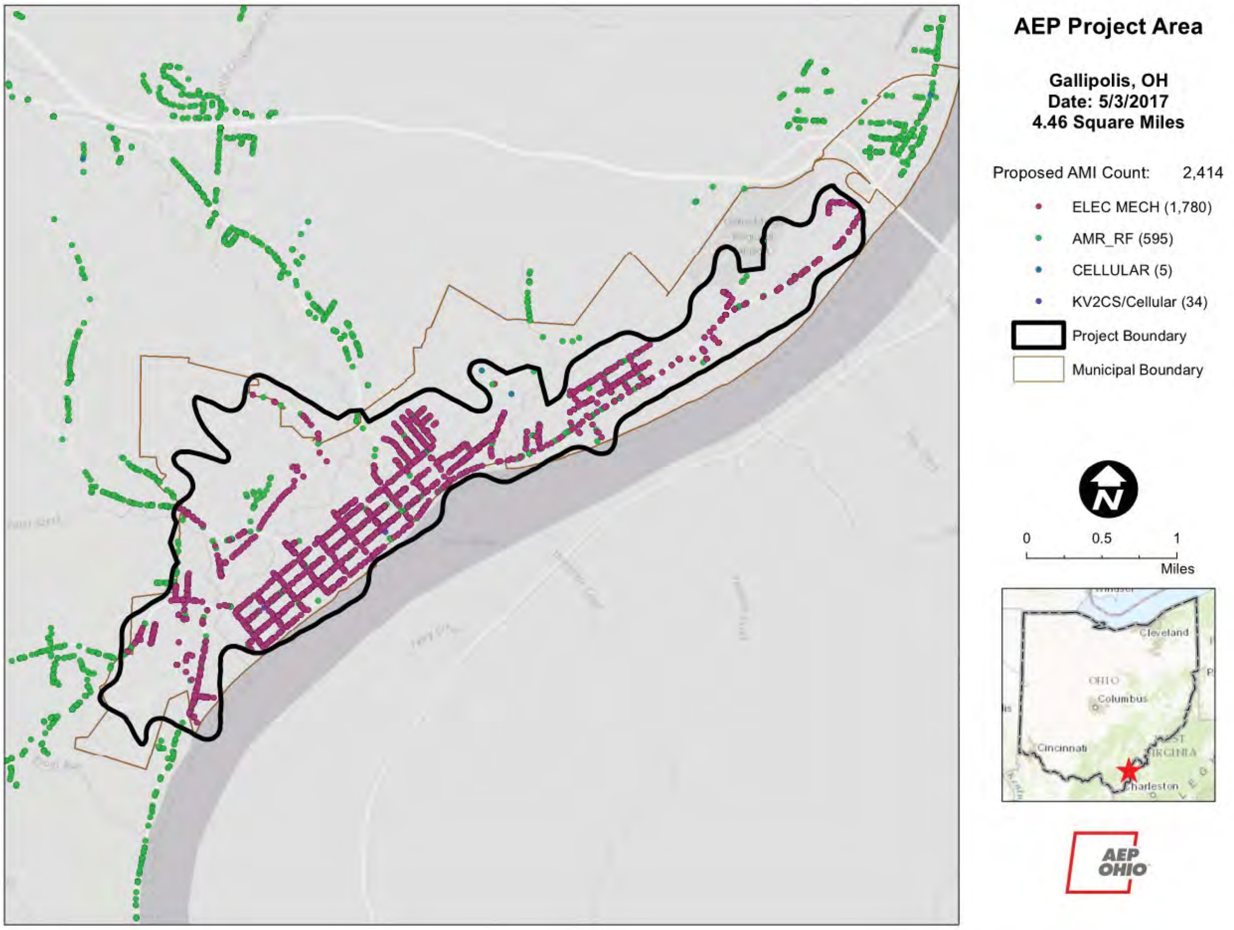

Figure 23: Planned AMI Deployment Area for Gallipolis, Ohio

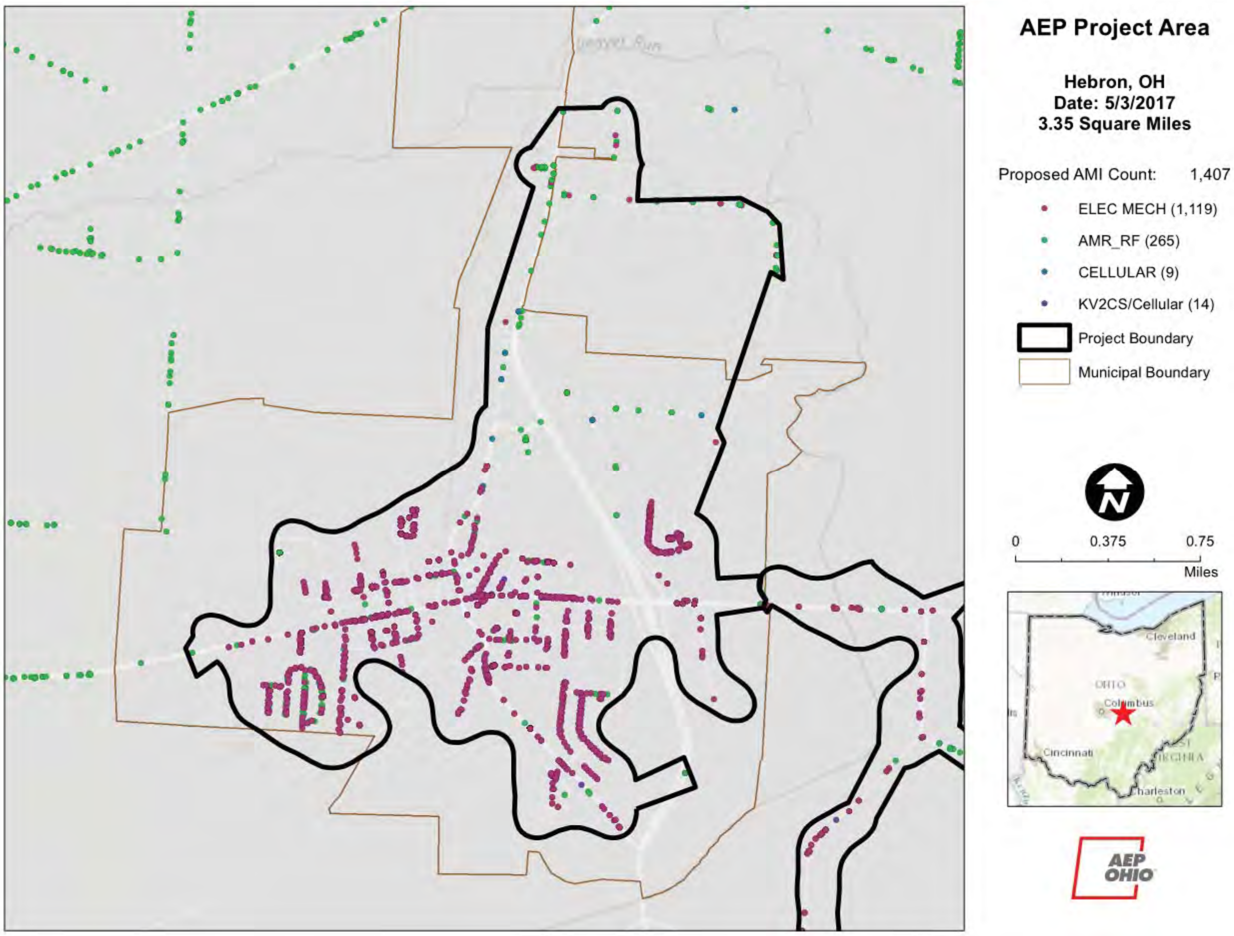

Figure 24: Planned AMI Deployment Area for Hebron, Ohio

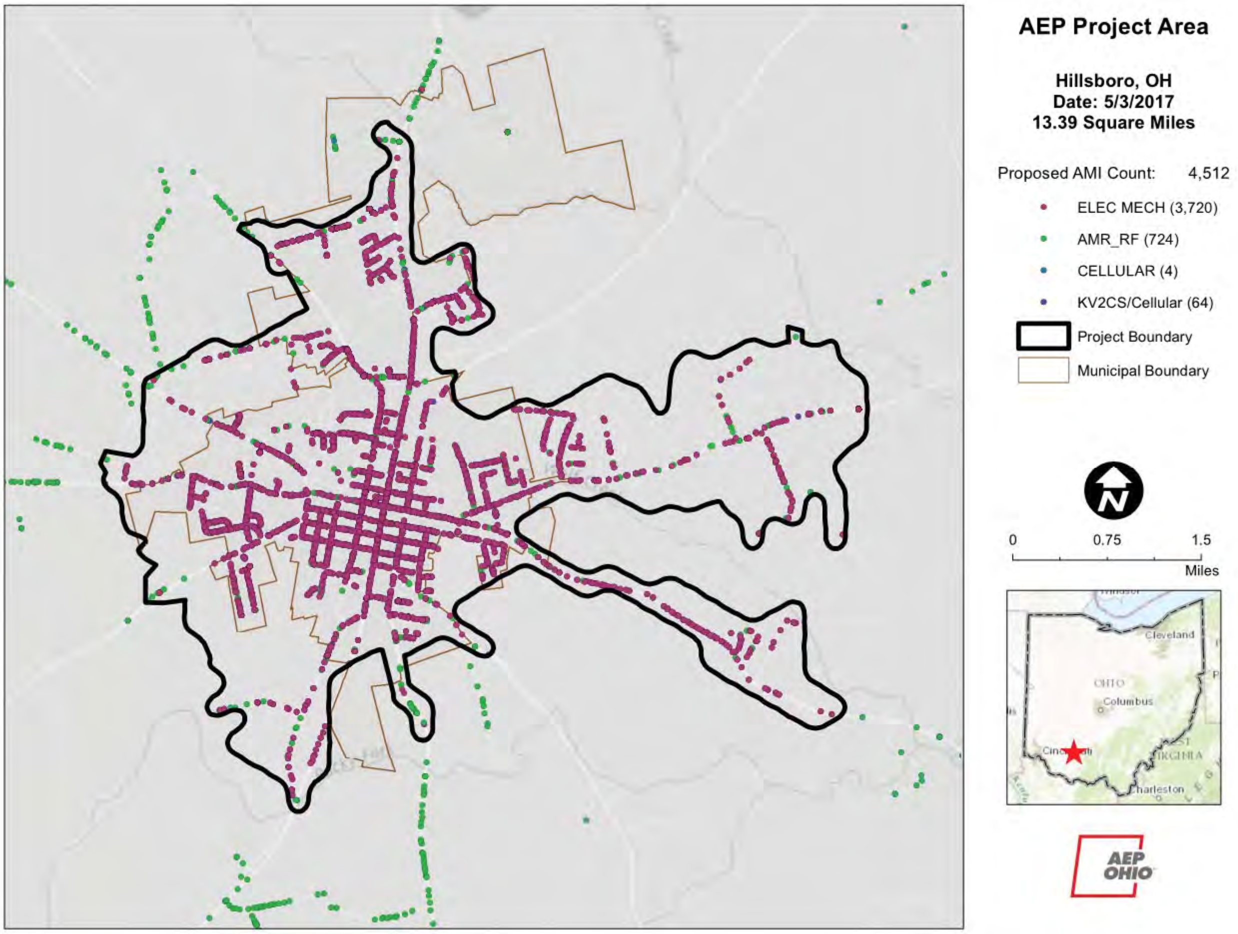

Figure 25: Planned AMI Deployment Area for Hillsboro, Ohio

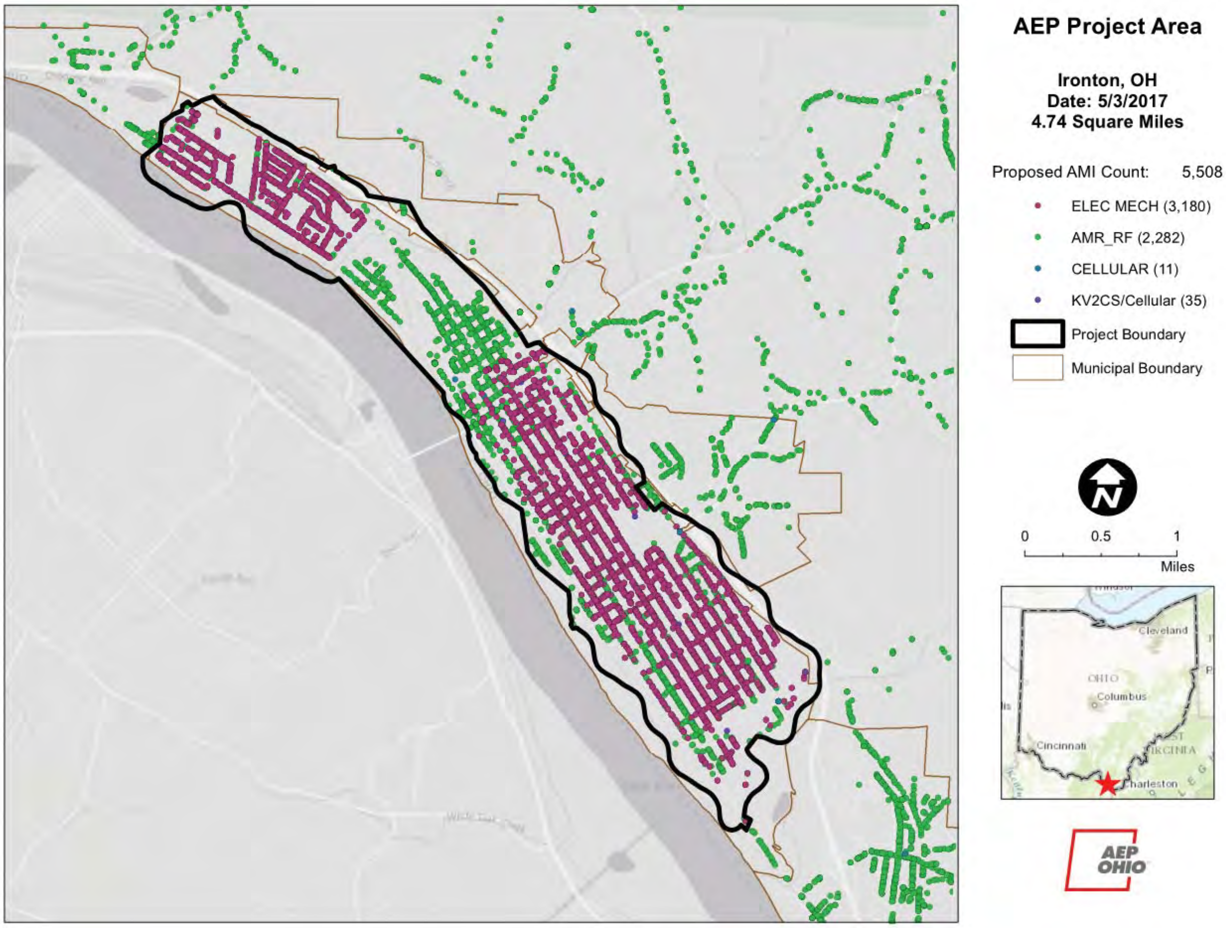

Figure 26: Planned AMI Deployment Area for Ironton, Ohio

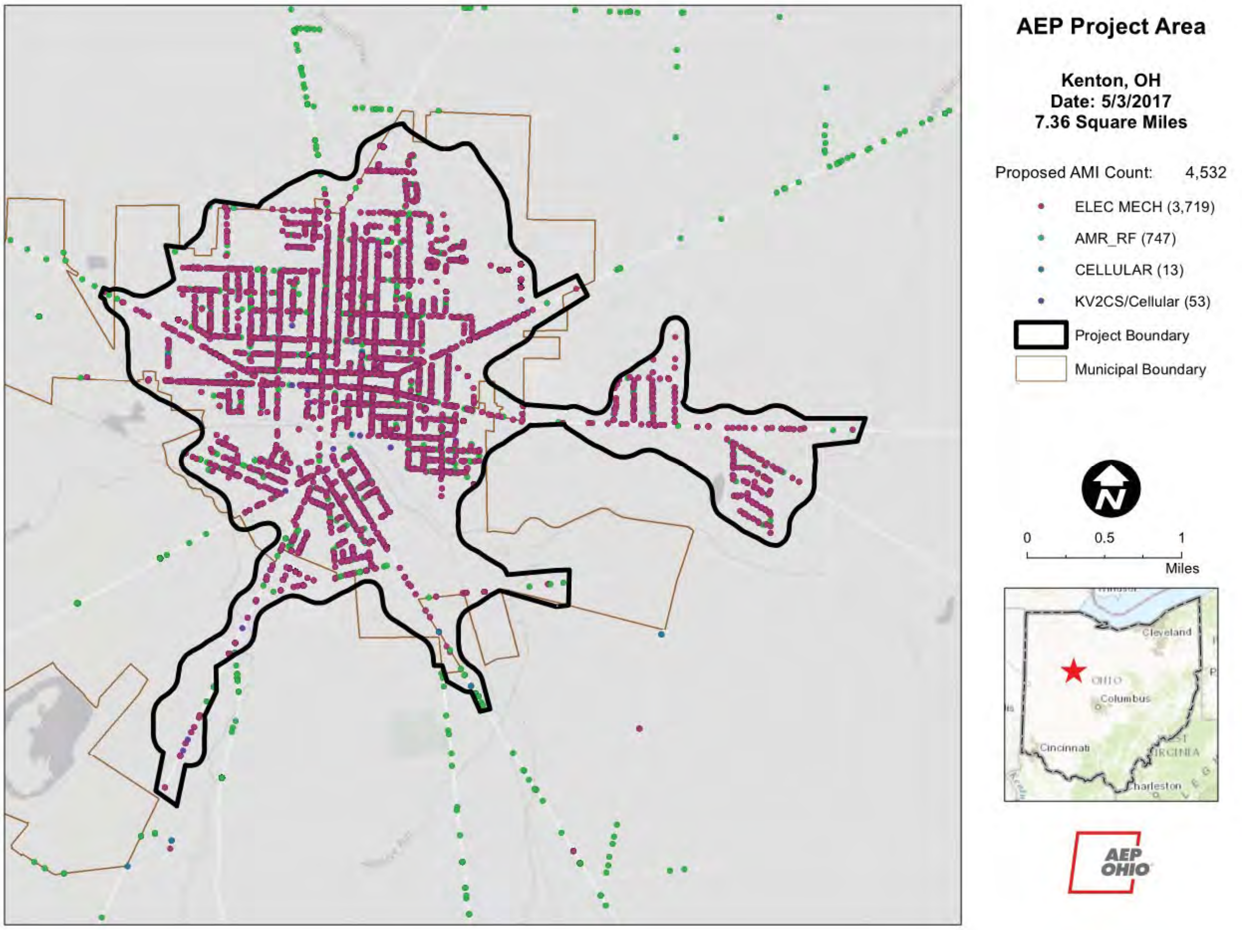

Figure 27: Planned AMI Deployment Area for Kenton, Ohio

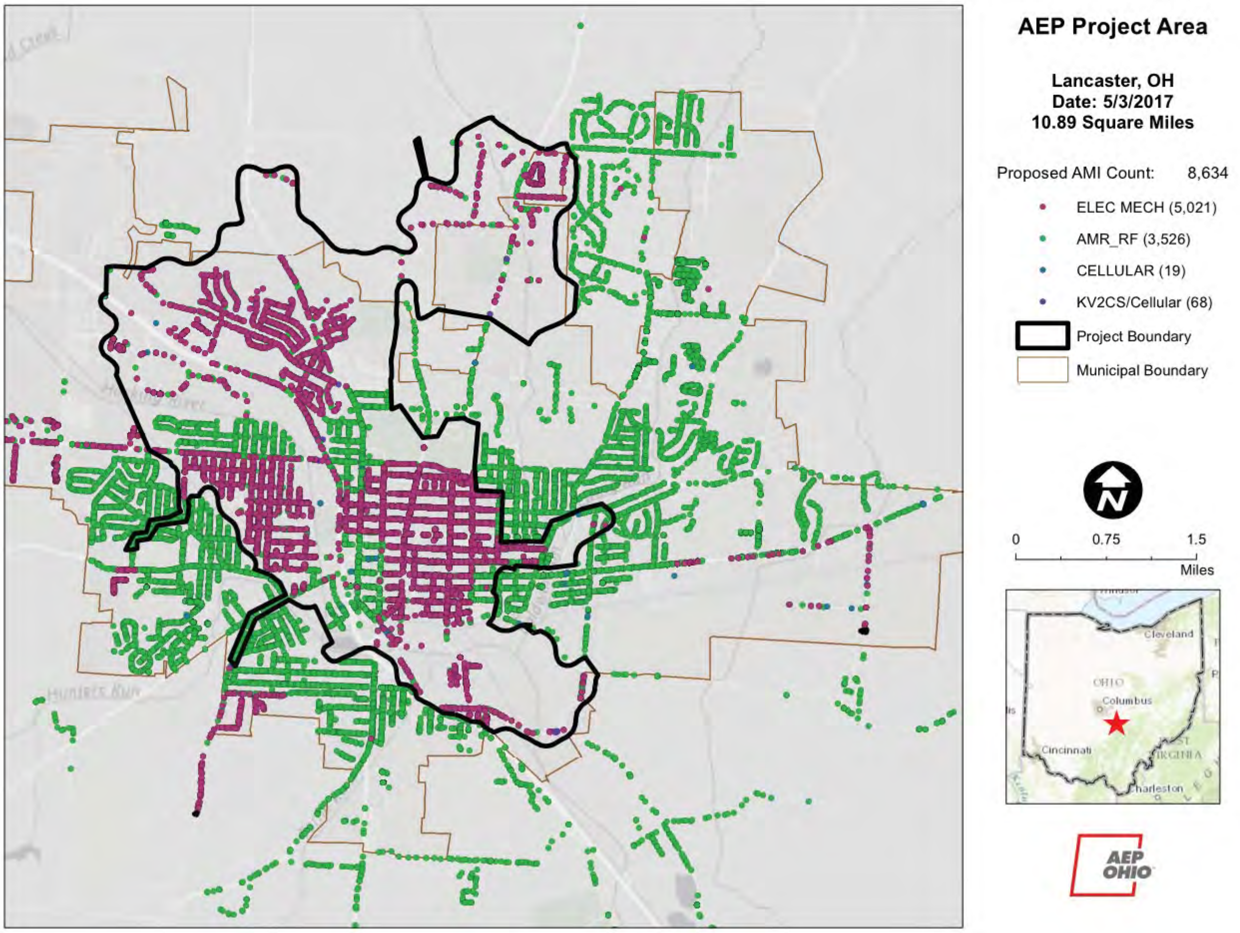

Figure 28: Planned AMI Deployment Area for Lancaster, Ohio

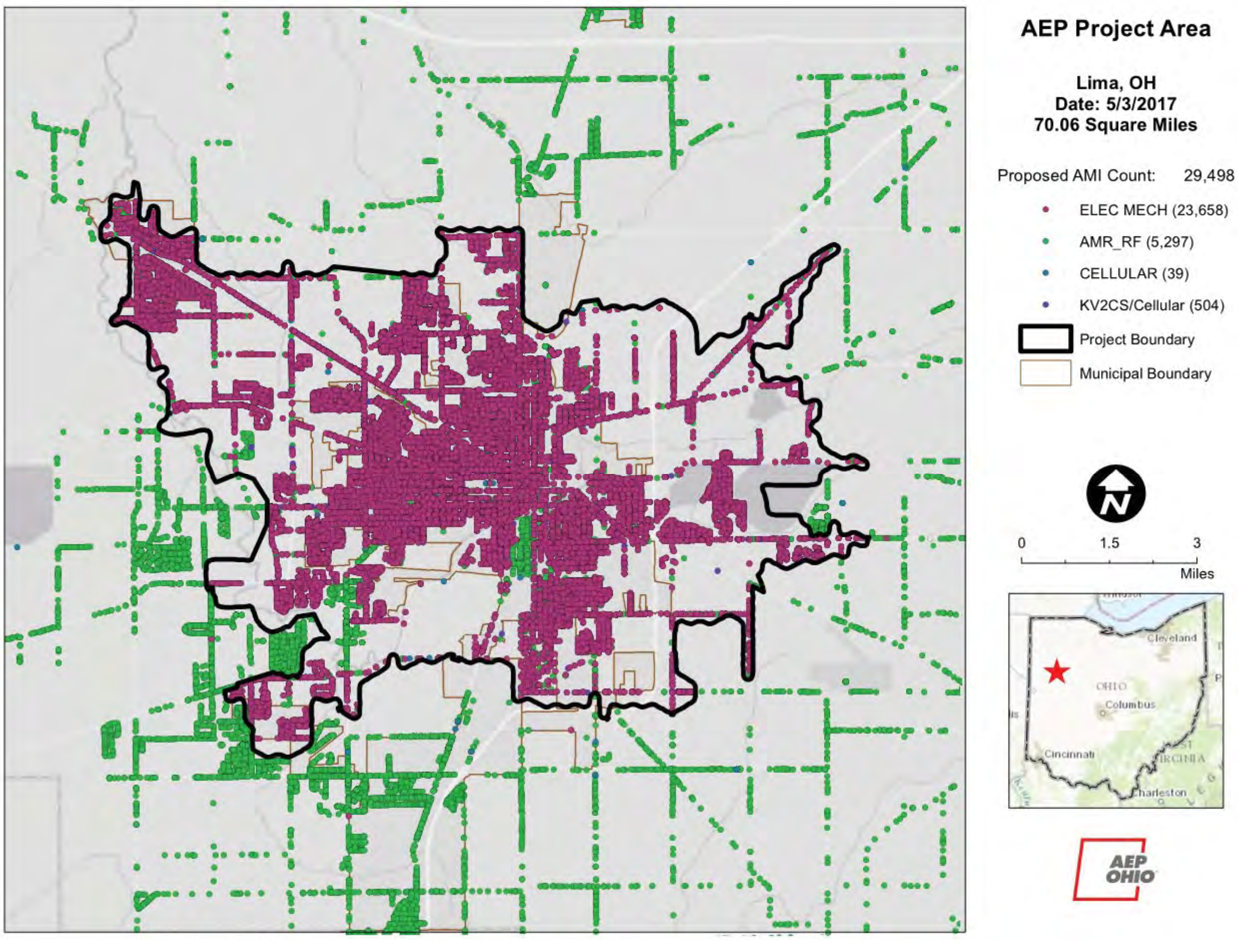

Figure 29: Planned AMI Deployment Area for Lima, Ohio

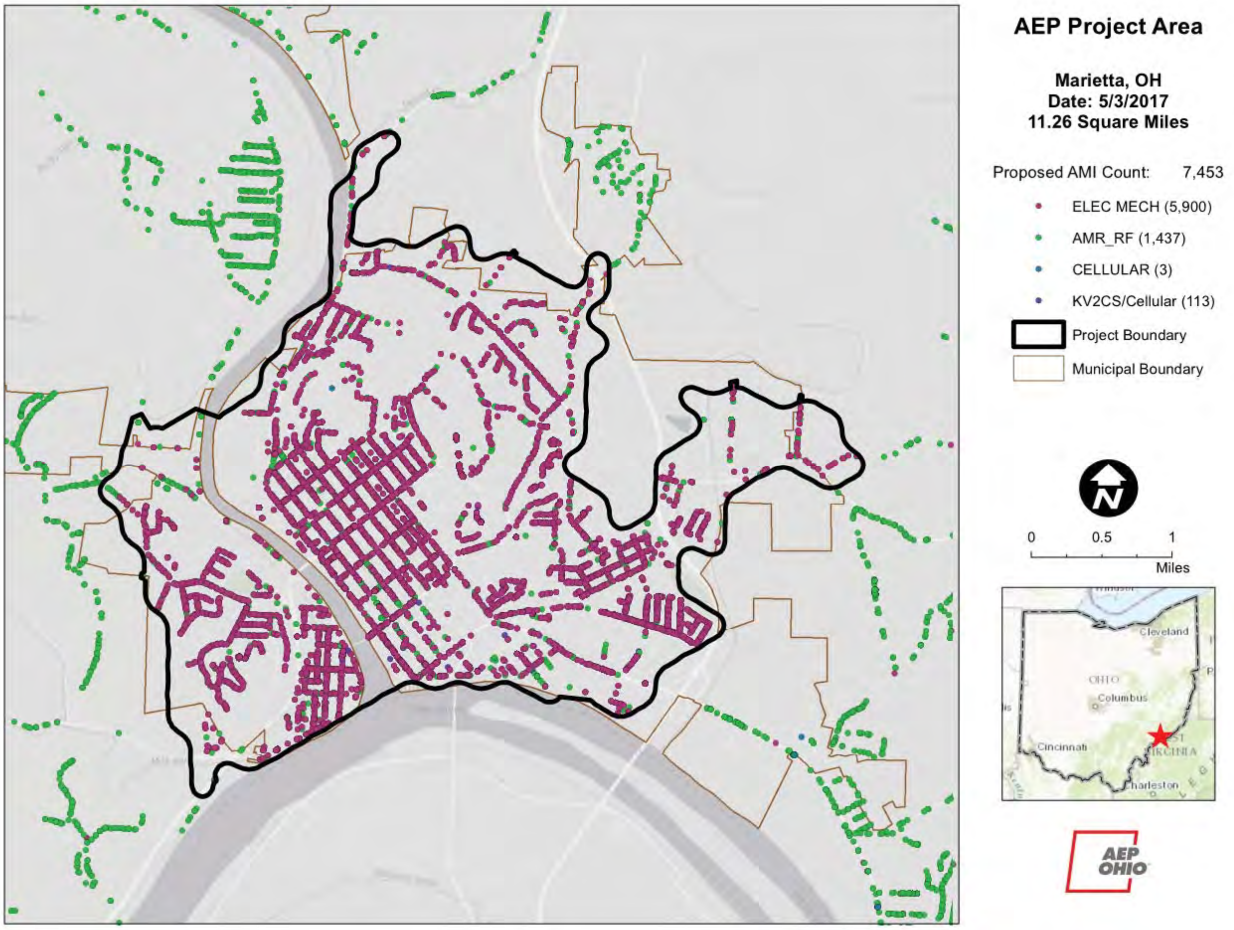

Figure 30: Planned AMI Deployment Area for Marietta, Ohio

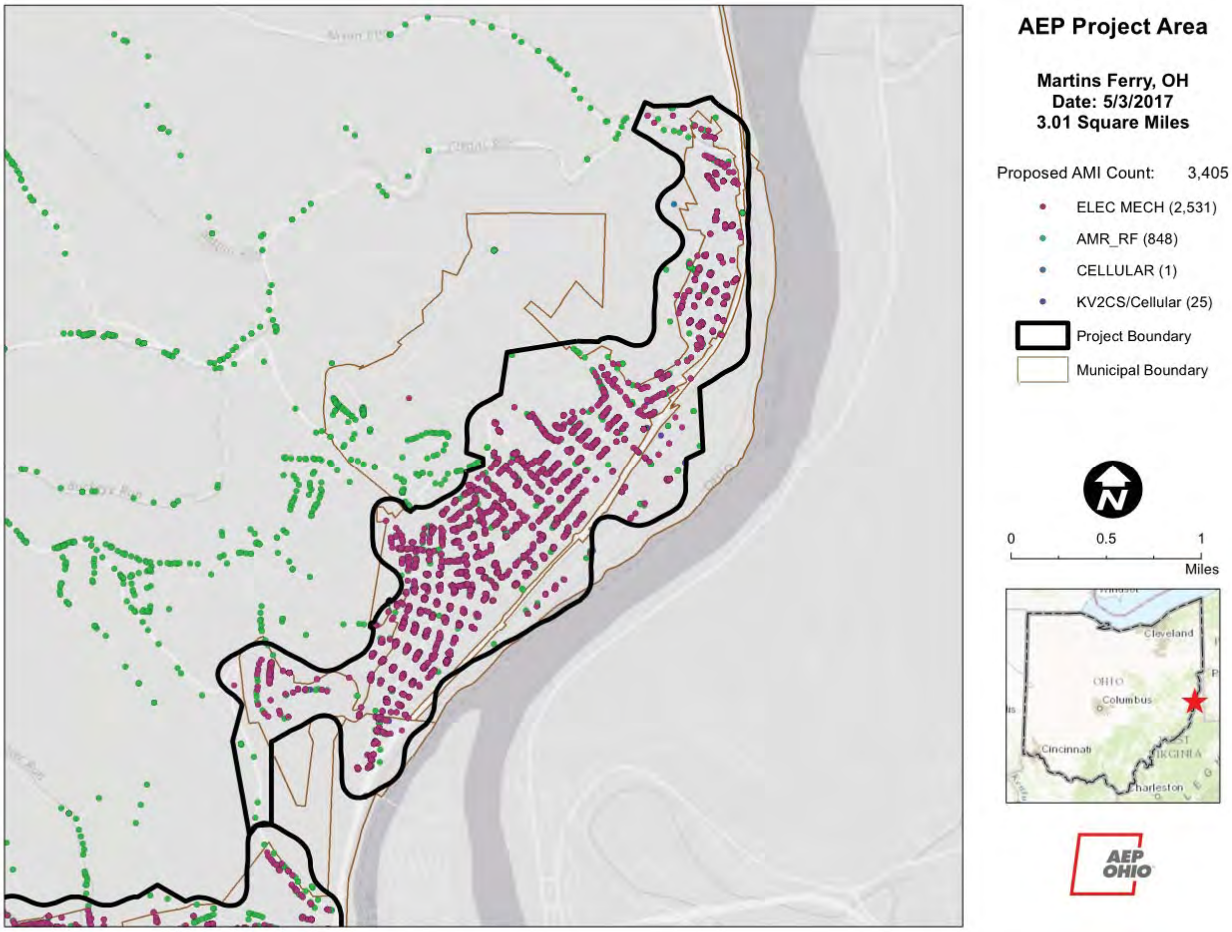

Figure 31: Planned AMI Deployment Area for Martins Ferry, Ohio

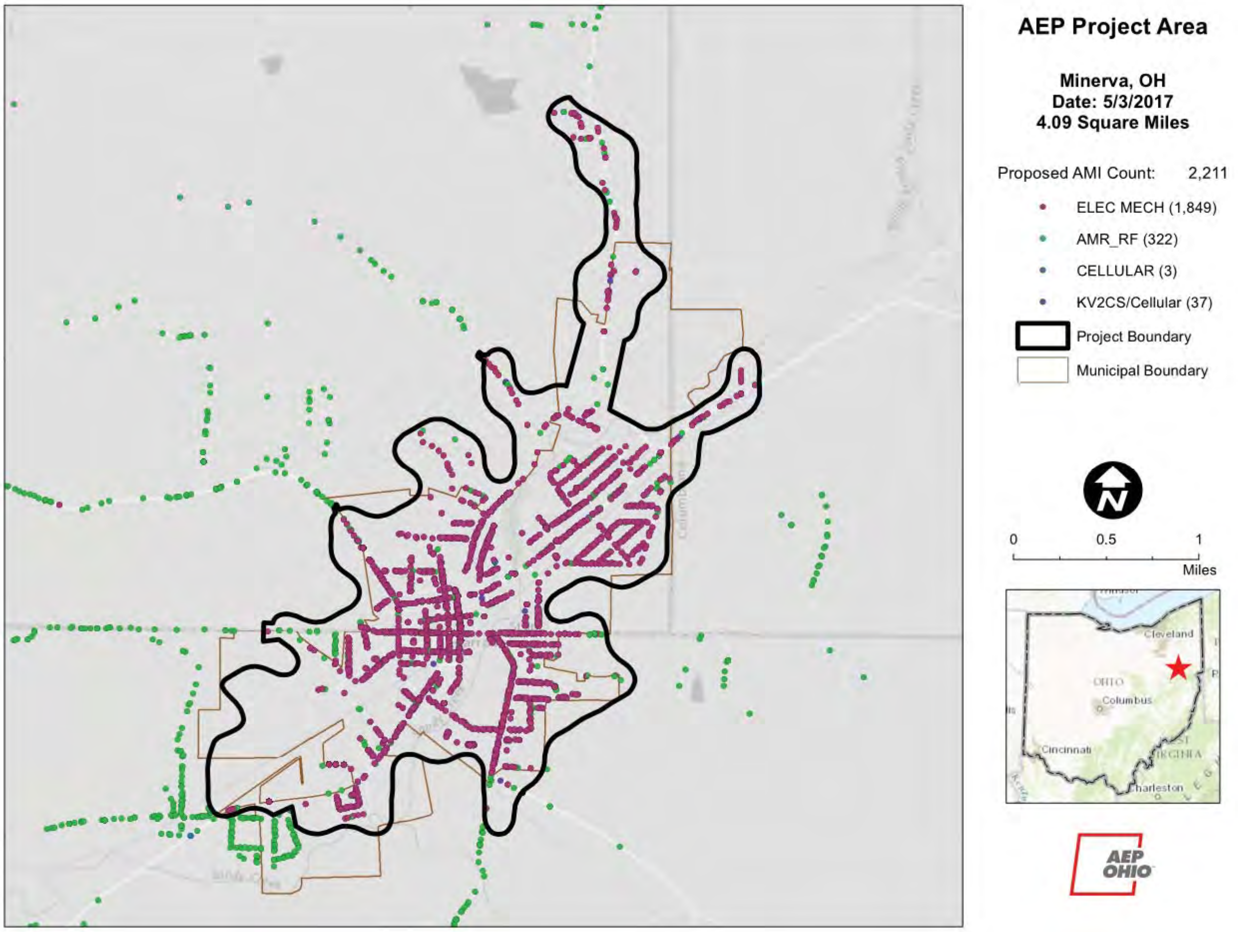

Figure 32: Planned AMI Deployment Area for Minerva, Ohio

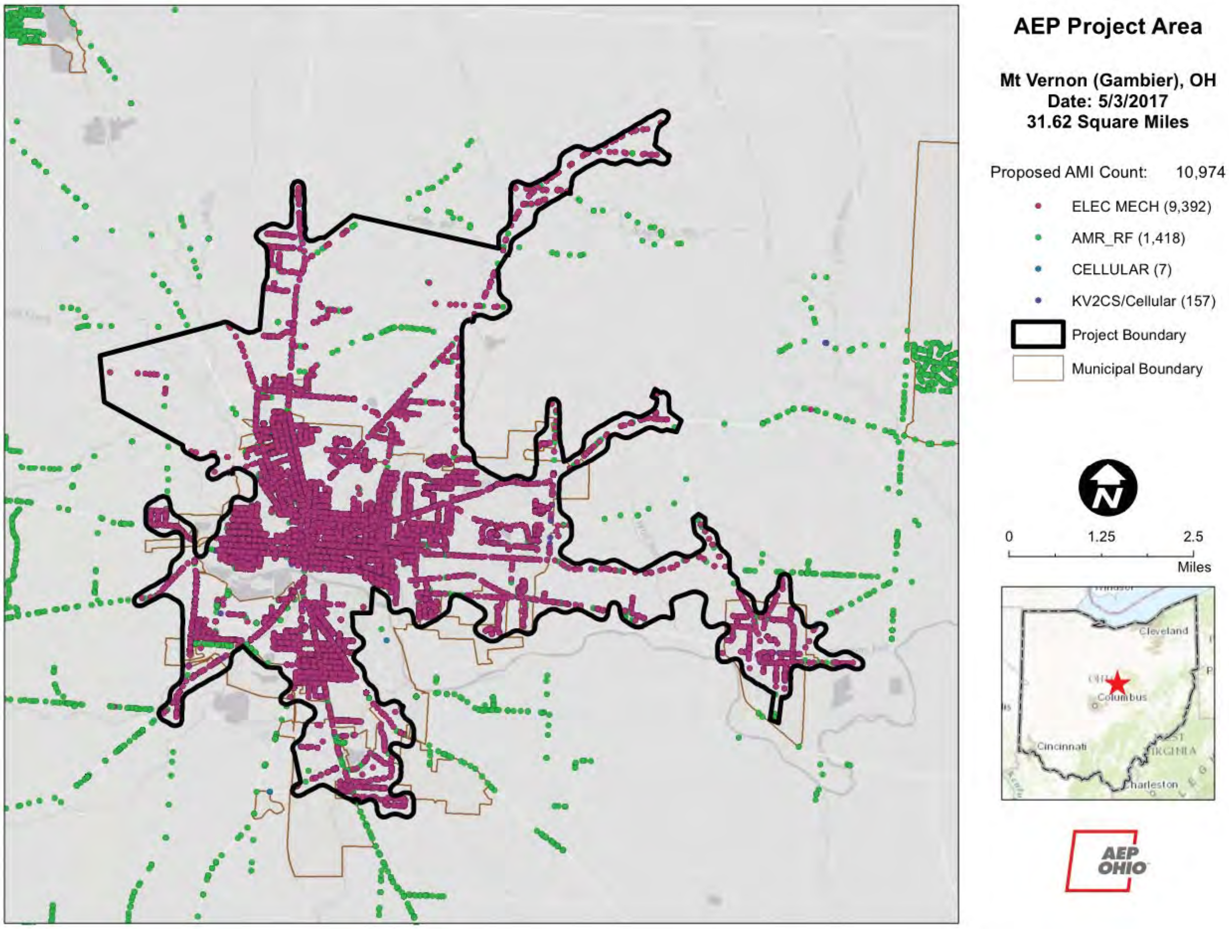

Figure 33: Planned AMI Deployment Area for Mt. Vernon (Gambier), Ohio

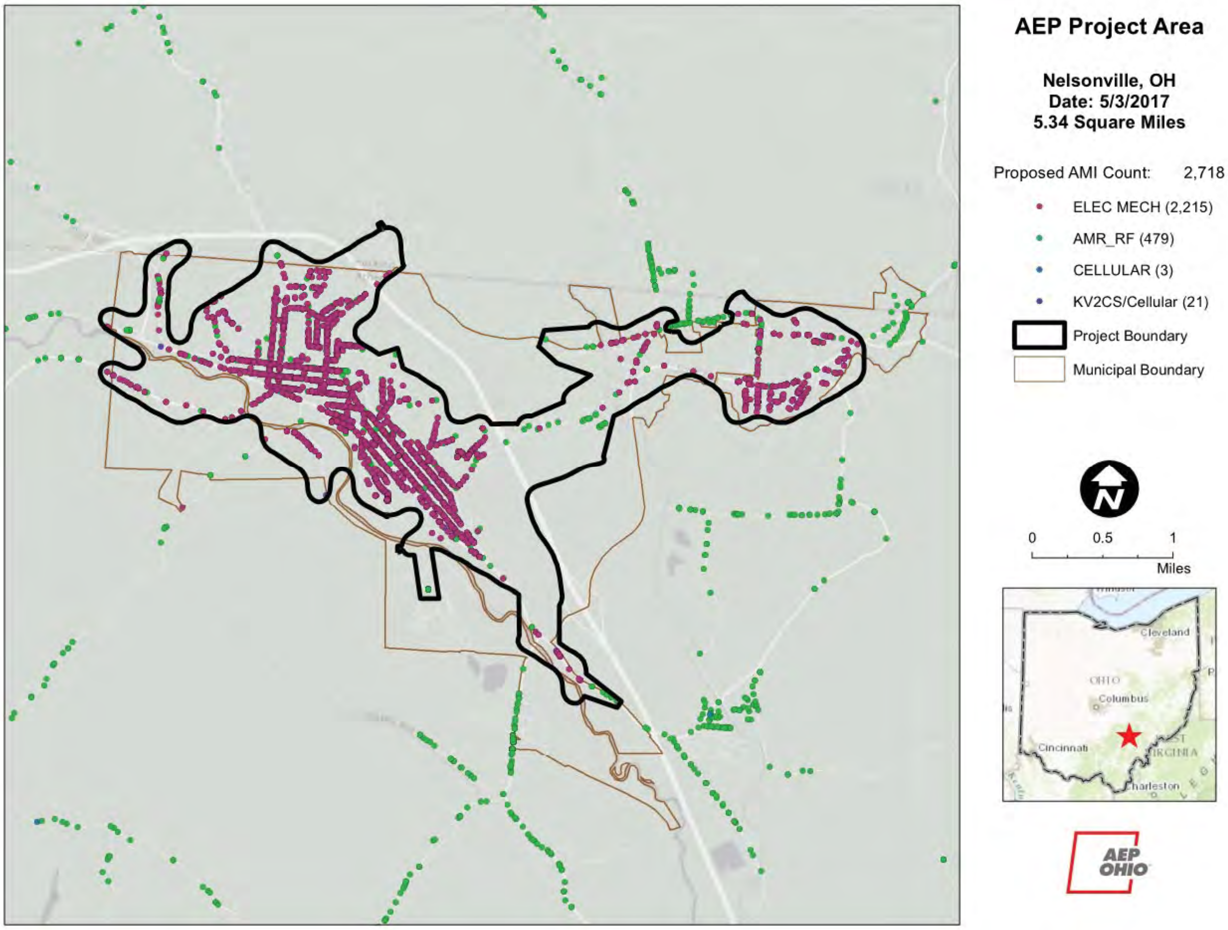

Figure 34: Planned AMI Deployment Area for Nelsonville, Ohio

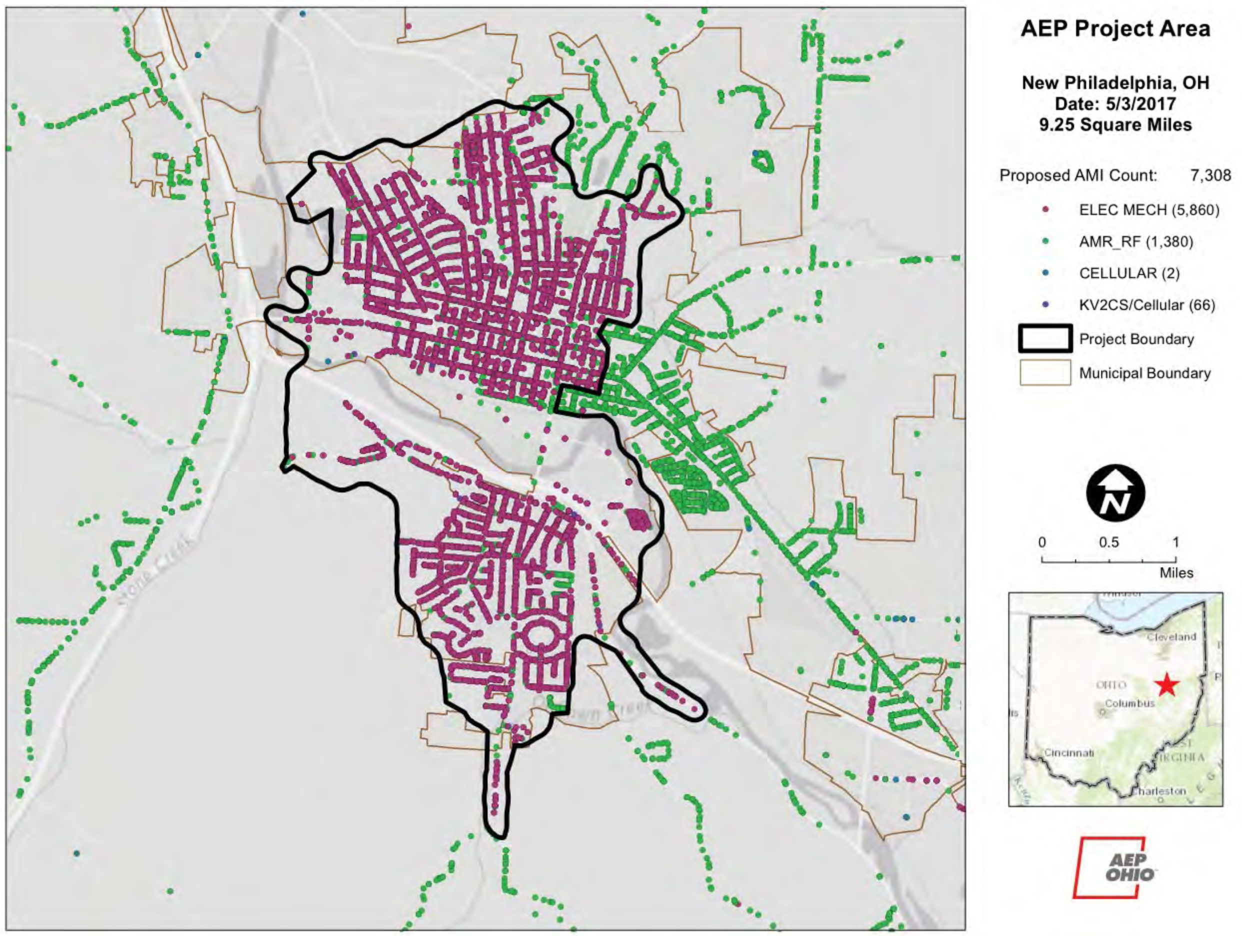

Figure 35: Planned AMI Deployment Area for New Philadelphia, Ohio

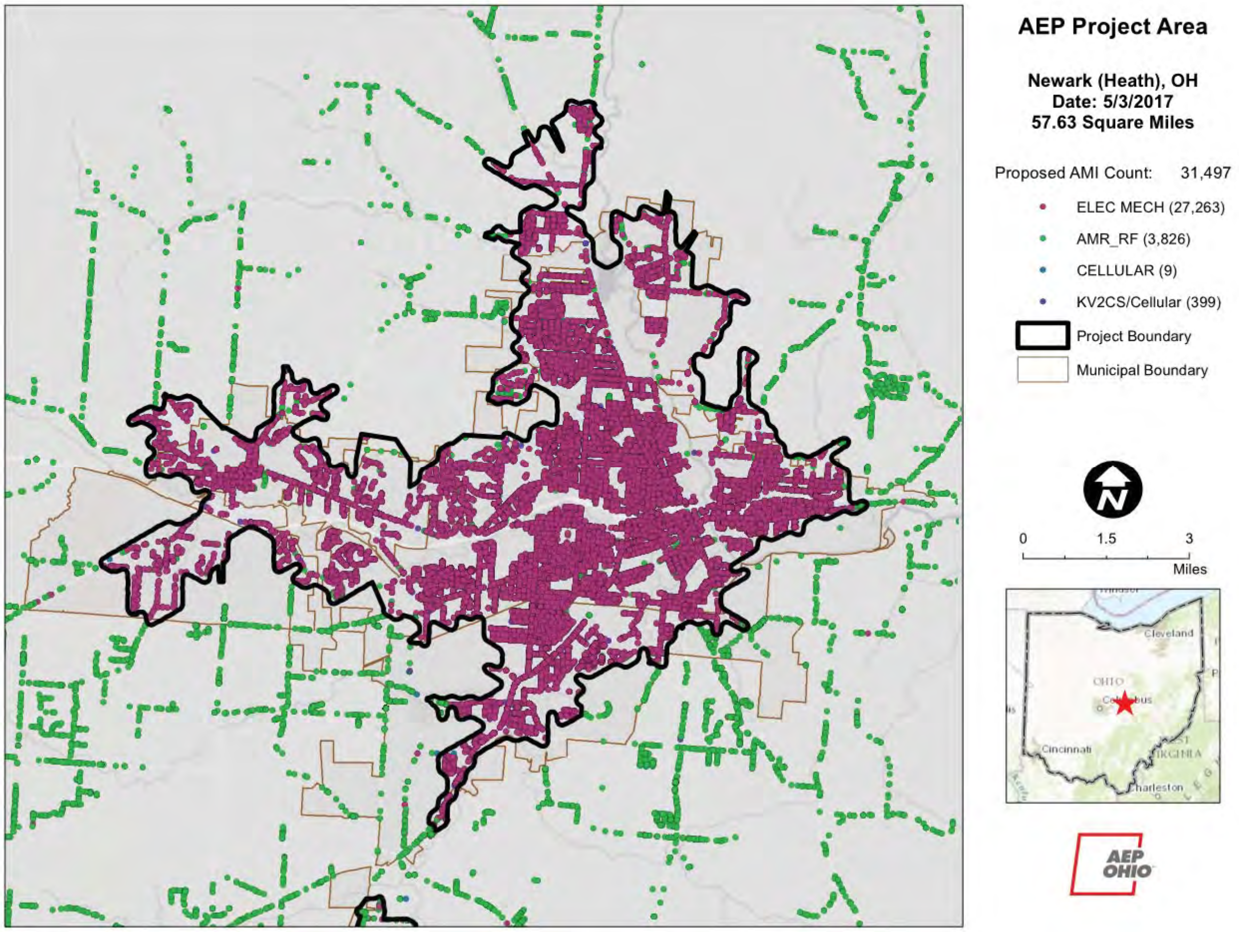

Figure 36: Planned AMI Deployment Area for Newark (Heath), Ohio

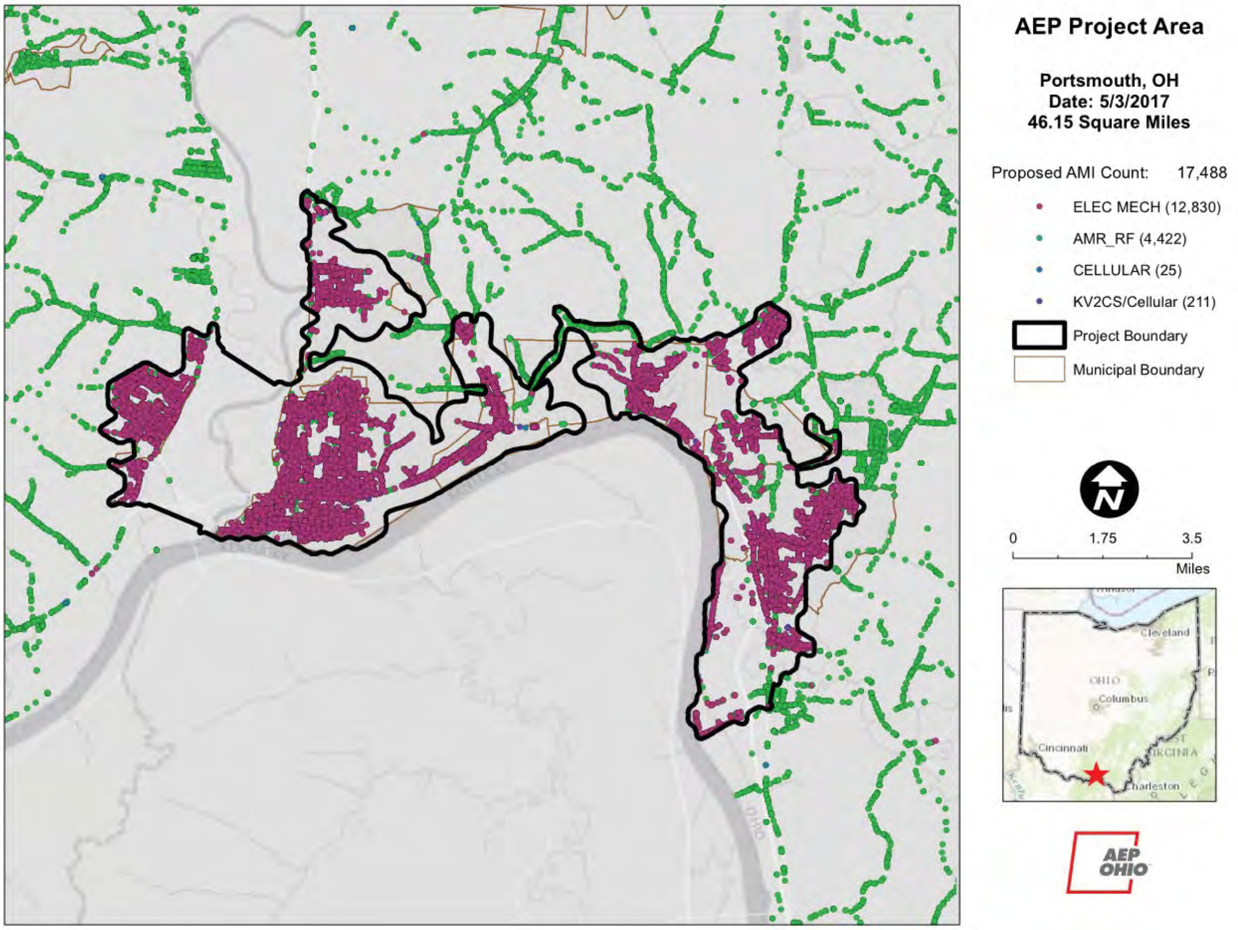

Figure 37: Planned AMI Deployment Area for Portsmouth, Ohio

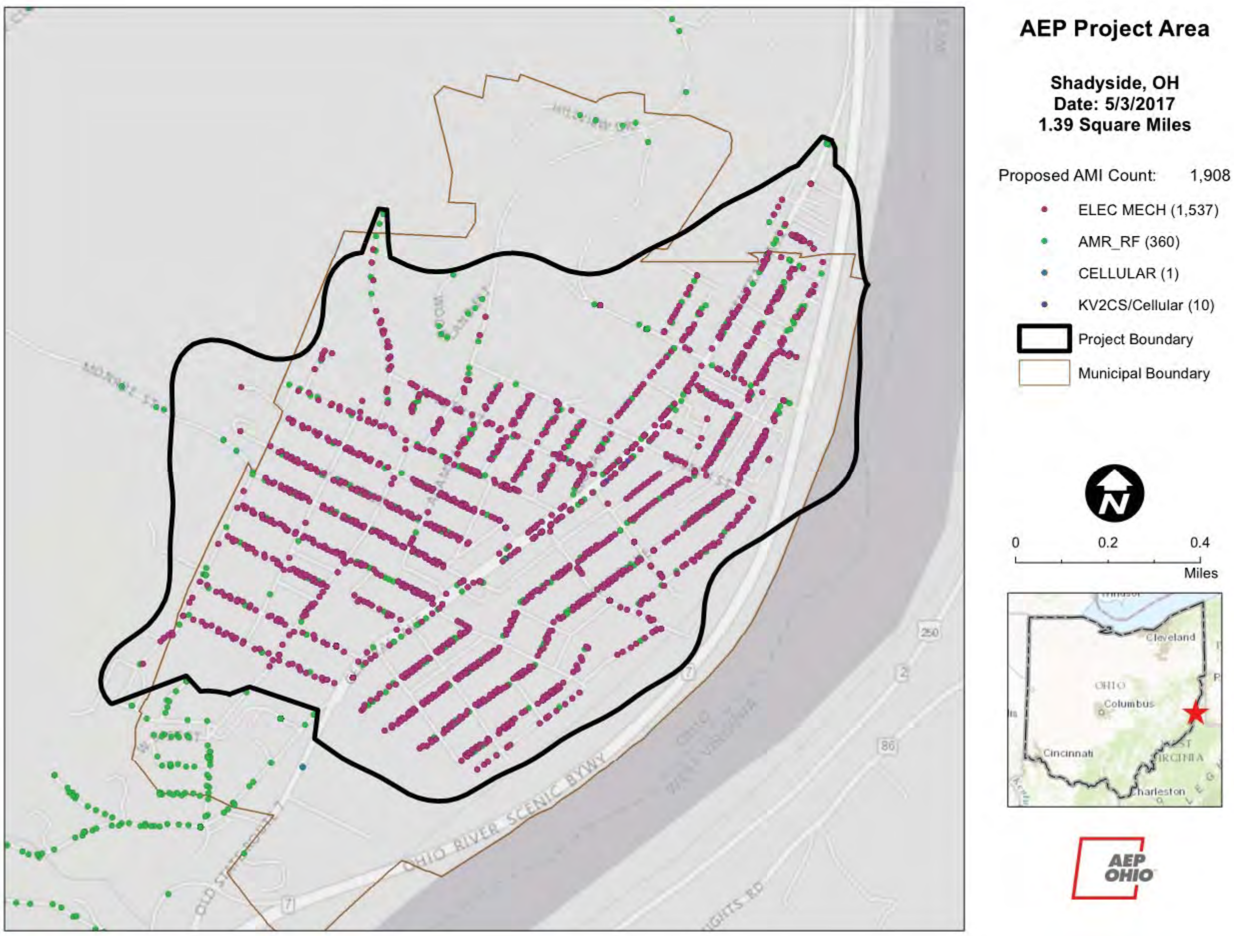

Figure 38: Planned AMI Deployment Area for Shadyside, Ohio

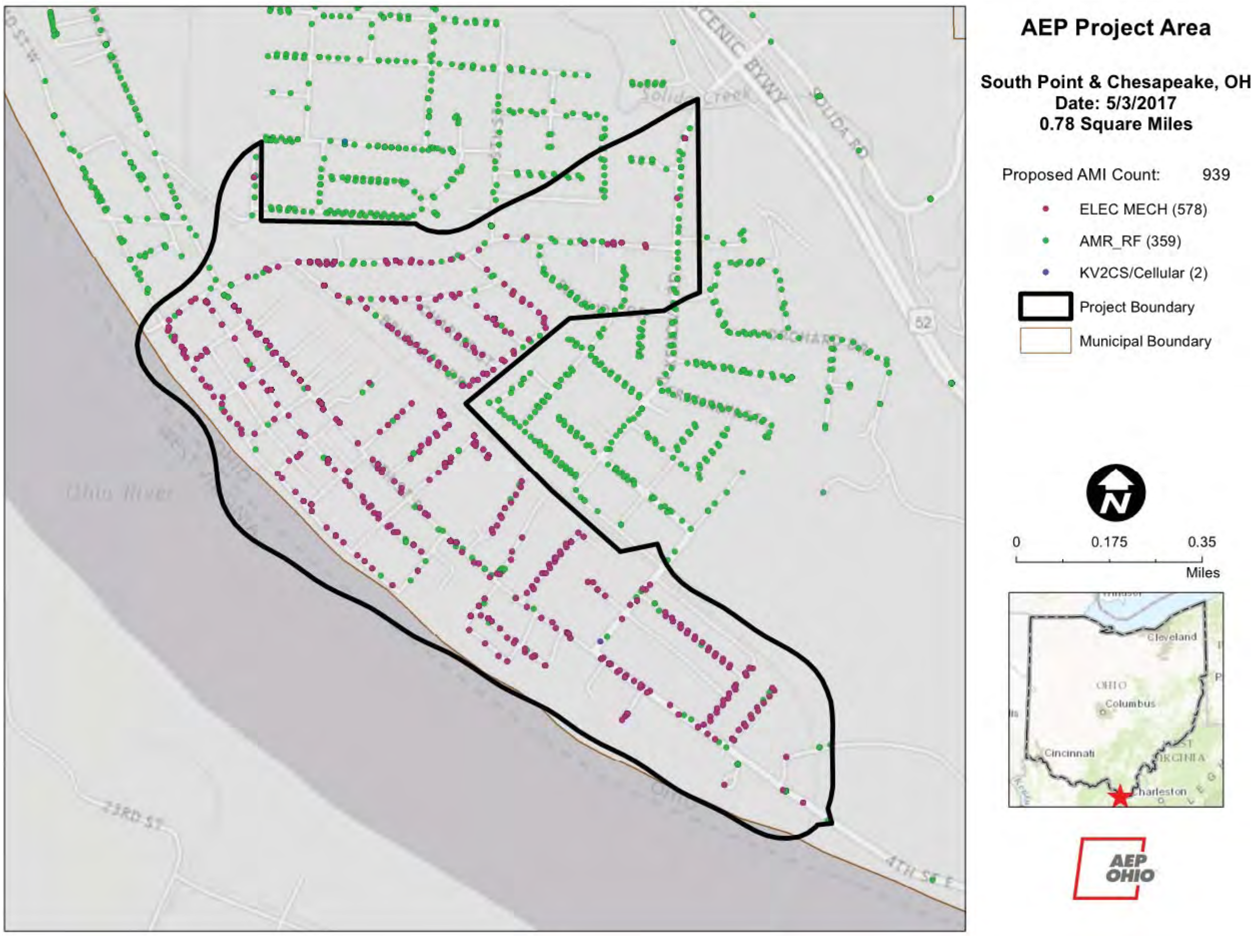

Figure 39: Planned AMI Deployment Area for South Point & Chesapeake, Ohio

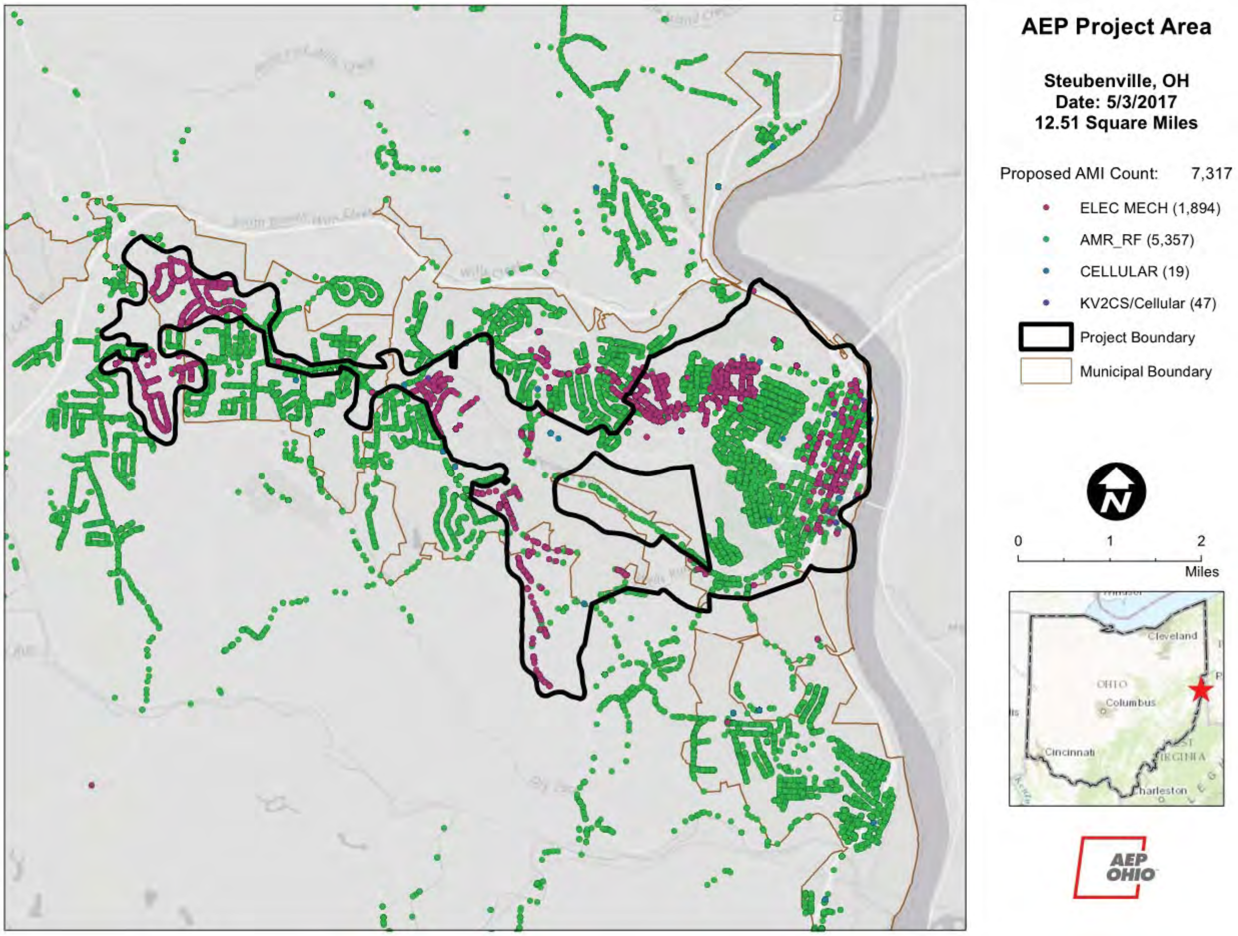

Figure 40: Planned AMI Deployment Area for Steubenville, Ohio

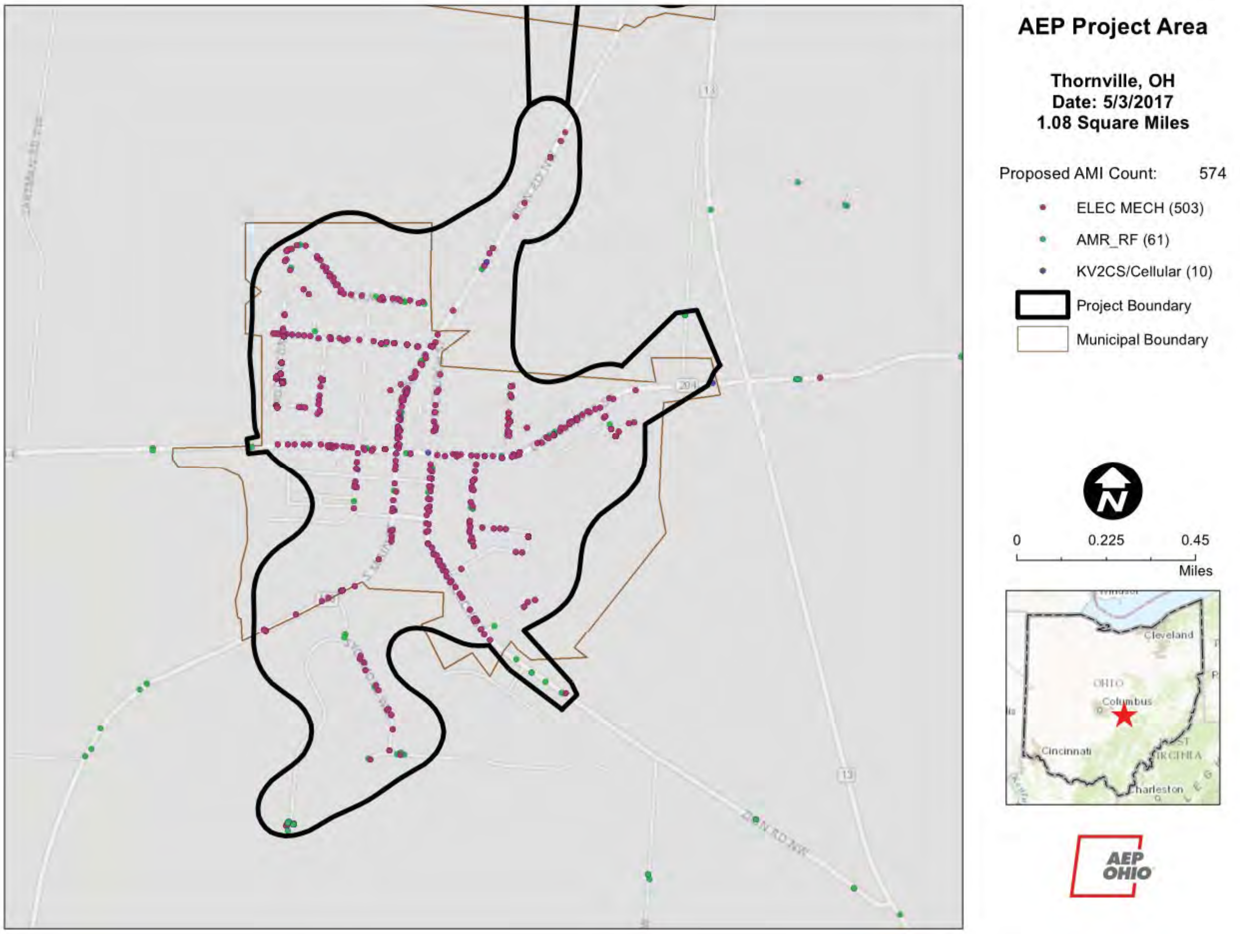

Figure 41: Planned AMI Deployment Area for Thornville, Ohio

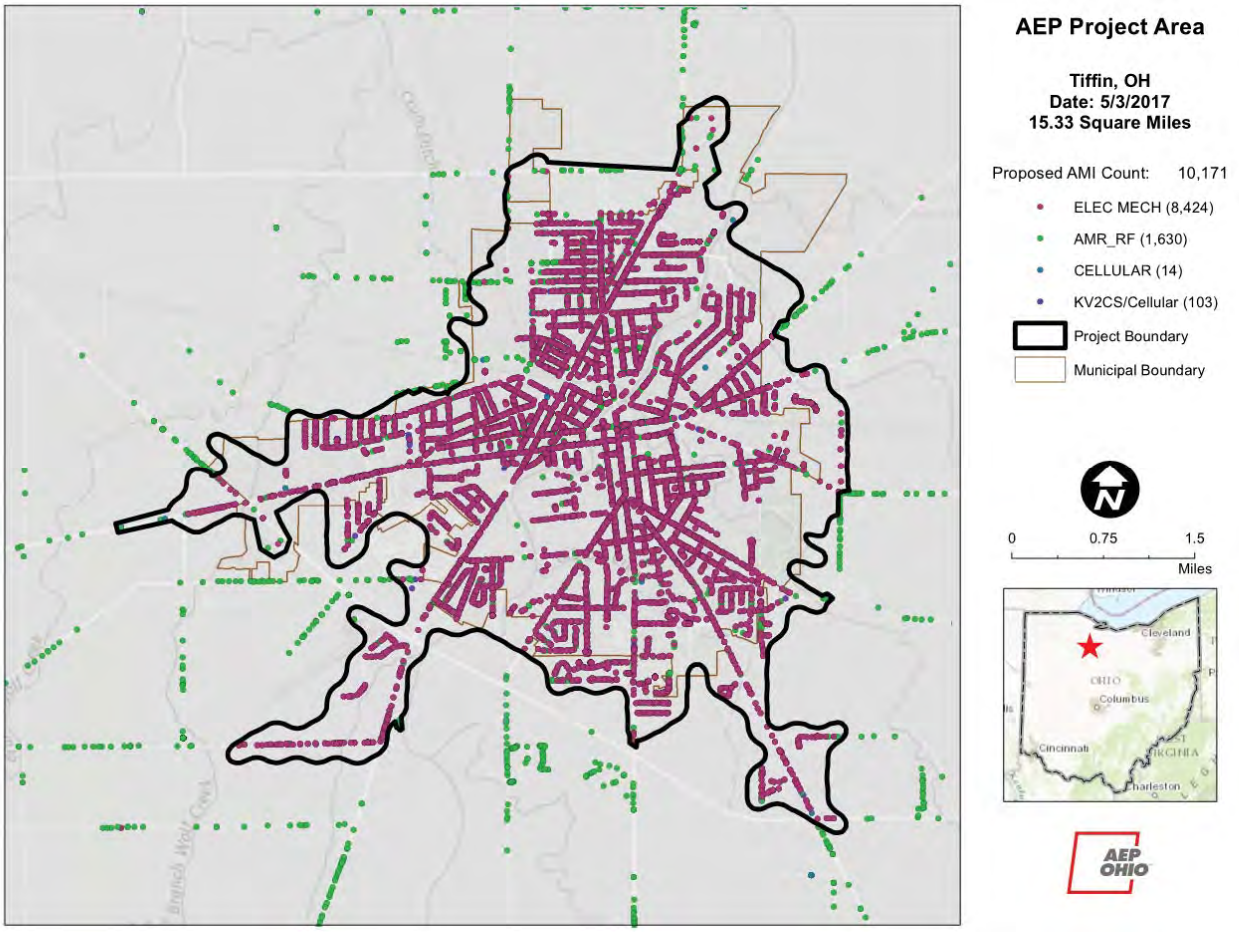

Figure 42: Planned AMI Deployment Area for Tiffin, Ohio

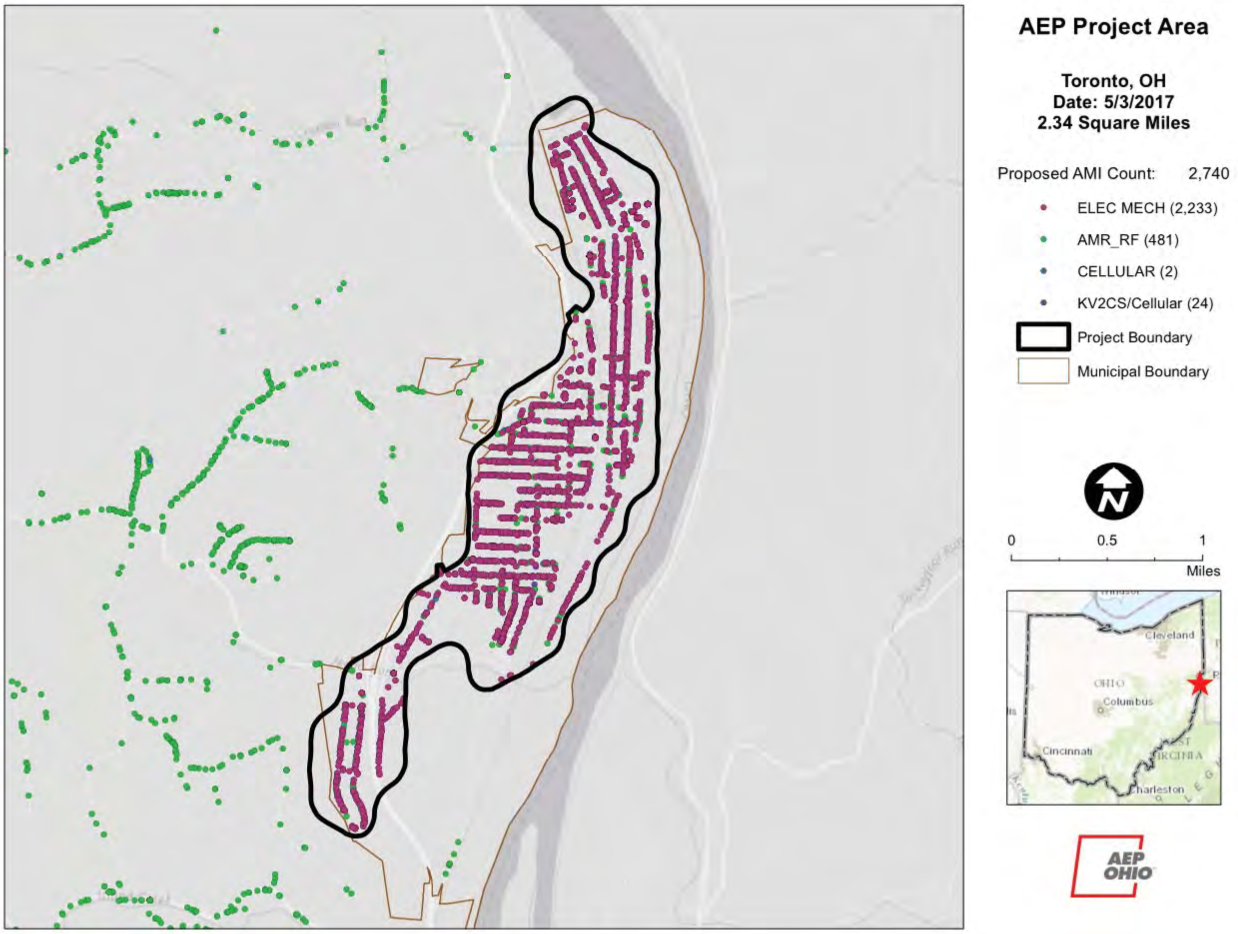

Figure 43: Planned AMI Deployment Area for Toronto, Ohio

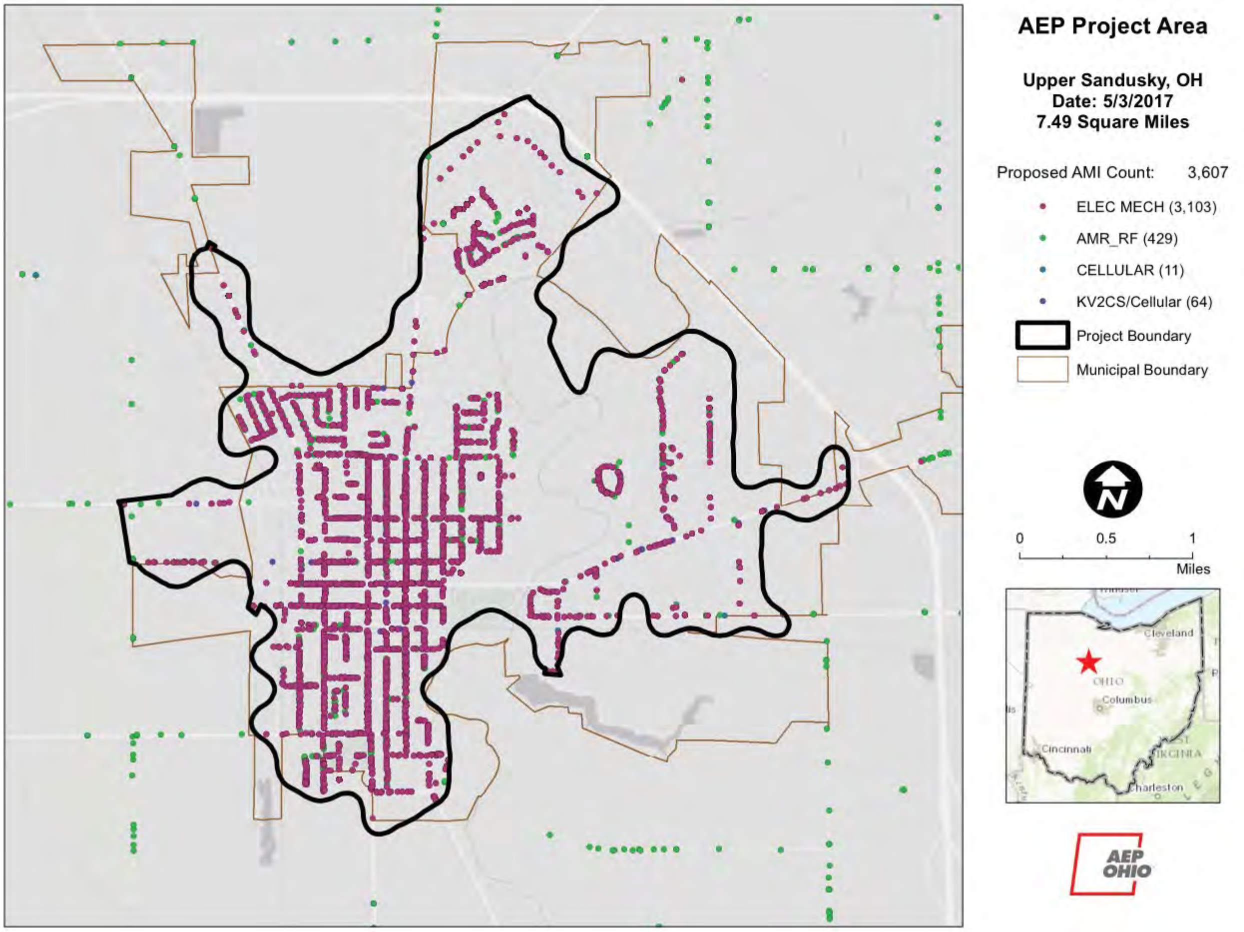

Figure 44: Planned AMI Deployment Area for Upper Sandusky, Ohio

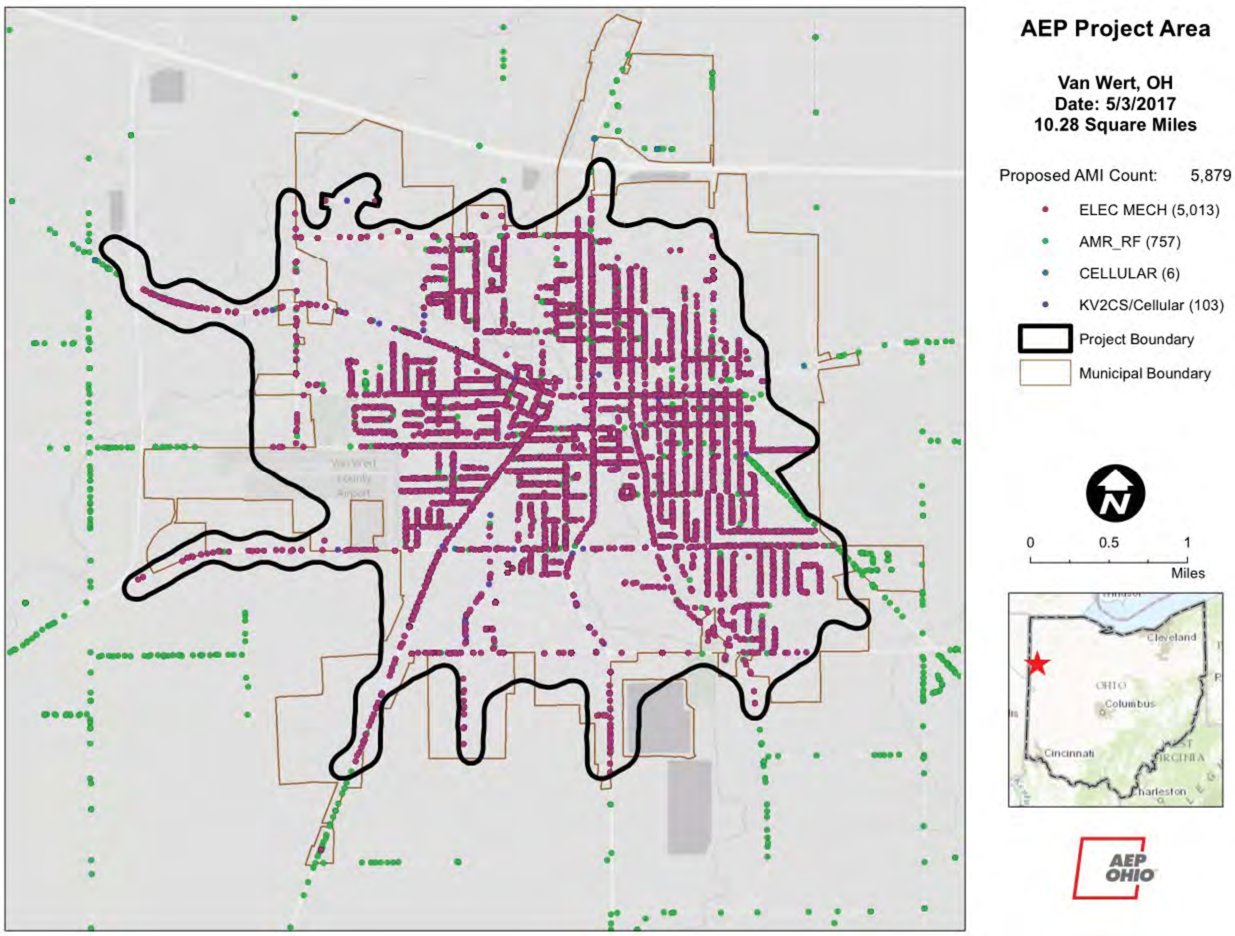

Figure 45: Planned AMI Deployment Area for Van Wert, Ohio

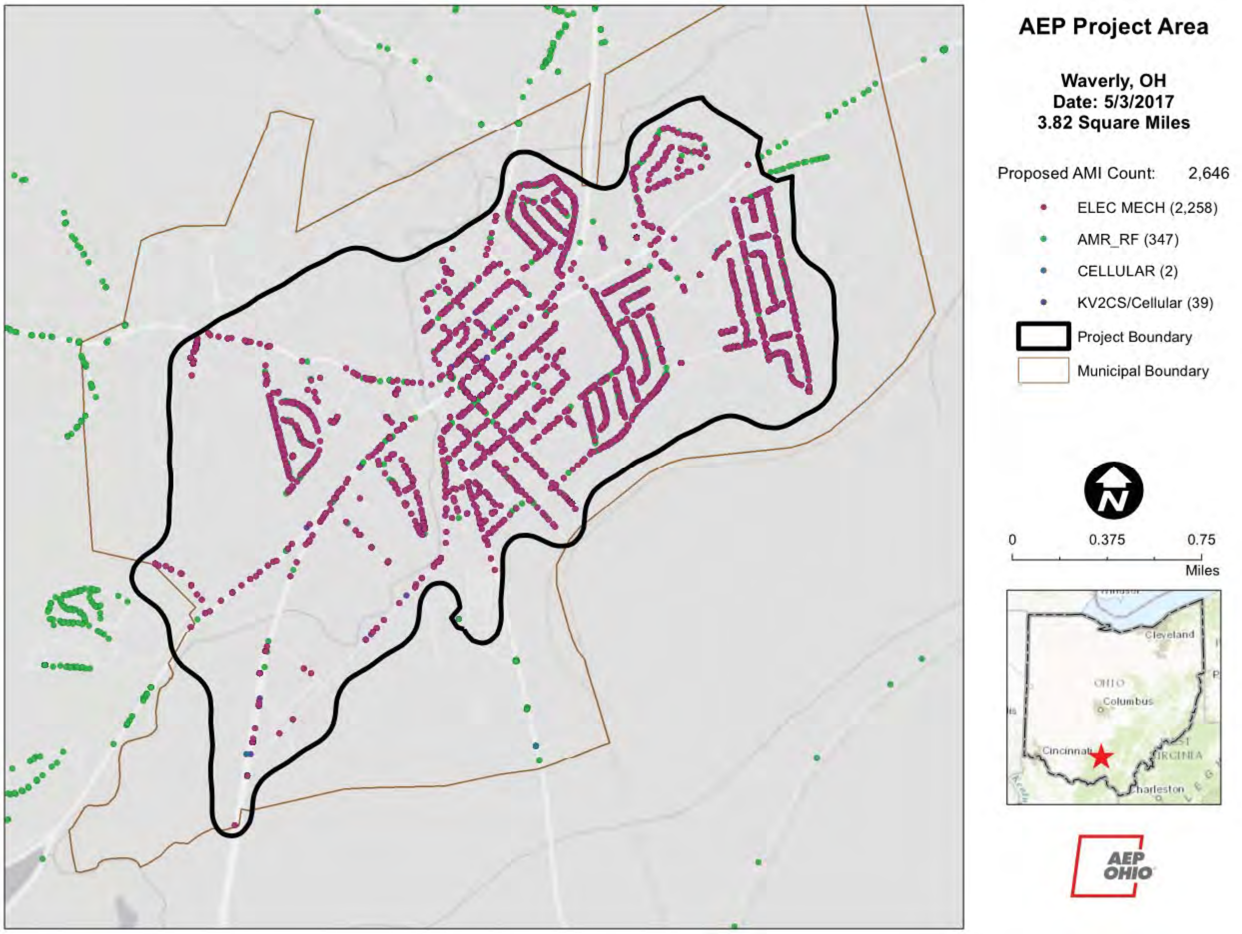

Figure 46: Planned AMI Deployment Area for Waverly, Ohio

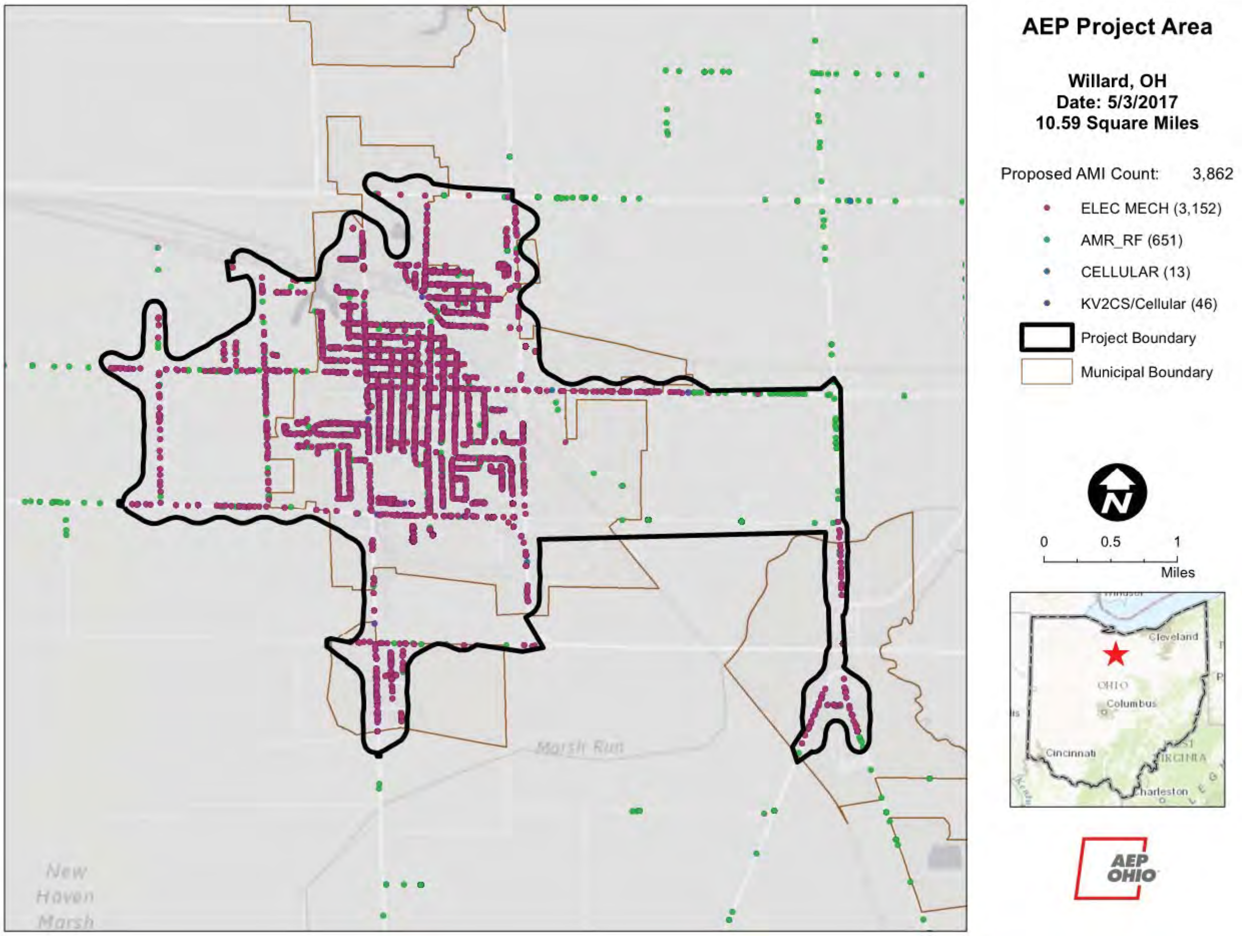

Figure 47: Planned AMI Deployment Area for Willard, Ohio

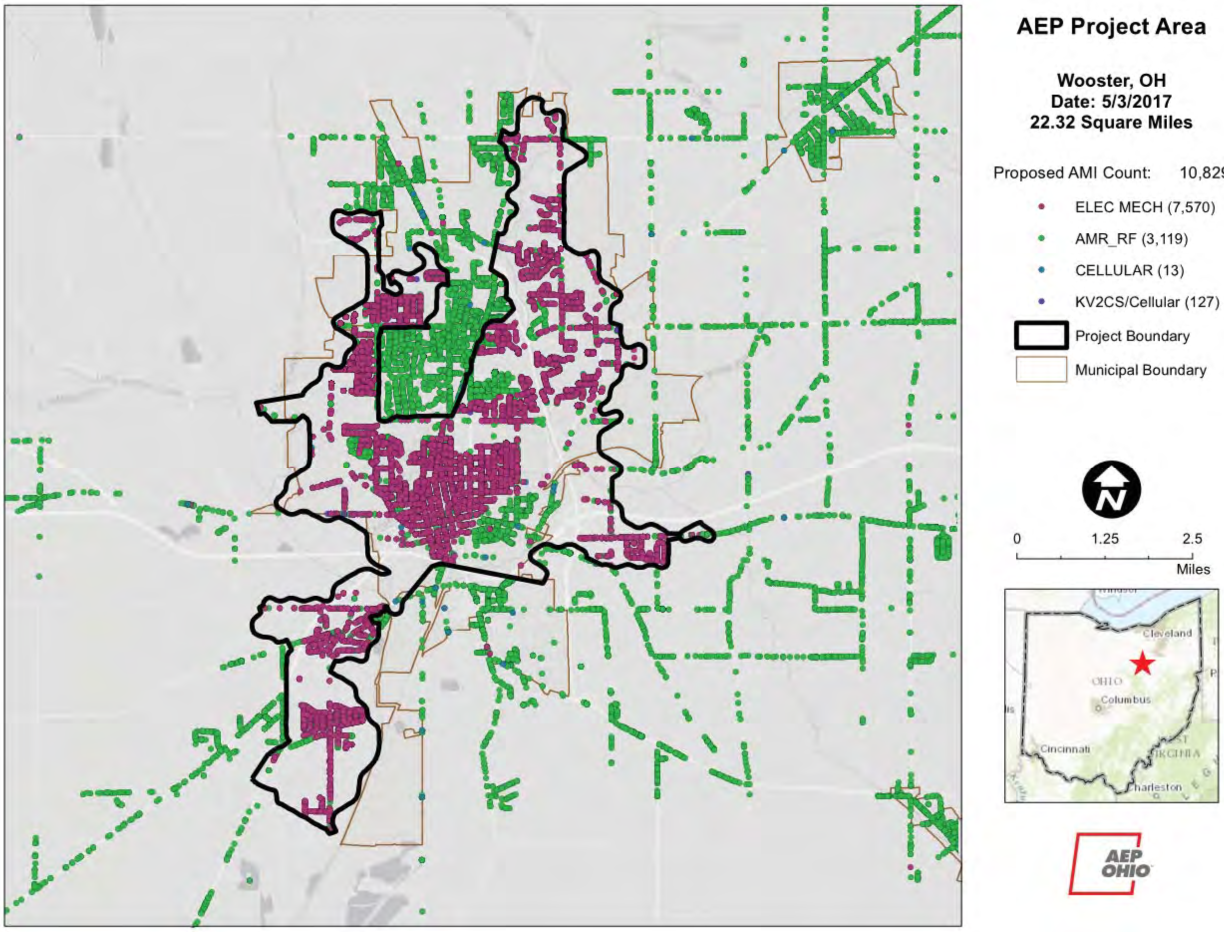

Figure 48: Planned AMI Deployment Area for Wooster, Ohio

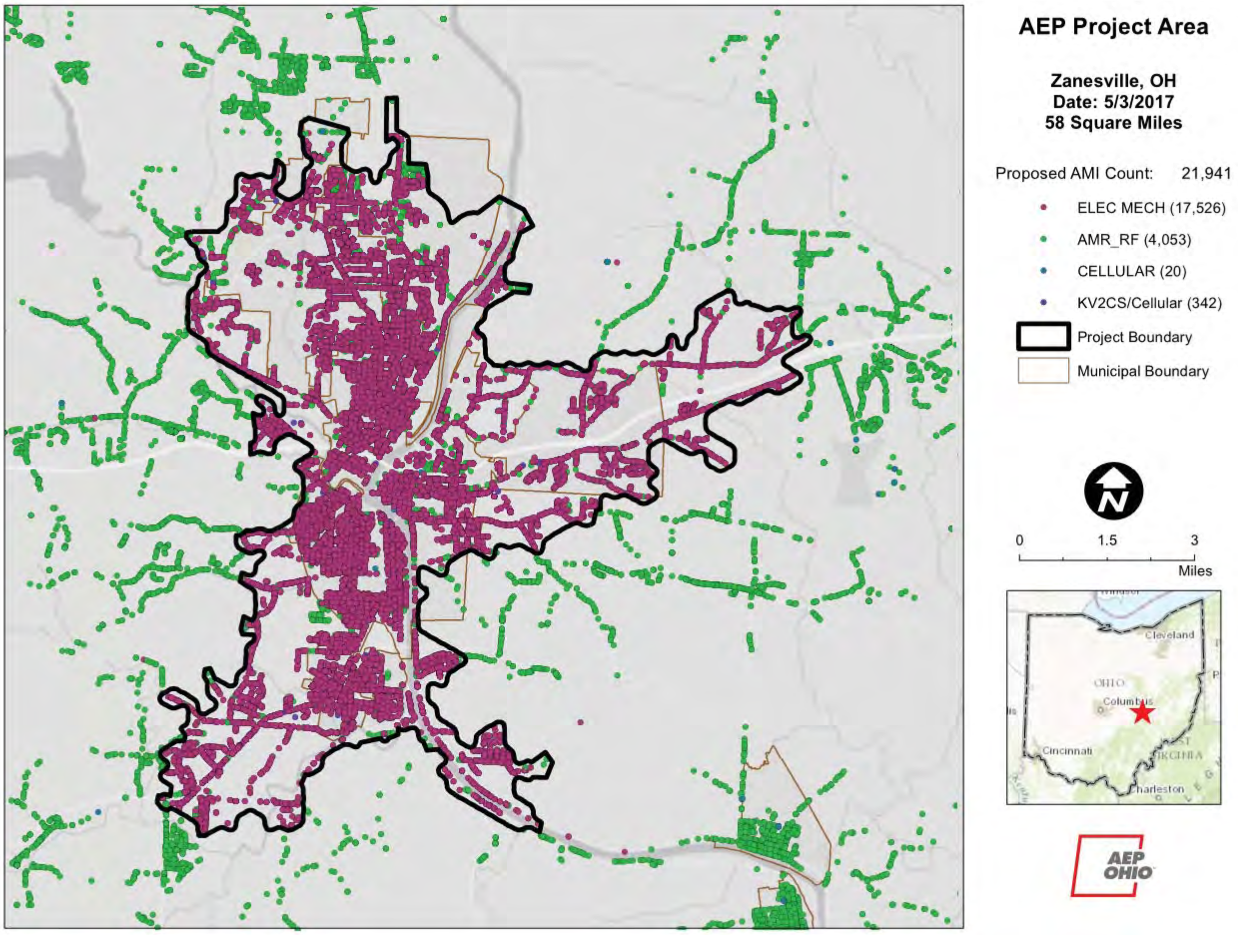

Figure 49: Planned AMI Deployment Area for Zanesville, Ohio

Table 8
Tabular Summary of Smart Meters by City

City	Quantity
Columbus	479,780
Canton	96,128
Newark (Heath)	31,497
Lima	29,498
Zanesville	21,941
Portsmouth	17,488
Findlay	17,258
Chillicothe	14,618
Fremont	11,352
Mt Vernon (Gambier)	10,974
Wooster	10,829
Athens	10,743
Tiffin	10,171
Lancaster	8,419
East Liverpool	7,999
Fostoria	7,671
Marietta	7,453
Steubenville	7,397
New Philadelphia	7,308
Coshocton	7,304
Circleville	6,786
Bucyrus	6,584
Cambridge	5,926
Van Wert	5,879
Ironton	5,508
Buckeye Lake (Millersport)	4,823
Kenton	4,532
Hillsboro	4,512
Willard	3,862
Upper Sandusky	3,607
Martins Ferry	3,405
Toronto	2,740
Nelsonville	2,718
Waverly	2,646
Gallipolis	2,414
Bridgeport (Brookside)	2,260
Minerva	2,211
Barnesville	2,205
Shadyside	1,908
Hebron	1,407
Byesville	1,116
South Point & Chesapeake	939
Thornville	574
Total	894,390

5.4 AMI Deployment Schedule

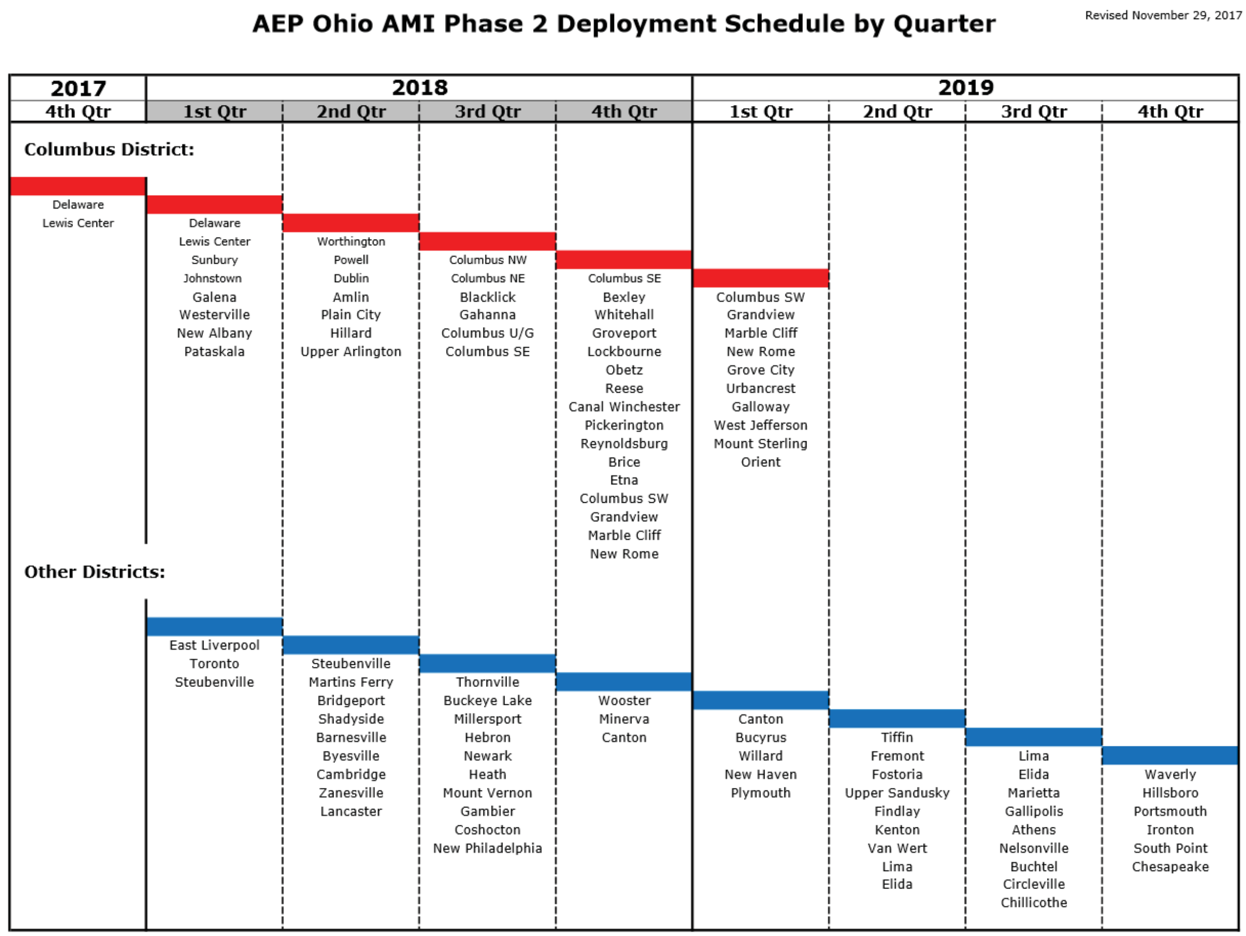

Figure 50: Full AMI Deployment Schedule by Quarter