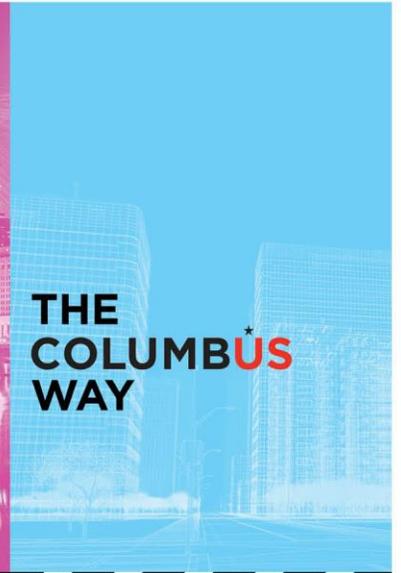
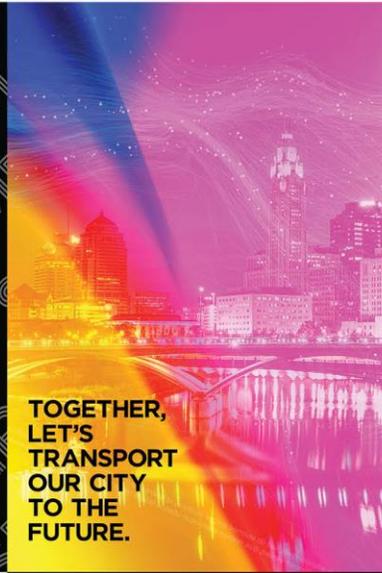
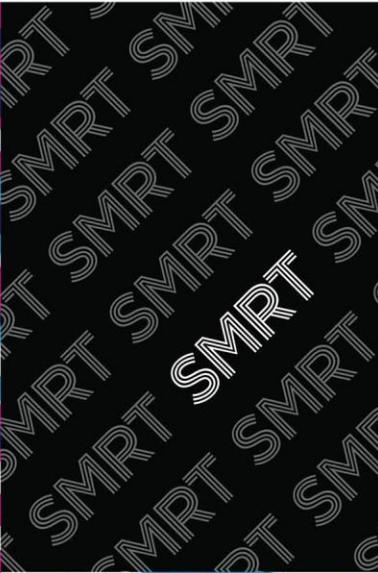
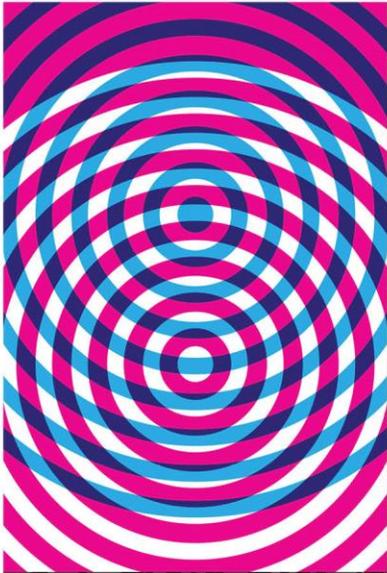


SMART COLUMBUS ELECTRIFICATION PROGRAM

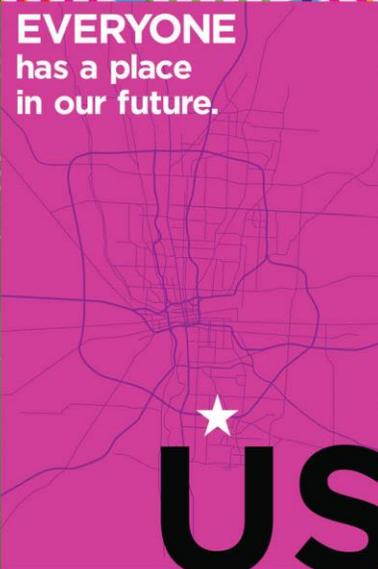
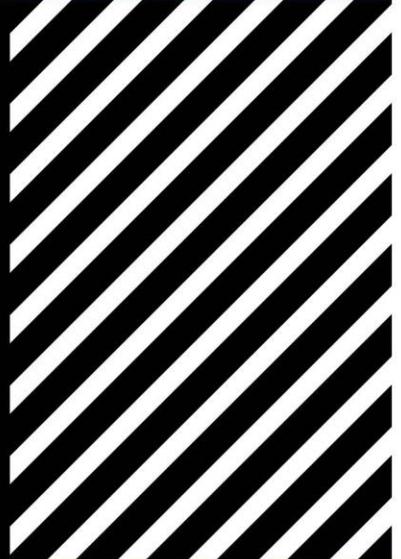
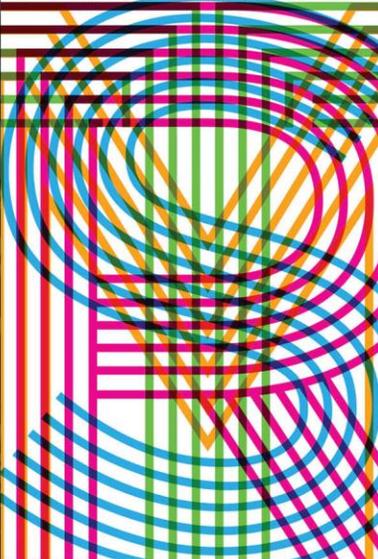
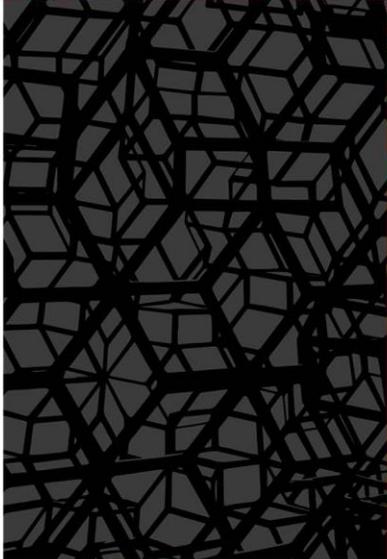
Final Report

July 2020



**THE
COLUMBUS
WAY**

TOGETHER,
LET'S
TRANSPORT
OUR CITY
TO THE
FUTURE.



EVERYONE
has a place
in our future.

US



EXECUTIVE SUMMARY

This report describes program highlights, impacts and lessons learned as well as financial data and observations of the Smart Columbus Electrification Program. This program began in August 2016 and concluded at the end of March 2020.

THE COLUMBUS WAY

In 2016, the City of Columbus won the U.S. Department of Transportation (USDOT) Smart City Challenge, after competing with 77 other cities. These dollars provided the seed funding for Smart Columbus—a seven-county region-wide Smart City initiative (Franklin, Delaware, Fairfield, Licking, Pickaway, Madison, and Union Counties). Smart Columbus was awarded two grants: \$40 million from the U.S. Department of Transportation to test the latest mobility technologies that improve residents' quality of life, and \$10 million from the Paul G. Allen Family Foundation (PGAFF) to reduce greenhouse gas emissions through the electrification and decarbonization of the transportation sector.

After winning the Smart City Challenge, the City of Columbus and its partners were directed to immediately put a collaborative and robust program plan in place. To do so, [specific, measurable, attainable, reproducible and time bound \(SMART\) goals were set](#). Creating these goals required substantial stakeholder support from the investor-owned utility company, American Electric Power (AEP) Ohio, and dozens of local private corporations, ranging from small businesses to global headquarters, along with government agencies and academic institutions in the seven-county central Ohio region.

Key staff from the City of Columbus Department of Public Service were assigned to the program. The Columbus Partnership, a coalition of 75 Columbus-based CEOs, dedicated staff, and others were engaged over the course of the first year to establish a team to shepherd the program and deliver the established goals. In support of the program, the Smart Columbus Experience Center opened in the summer of 2018, providing a collaborative office space, meeting rooms and a public showroom to educate a diverse array of groups on smart technologies, electrification and decarbonization efforts.

This project would not have been successful without the Paul G. Allen Family Foundation and our partners. Done the Columbus Way, the key to Smart Columbus' regional success is the spirit of collaboration across public, private, non-profit and academic organizations. Smart Columbus used the \$10 million from the Paul G. Allen Family Foundation to leverage aligned investment from over 100 regional partners to create a movement toward a more sustainable and connected future for our community. What started as a strategic investment of \$90 million will flourish with an anticipated total impact of \$720 million as the grant culminates. The Smart Columbus Electrification Program is estimated to have inspired \$298 million in regional economic activity resulting in 3,900 full and part-time jobs to date. The team continues to partner and pursue grant funds to help maintain and build on the initial successes.

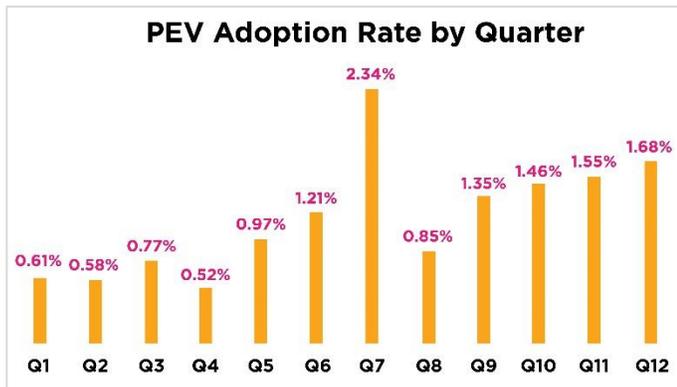
Thank you to the Paul G. Allen Family Foundation and all our partners who contributed to the success of this grant, especially our foundational partners, shown below. Visit <https://smart.columbus.gov/about/partners> for additional partners.



PROGRAM OBJECTIVE AND SUCCESSES

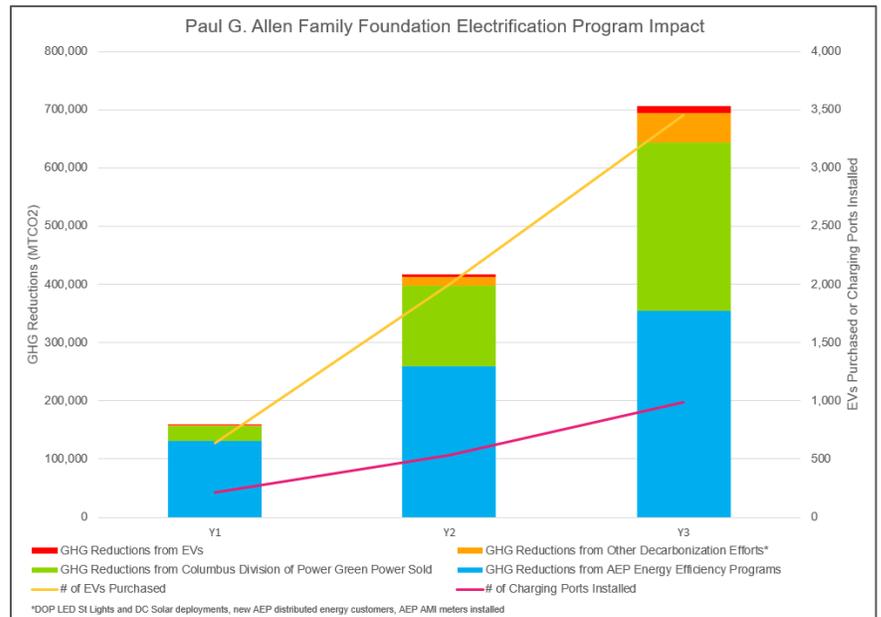
Program Objective: The overall goal of this program was to measurably decrease light-duty transportation greenhouse gas (GHG) emissions expressed in equivalent metric tons of carbon dioxide (MTCO₂) as a result of five priorities: Grid Decarbonization; followed by Electric Vehicle (EV) Fleet Adoption; Transit, Autonomous and Multi-Modal Systems (implemented via USDOT grant agreement); Consumer EV Adoption; and Charging Infrastructure during the grant period compared to a baseline year (2016).

Program Highlights:



THE HIGHEST QUARTER OF REGIONAL EV SALES INCREASED TO 2.34%, UP FROM THE BASELINE OF 0.4% AND EXCEEDING THE GOAL OF 1.8%

2.73%
GHG EMISSION REDUCTIONS FROM THE 2016 BASELINE YEAR



3,458
EVs PURCHASED, EXCEEDING THE GOAL OF 2,998

914
EV CHARGING PORTS INSTALLED IN THE REGION, NEARING THE GOAL OF 925

18.6M
PEOPLE EDUCATED ON SMART COLUMBUS, EXCEEDING THE GOAL OF 1.8M

KEY LESSONS LEARNED FOR MANAGING AN ELECTRIFICATION PROGRAM

Outlined below are significant findings, recommendations and insights for managing an Electrification Program from the perspective of the Smart Columbus team. The application of these lessons learned by the City of Columbus can potentially increase the effectiveness of the Paul G. Allen Family Foundation capital investment and provide support for EV adoption in cities around the world. Throughout this report, lessons learned are highlighted for each priority and initiative, including both successes and shortcomings.

A few of the most impactful lessons learned are relayed below:

- **Educate Industry:** As smart city and electrification concepts are new and evolving, it is important to build relationships and a knowledge base among local and regional stakeholders. Attending early learning sessions and workshops was key to developing rapport among the Smart Columbus team and introducing EV concepts.
- **Take Time for Detailed Planning:** As a city or agency implements a similar program, it is important to allocate sufficient time for detailed project planning. In this case it involved things including, but not limited to, establishing/certifying baseline data; building a project organization structure; developing procedures for training staff; establishing plans for replacing staff due to attrition; identifying stakeholders; and detailing how impacts will be calculated.
- **Measure Performance:** It is important to define specific details for data collection for each priority, initiative and strategy, and to establish the GHG baseline early in the program. A program of this complexity requires a certain amount of flexibility in order to evolve, incorporate new learnings and capitalize on opportunities.
- **Partner:** Identify partners willing to work with the program and find out how to incentivize collaboration. It is important to keep in mind that relying heavily on external funding sources may require the use of Key Performance Indicators (KPIs) (i.e. EV adoption, public charging). Additionally, project schedules may be dependent on the requirements and needs of partners/funders. Coordination between similar programs will promote an effective use of funds and better audience participation. As an example, when two funding opportunities for charging were available at the same time (i.e. the Smart Columbus Multi Unit Dwelling charging program and the AEP Ohio EV Charging Incentive Program), the team was able to explain the overlap and differing criteria, and improve a couple items while providing clarification for applicants.
- **Coordinate with OEMs and Dealers:** Original Equipment Manufacturers (OEMs) have varying approaches and beliefs on how to best market, educate and sell EVs. This manifests itself in their approach to dealer training (i.e. some brands intentionally avoid discussions on charging, while others embrace it and ensure it is talked about with every customer). Working with both the OEMs and the dealers helped with understanding of the ecosystem and allowed for mutually beneficial relationships.
- **Focus on Safety:** Safety plays a major role in electric vehicle supply equipment (EVSE) design. The draft City of Columbus Fire Code includes a section for EVSE installations. Fires involving EV batteries can take up to 2-4 times as much water to put out and can sometimes reignite. In the event of an EV fire, the Division of Fire needs to be able to quickly and safely de-energize the adjacent charging stations without having to search for a power disconnect.

- **Plan for the Future:** As projects are being executed, look further ahead to future grant opportunities. A small amount of seed funding can go a long way to help bring new partners on board. Continually develop the needed partnerships and strategies that will allow you to pursue your highest order goal.
- **Consider Challenges Outside the Program:** Consider the following external forces and develop a way to work with or around the potential negative impacts to EV adoption. For more detailed information on how these challenges directly impacted the Smart Columbus program, see *Challenges and Considerations Outside the Program* on page 127.
 1. State Government Policy – Lack of a Zero Emission Vehicle (ZEV) program and transportation infrastructure budget needs leading to registration fees for plug-in EVs and non-plug-in hybrids.
 2. Utility Policy – Public Utility Commission of Ohio (PUCO) decisions on proposed projects from local utility providers including solar, wind, EV charging, and energy efficiency programs.
 3. Local Policy – Building and Zoning codes may include language inherently detrimental to EV adoption due to limitations on EV only parking spaces with regards to minimum parking space requirements. Similar to gas station pumps, for EV charging sites charging a fee at the charging port, cities or counties may enact EV Charger inspection program fees in order to confirm the accuracy of EV charging station measured output. These may be applied to both \$ per kWh charges and \$ per time charges.
 4. Availability of External Funding Sources – Smart Columbus planned to use VW Settlement Funds as part of the public EV Charging work, but the program was delayed just beyond the end of the grant program.
 5. External Market Forces – As with the rest of the world, Smart Columbus was and still is directly impacted by COVID-19. The virus directly impacted the program both at a key performance indicator (KPI) level for EV adoption and at the personal level for how our team worked within the program. The State of Ohio and the City of Columbus took early decisive action to mitigate the impacts of the virus on the workforce that has allowed the program to continue to progress.

The key to Smart Columbus' regional success is the spirit of collaboration across public, private, non-profit and academic organizations.

QUALITATIVE ASSESSMENT: HOW CAN A CITY REDUCE GHG EMISSIONS BY FOCUSING ON TRANSPORTATION?

The Smart Columbus Electrification Program was largely focused on reducing GHG emissions through transportation, as transportation is one of the highest GHG polluters and has the potential for the most significant impact to our air quality. While the Smart Columbus team saw the largest GHG reduction from decarbonization efforts throughout the program, the work that Smart Columbus did to spur EV adoption and build a charging network throughout the region will serve as a large catalyst to move the needle for significant future transportation emission reductions. Based on the experience and lessons learned throughout the program, Smart Columbus believes other cities can get the largest impact in reducing GHG emissions by focusing on the following items:

- **Decarbonization:** The term decarbonization simply means the reduction of GHG emissions (or carbon) that is released into the atmosphere. Achieving decarbonization is a three-fold process that includes reducing total energy use in all sectors, shifting electricity to renewable energy resources, and adopting energy efficiency technology. The City of Columbus took several different approaches; however, the biggest impact area a city should pursue in electricity is to focus on expanding the use of renewable energy, such as solar and wind, both through purchase power contracts (Renewable Energy Certificates) and through investing in local renewable energy projects (Additionality of Renewable Generation). The successes being made locally in cleaning the grid and lowering associated GHG emissions is paving the way for even greater success through EV adoption.
- **Fleet EV Adoption:** For cities, the biggest impact on reducing GHG emissions from fleet EV adoption will be in removing the main barriers to adoption – vehicle purchase price and charging. To address the higher initial purchase price of EVs, cities should utilize all available discounts. Overall, one of the greatest successes in Public Fleet EV Adoption was the ability to use a Universal Term Contract and make it available to all other cities in Ohio. Under the contract, the City of Columbus was able to provide competitive bidding and capture the federal incentive. Especially for central Ohio cities, the \$3,000 rebate offered from the Paul G. Allen Family Foundation grant made the transfer from Internal Combustion Engine (ICE) vehicles to EVs extremely viable, as the total discounts from the bid, rebate, and grant was around 40%. Without the additional grant funding, purchasing the more expensive EVs at the scale reached during the grant would not have been as feasible from a city budgeting standpoint. By leading the way in purchasing city fleet EVs, the city demonstrated its commitment to this effort and helped spur fleet EV adoption throughout other cities in the region.
- **Consumer EV Adoption:** In states with neutral to antagonistic EV policies like Ohio, EVs commonly make up less than 1% of new vehicle sales. Nationally, only 26% of auto dealerships sell EVs and many regions outside ZEV or low-emission vehicle (LEV) states have access to less than half of the EV models currently available in the U.S. In 2015, only 0.4% of new cars purchased in the seven-county region were EVs and just 46% of the models available in the U.S. were available in the region. Through the PGAFF grant-funded Electrification Program, Columbus has demonstrated how education and outreach, primarily through a grant-funded integrated marketing campaign and engagement with large employers (which rate as consumers' most trusted institution for information), can drive increased understanding of and demand for EVs. Furthermore, Smart Columbus honed an engagement model through partnerships with OEMs and dealers to increase EV model supply in the region. Smart Columbus initiatives served to increase the number of national models available in

Columbus to 61%, and to increase the number of vehicles sold as a percentage of sales to as high as 2.34%. This program demonstrates ways to commercialize EVs for consumer adoption through consumer education, private sector engagement, and OEM/dealer engagement. This growth can be replicated in non-ZEV states nationwide to continue to advance EV adoption outside the coasts.

- Charging Infrastructure:** In the near term, the biggest impact on reducing GHG emissions through EV charging will be how efficiently a critical mass of charging infrastructure can be installed to support the growing EV market demand. By starting efforts with city fleet charging, it allowed the city to learn and gain hands-on experience with EV charging in a controlled setting. In conjunction, creating EV charging-related policies focused on EV readiness can help to set up future development for all types of EV charging installations. In the long term, cities should work with utilities on integrated charging solutions including utilizing renewable energy sources, battery storage and Vehicle-to-Grid technologies to directly reduce GHG emissions.

The chart below shows a breakdown of how Smart Columbus allocated financial and time commitments to the different program priorities, as well as a quick summary of our success in achieving the program goals.

INITIATIVE NAME	FINANCIAL COMMITMENT FROM GRANT	TIME COMMITMENT	% OF GOAL COMPLETE
Priority 1 – Decarbonization (*goal by 2030)			
Utility Scaled Renewables	\$	⌚⌚	1.5%*
Grid Modernization / Efficiency	N/A	⌚⌚	138%
Priority 2 – Fleet EV Adoption			
Public Fleet EVs	\$\$\$	⌚⌚⌚	96%
Private Fleet EVs	N/A	⌚⌚	8%
Transportation Service Provider EVs	\$	⌚⌚	55%
Priority 3 – Transit, Autonomous and Multi-Modal Systems in the City			
Connected Electric Autonomous Vehicles	N/A	⌚⌚⌚	100%
Electric Bikes	\$	⌚	72%
Bike Lane Infrastructure	N/A	⌚⌚	132%
Priority 4 – Consumer EV Adoption			
EV Market Penetration	\$\$\$	⌚⌚⌚	130%
Estimated Equivalent # of EVs Purchased	\$\$\$	⌚⌚⌚	115%
Accelerator Partner Program	\$	⌚⌚⌚	100%
Priority 5 – Charging Infrastructure (+includes chargers installed with no cost extension)			
Residential Charging	\$\$	⌚⌚	59%
Public Access Charging	\$	⌚⌚⌚	78%
Workplace Charging	N/A	⌚⌚	161%
Fleet Charging	\$\$\$	⌚⌚⌚	86%+
B&Z Changes to Support EV Charging	N/A	⌚⌚	233%

LOOKING FORWARD: ELECTRIFICATION SUSTAINABILITY PLAN

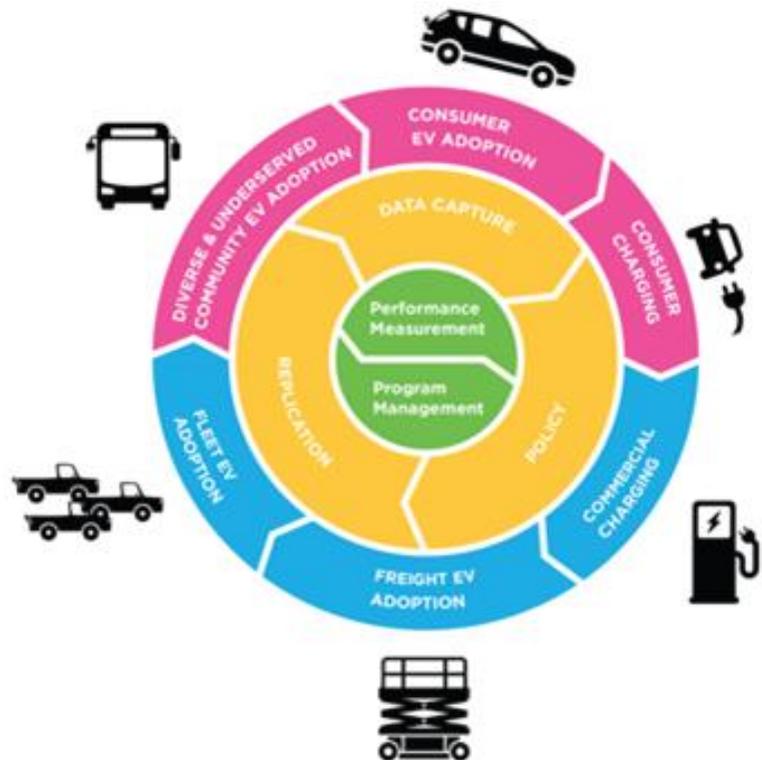
The next phase of Smart Columbus' electrification effort, summarized in the Smart Columbus Electrification Program EV Adoption Ecosystem figure to the right, aims to build upon the current ecosystem, leveraging a robust network of partners and prior experience. It will also incorporate outreach and policy needs; develop, pilot, and evaluate replication models for EV adoption; and provide publicly available data, results, and replication templates via the open source Smart Columbus Operating System and Smart Columbus digital Playbook.

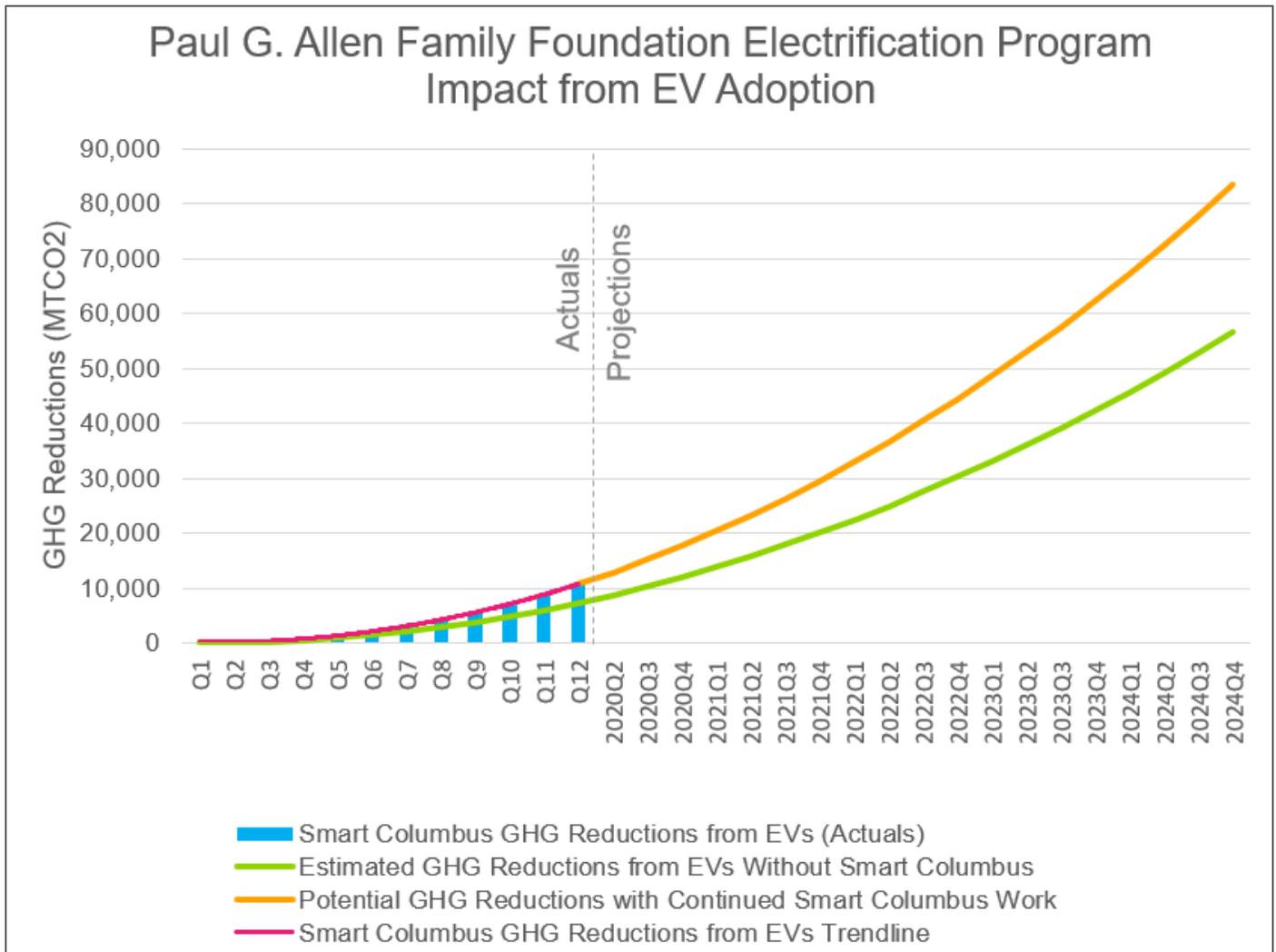
Smart Columbus hopes to continue the efforts of this program and has put together a plan for a 39-month Electric Vehicle and Charging Community Partner Project, pending securing grant funds to support the work. The Smart Columbus team would aim to achieve two overarching goals:

1. To nurture an innovative and comprehensive EV adoption ecosystem; and
2. To develop templated replication models that can be used by communities nationwide to facilitate expanded electrification efforts, especially in non-ZEV states.

In addition to the two grants awarded locally (referenced on the following page), the Smart Columbus team plans to continue pursuing other grant programs that will allow us to replicate program elements across the region.

The graph on the following page illustrates the expected GHG trends with and without the Paul G. Allen Family Foundation grant, and with and without additional funding to continue and replicate the program.





Clean Fuels Ohio was recently awarded a grant from the U.S. Department of Energy (USDOE) for Zero Emission Freight Future. With these funds, the city intends to purchase an electric refuse truck for a pilot project. The grant also includes the purchase of an EV Delivery Step Van and a Class 8 on-road freight truck. A portion of the remaining funds from the Paul G. Allen Family Foundation grant will be used to build charging infrastructure to support this effort.

In addition, the City of Columbus has committed to furthering decarbonization efforts, demonstrated by the Mayor’s commitment to deliver 100% renewable electricity to residents by 2022. Request for Proposals (RFPs) from aggregation firms were due to the city in July 2020 with their plan to transform Central Ohio’s green power supply. For more information, visit <https://www.dispatch.com/news/20200712/can-all-of-columbus-really-be-powered-by-green-sources-within-2-years>.

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- Appendix M – AEP Ohio EV Charging Station Rebate Program May 2020 Status Report
- Appendix N – Consumer Awareness Survey Findings
- Appendix O – No Cost Extension (NCE) Fleet Charging Design and Construction Update
(to be developed at the end of 2020)

PROGRAM OVERVIEW

This section will give an overview of high-level activities that occurred over the course of the program for each of the five project priorities, program management, priority implementation and coordination items.

PROGRAM SCOPE

OBJECTIVE

The overall goal of this program was to measurably decrease light-duty transportation greenhouse gas (GHG) emissions expressed in equivalent metric tons of carbon dioxide (MTCO₂) as a result of Grid Decarbonization; followed by EV Fleet Adoption; Transit, Autonomous and Multi-Modal Systems (implemented via USDOT grant agreement); Consumer EV Adoption; and Charging Infrastructure during the grant period compared to a baseline year (2016).

FIVE PRIORITIES

Priority 1 – Decarbonization

Objective: In partnership with power providers, by 2030 install 905 MW of utility scale renewable energy generation capable of serving the Columbus region, procure a minimum of 1.2 million MWh of renewable energy for the City of Columbus between 2017 and 2022, and save 480 GWh consumed through energy efficiency and smart grid programs during the time period of the grant.

Priority 2 – Fleet EV Adoption

Objective: Work with public, private and academic sectors to place in operation 755 EVs into their fleets by the end of the grant period.

Priority 3 – Transit, Autonomous and Multi-Modal Systems in the City

Objective: Ensure a comprehensive, multi-modal approach to decarbonizing the Columbus region's mobility options. *This priority was largely funded by the USDOT grant.*

Priority 4 – Consumer EV Adoption

Objective: Increase EV market adoption as evidenced by the percentage of light duty EV registrations in Columbus and the surrounding seven-county region, attaining 1.8% of all new and used light duty vehicle registrations by the end of the three-year grant period, representing a 486% increase from the 2015 baseline of 0.4%.

Priority 5 – Charging Infrastructure

Objective: Support the acceleration of EV adoption through installation of charging infrastructure, with the goal of 925 new charging ports by the end of the grant period.

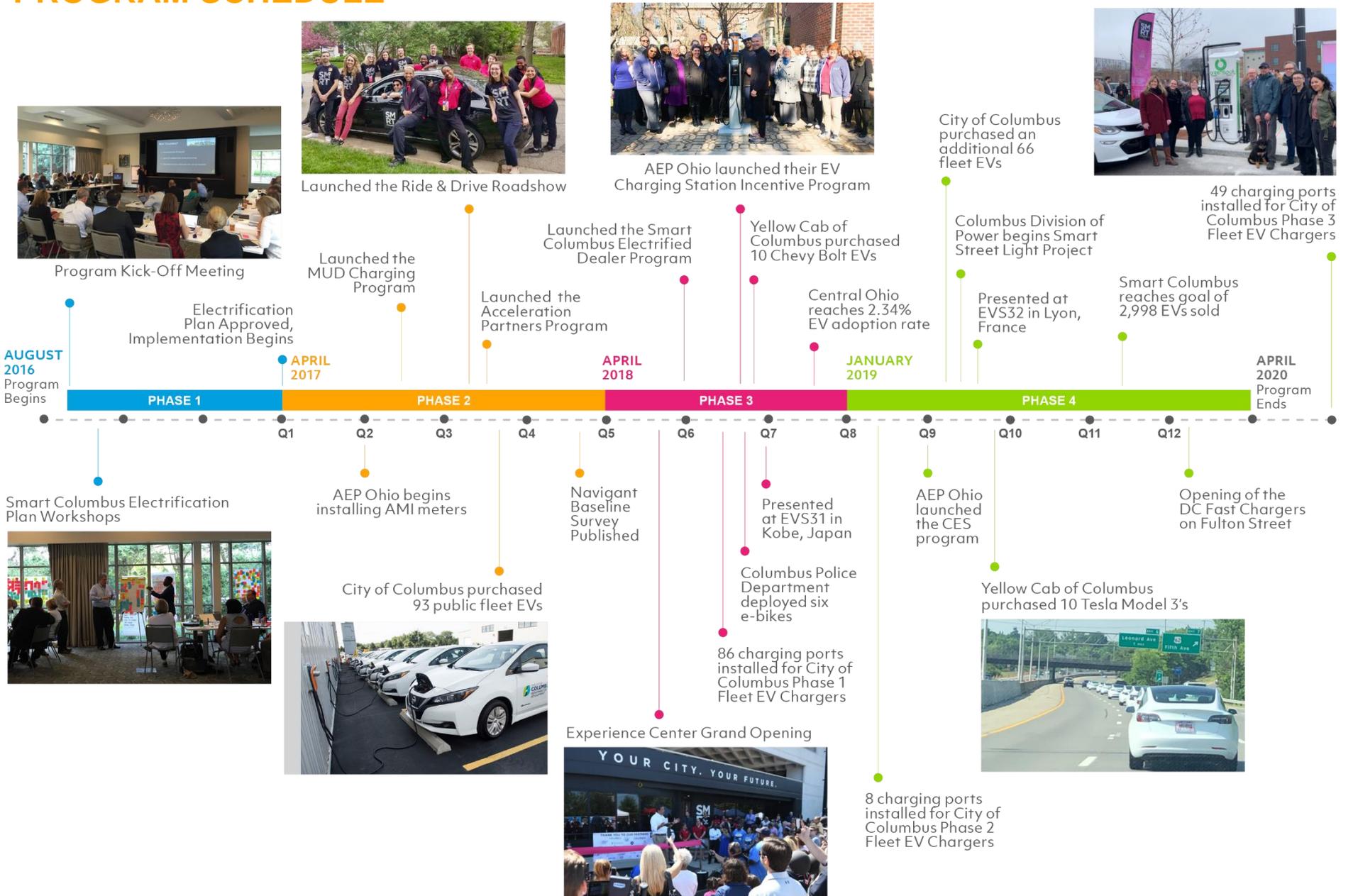
Playbook

Objective: The Playbook is to be an evolving portfolio of activities that facilitates knowledge transfer across all priorities. It will ensure that lessons learned through the Smart Columbus Program are disseminated to other cities in order to maximize the program's impact in decarbonizing urban transportation systems.

For more information on how our Electrification Goals were set, visit

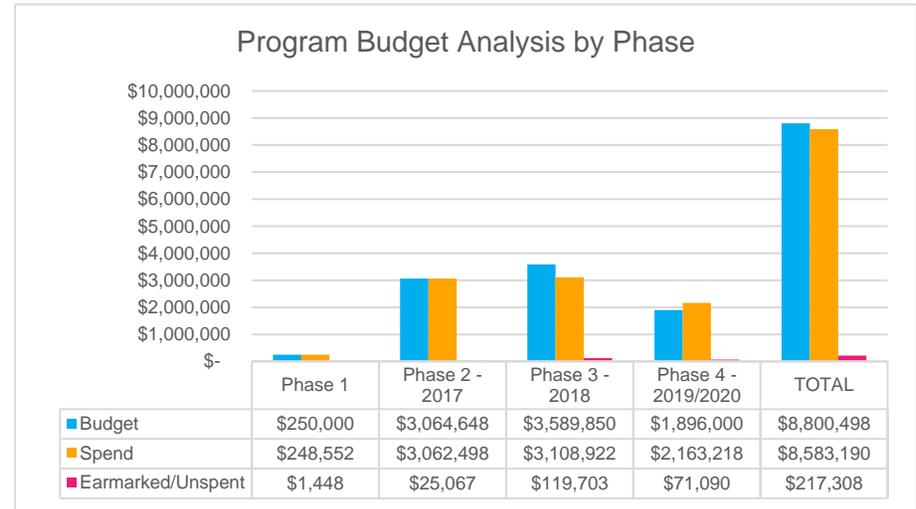
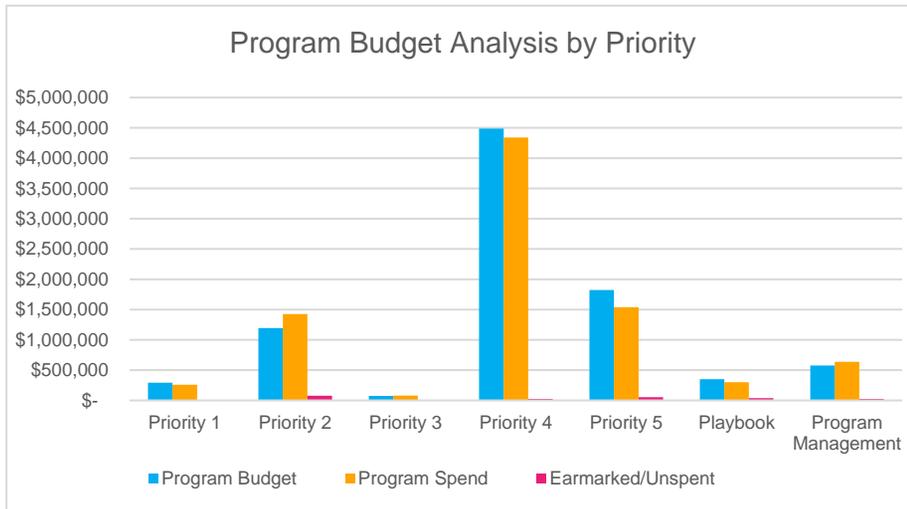
<https://smart.columbus.gov/playbook-asset/our-journey/setting-electrification-goals>.

PROGRAM SCHEDULE



PROGRAM BUDGET

Ninety-eight percent (98%) of the \$8.8M budget has been paid out. The reporting period for financial expenditure data for the City of Columbus is based on invoices received through July 31, 2020. Note: a final budget report will be provided by the end of 2020. A no cost extension was processed that transferred all remaining funds earmarked from other priorities towards charging infrastructure.



AUGUST 2016 THROUGH JULY 2020

Program Budget: **\$8,800,498** Total Spend: **\$8,583,190** Total Earmarked: **\$192,308** Unspent (Travel): **\$25,000**

	<u>Budget</u>	<u>Spent</u>	<u>Earmarked</u>	<u>Unspent</u>	<u>% Spent</u>
Priority 1	\$ 292,021	\$ 259,585	\$ 0	\$ 0	89%
Priority 2	\$ 1,195,592	\$ 1,426,688	\$ 76,419	\$ 0	119%
Priority 3	\$ 75,000	\$ 79,388	\$ 0	\$ 0	106%
Priority 4	\$ 4,489,131	\$ 4,341,928	\$ 25,013	\$ 0	97%
Priority 5	\$ 1,822,061	\$ 1,538,554	\$ 54,421	\$ 0	84%
Playbook (PB)	\$ 350,000	\$ 300,664	\$ 25,285	\$ 12,359	86%
Program Management (PM)	\$ 576,693	\$ 636,382	\$ 11,172	\$ 12,640	110%

REGIONAL ECONOMIC IMPACT

Smart Columbus initiatives have benefited both the economy and quality of life in the seven-county region and greater 11-county Columbus region. Direct program investment has resulted in new jobs, cleaner air, and more cost-effective and convenient transportation. As a result, these benefits have helped attract new economic development, as workers and corporations from outside the region see that Columbus is a great place to live and invest in. While many of these impacts are hard to quantify, an Economic Impact Analysis (EIA) can quantify a portion of them. The EIA measured the increased economic activity and jobs in a larger 11-county region by quantifying new funds being funneled into our community. While all Smart Columbus activities were designed to add maximum value to the community, some have the additional benefit of directly spurring the local economy. An EIA provides a dollar amount that shows how initial ("direct") project spending has an extended impact on economic activity and jobs in a region. Those initial dollars are paid to local businesses, who in turn pay them to employees, who then buy groceries, and so on.

Developed in August 2019, the chart below shows our estimated **\$723M regional economic impact** of spending aligned with Smart Columbus goals.

ACCELERATION FUND TALLY	ESTIMATE OF AMOUNT SPENT
AEP Advance Clean Energy Research & Development	\$500,000
IKE Kiosks	\$85,000
DOP Bio-Energy Power Purchase Agreement Increase	\$90,000
Exterior Signage for IKE	\$75,000
Staff Support	\$1,000,000
Corridor Study	\$100,000
DOP Green Power Purchase Agreement	\$100,000
DOP Eco-Smart Choice Green Pricing Option	\$100,000
DOP Bio-gas Cogen Plant at Wastewater Facility - Design	\$4,718,142
AEP - Distributed Generation of New Customer Installation	\$68,812
AEP Energy Efficiency Program - Wages	\$58,992,744

ACCELERATION FUND TALLY	ESTIMATE OF AMOUNT SPENT
AMI (AEP gridSMART 2.0) Advanced Metering Infrastructure Outside services	\$14,430,822
AMI (AEP gridSMART 2.0) Advanced Metering Infrastructure Wages	\$526,237
AMI Material	\$65,772,097
AEP Microgrids and Battery Storage	\$150,526
DOP Bio-gas Cogen Plant at Wastewater Facility - Materials and Labor	\$25,911,854
DOP Bio-gas Cogen Plant at Wastewater Facility - Maintenance Contract	\$3,500,000
DOP Hydroelectric Project Design & Egr Services	\$2,848,000
City of Columbus Consultants (GPD, HNTB, LSG, CFO, Atlas, etc.)	\$188,854
Public Fleet Vehicle Incentives	\$486,000
Taxi and Car Share Incentives	\$120,000
City of Columbus Consultants	\$288,713

ACCELERATION FUND TALLY	ESTIMATE OF AMOUNT SPENT
Future Allocated Priority 2 Amounts	\$103,321
USDOT Grant & Partnering	\$2,351
Polk Data	\$17,600
Primary and Secondary Research	\$172,613
Community Events - Local/Public Event Sponsorships	\$7,000
Electric Asset Branding	\$9,500
Smart Columbus Experience Center Construction	\$1,546,000
Dealer Training Program Design and Facilitation	\$60,000
Marketing and Communications Materials for Dealers and OEMS	\$26,044
Consumer Education Showroom	\$100,000
EV Awareness Campaign (Website Development and Online Resources/Tools)	\$170,000
Ride and Drive Road Show	\$895,551
Workplace Campaign - Ignite Action Fund	\$74,000
Workplace Campaign - Ignite Action Fund Partner Matching	\$805,525
Workplace Campaign - Ignite Action Fund	\$30,000
Digital Education	\$528,368
B2B Marketing	\$4,859
Marketing/Communications Materials for Dealers/OEMS	\$9,097
Staff	\$9,097
Strategy Consultants	\$2,150,000
Mission Advancement Projects Aligned with the Smart Columbus Mission	\$70,000
Other: Learning Excursions, Company Visits, Membership Engagement	\$173,000

ACCELERATION FUND TALLY	ESTIMATE OF AMOUNT SPENT
Balance of AFF - Cash Spent	\$926,000
TCP Staff	\$266,540
NGO Partner - Electrification Coalition	\$442,432
Communications Support/Asset Development	\$206,889
Charging Program (MUD sites) Incentives	\$4,600,000
Charging Program Administration	\$34,400
Application Management for MUD Sites	\$36,000
Charging Program Data Collection - Build Software Platform	\$112,500
DOP Hydroelectric Project Construction	\$12,000,000
Cost for Charging Station Planning & Design	\$390,000
Cost for Stations	\$100,000
City of Columbus Consultants	\$364,947
Future Allocated Priority 5 Amounts	\$71,295
Content Generation/Storyteller	\$49,620
Multimedia Storytelling	\$17,450
Media Relations/PR	\$24,990
PGA Grant Q0 Funds - Wages and Consultants	\$250,000
Project Coordinator and Scheduling	\$19,511
Technical & Grant Writer	\$96,959
Travel, Sponsorships, Conference Attendance, etc.	\$32,308
Future Allocated Overall Program Admin. Amounts	\$91,417
Corridor Study	\$100,000
Institutional EVSEs (Installation Cost)	\$435,747
Accelerator	\$700,000
Illumination Summit, May 2019, Conference Cost	\$1,400,000
In-Kind: Center Contribution - Broadband	\$250,000

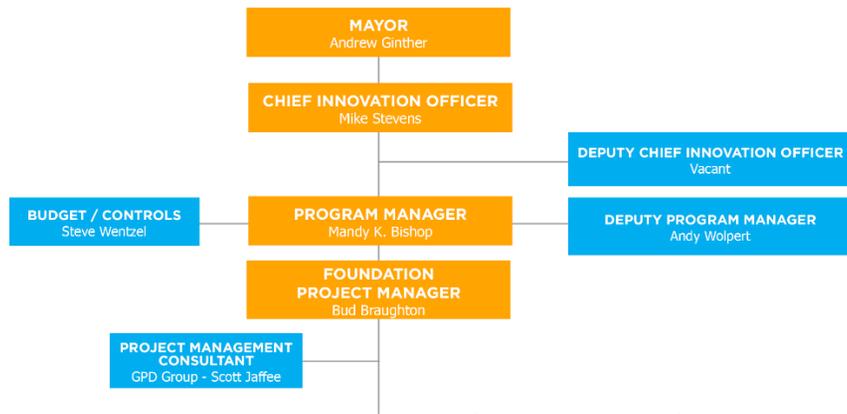
ACCELERATION FUND TALLY	ESTIMATE OF AMOUNT SPENT
DOP Advanced Metering Infrastructure (AMI) 10k AMI	\$5,000,000
Security system	\$160,000
Mobile Payment System Upgrade and Resident WiFi on the Bus	\$9,000,000
DOP Street Light Technology Conversion - Design	\$1,100,000
DOP Street Light Technology Conversion – Const.	\$2,500,000
Corridor Study	\$305,000
Deloitte: In-Kind Services	\$250,000
EY: In-Kind Services	\$150,000
Incentive MUD EVSEs	\$272,000
Public Access EVSEs	\$165,000
Insight2050 Corridor Concepts (the Corridor Study)	\$200,000
Community Projects	\$1,000,000
Columbus Connected Transportation Network DOT MOU: Labor	\$1,600,000
Columbus Connected Transportation Network DOT MOU: Hardware	\$1,540,000
Columbus Connected Transportation Network DOT MOU: Software	\$600,000
Transportation Research Center (TRC) - Wind Tunnel	\$124,000,000
Branding and Communications Support	\$500,000
Heavy Truck CNG Conversion Program	\$5,000,000
Homeowner Charging Program	\$15,275
Connected Vehicle Programs - County Spending	\$1,000,000
Connected Vehicle Programs - Cash to City	\$1,000,000
Research & Development Grant to TRC	\$7,500,000
CPASS Program for all Downtown EES	\$4,556,250

ACCELERATION FUND TALLY	ESTIMATE OF AMOUNT SPENT
RSTI (Hyperloop) - Local Funding	\$340,000
RSTI (Hyperloop) - State Funding	\$250,000
RSTI (Hyperloop) - Outside of State Funding	\$450,000
Additional Technology Partners: In-Kind Services	\$6,773,080
Research - Jobs and Commerce Grant to TRC	\$9,625,000
Corridor Study	\$100,000
Staff Services, per MOU	\$7,350,000
Pillar Technologies: In-Kind services	\$1,500,000
Siemens Intelligent Transportation Systems	\$390,000
Singularity University – Smart Cities Accelerator	\$7,500,000
Faculty Research	\$6,646,000
OSU Research & Development	\$8,000,000
TRC - Smart Mobility Center	\$49,000,000
Smart Columbus Conference and Delegation Visitor Spending	\$2,000,000
Columbus Fleet EVSEs - Elec Contractors	\$8,000,000
Columbus Fleet EVSEs - Consulting Engineer	\$49,000,000
Other Government Fleet EVSEs	\$912,500
Smart Roads and Smart Signals	\$110,093,453
All Fleet/Consumer EV Purchases (less incentives)	\$4,037,761
Federal Incentives for Consumer EVs	\$6,929,545
Smart Columbus Private Sector Donations	\$10,000,000
TOTAL	\$723,449,712

ORGANIZATIONAL STRUCTURE

- As a city or agency implements a smart city program, it is important to have a clear understanding of staffing commitments and partner contributions in order to build the proper network and delegate tasks. A centrally-managed program should be considered, as program initiatives, complexities, and policies will likely incorporate various city departments. Having a sufficient team to handle the influx of work is important. Visit <https://smart.columbus.gov/playbook-asset/our-journey/assembling-a-smart-city-team> for more information on assembling a smart city team.
- This program could not have been implemented without support from City leadership, including the Mayor's office. Championed at the highest levels by Mayor Andrew J. Ginther, City Council, and CEO's from several companies, led by Alex Fisher of the Columbus Partnership, it encouraged buy-in from various city departments and was critical in forming a comprehensive team while also demonstrating to residents and neighboring suburbs the importance of the program. Leadership buy-in, supported by a strong commitment from the Columbus Partnership, was crucial for the success of the program. The Columbus Partnership's direct connection with local business and the private sector helped to rally support throughout the business community. Because of these efforts, our private partners helped us meet our goals by providing both financial support and employee buy-in, dedicating both staff and resources to our decarbonization and electrification efforts.
- Even with the level of planning for this grant program, determining staff demands and adjusting can take significant amounts of time and effort. Employee attrition, unexpected (but necessary) employee absences and lengthy hiring processes can have a noticeable impact on a program. Continued development of the program roles and training multiple levels of staff is important for program sustainment.
- Adoption campaigns need to be led by local, full-time members of the staff. Full-time, dedicated hires grow capacity and expertise in the community and organization. They also are critical for relationship development among stakeholders and contribute to the internal team culture.
- See the organizational chart on the following page for our team's organizational structure.





PRIORITY 1	PRIORITY 2	PRIORITY 3	PRIORITY 4	PRIORITY 5	PERFORMANCE MEASUREMENT	RESEARCH	PROGRAM SUSTAINABILITY	COMMUNICATIONS OUTREACH AND PLAYBOOK	POLICY
<p>City of Columbus Patti Austin*</p> <p>GPD Group Scott Jaffee</p> <p>AEP Ohio Wiley Elliot* Sherry Hubbard</p> <p>INITIATIVE 1.1 City of Columbus Kristian Fenner</p> <p>HNTB Katie Zehnder</p> <p>AEP Ohio Wiley Elliot Sherry Hubbard</p> <p>INITIATIVE 1.2 City of Columbus Kristian Fenner</p> <p>HNTB Katie Zehnder</p> <p>AEP Ohio Wiley Elliot Sherry Hubbard</p>	<p>City of Columbus Bud Braughton</p> <p>GPD Group Scott Jaffee</p> <p>Clean Fuels Ohio Sam Spofforth</p> <p>INITIATIVE 2.1 City of Columbus Kelly Reagan*</p> <p>INITIATIVE 2.2 Columbus Partnership Zach McGuire*</p> <p>Electrification Coalition Matt Stephens-Rich</p> <p>INITIATIVE 2.3 City of Columbus Kevin McSweeney</p> <p>Clean Fuels Ohio Andrew Conley</p> <p>HNTB Katie Zehnder</p>	<p>CEAV'S City of Columbus Andy Wolpert Ryan Bollo</p> <p>Michael Baker Jeff Kupko</p> <p>ELECTRIC BIKES City of Columbus Mandy Bishop</p> <p>BIKE INFRASTRUCTURE City of Columbus Maria Ruppe Nick Popa</p>	<p>Columbus Partnership Jordan Davis*</p> <p>Electrification Coalition Natalia Swalnik Matt Stephens-Rich</p> <p>City of Columbus Mandy Bishop*</p> <p>INITIATIVE 4.1 Columbus Partnership Alex Slaymaker</p> <p>Navigant John Gartner</p> <p>INITIATIVE 4.2 Columbus Partnership Jennifer Fening Alex Slaymaker McKinzie Harper</p> <p>ApPROach Marketing Local Media Relations</p> <p>INITIATIVE 4.3 Columbus Partnership Alex Slaymaker Jennifer Fening</p> <p>Civitas Now Lauren Eckles</p> <p>Fahlgren Mortine Consumer Adoption Campaign</p> <p>INITIATIVE 4.4 Columbus Partnership Zach McGuire Jennifer Fening</p> <p>Electrification Coalition Matt Stephens-Rich</p>	<p>City of Columbus Bud Braughton</p> <p>GPD Group Scott Jaffee</p> <p>INITIATIVE 5.1 City of Columbus Patti Austin* Kristian Fenner</p> <p>Clean Fuels Ohio Sam Spofforth</p> <p>INITIATIVE 5.2 City of Columbus Cristina Parady</p> <p>GPD Group Scott Jaffee</p> <p>INITIATIVE 5.3 Columbus Partnership Zach McGuire</p> <p>Electrification Coalition Matt Stephens-Rich</p> <p>AEP Ohio Sherry Hubbard</p> <p>INITIATIVE 5.4 City of Columbus Sonja Summer</p> <p>GPD Group Scott Jaffee</p> <p>INITIATIVE 5.5 City of Columbus Kevin McSweeney</p> <p>Columbus Partnership McKinzie Harper</p>	<p>HNTB Scott Lowry</p> <p>REPORTING GPD Group Kayla Stucke</p> <p>DOCUMENT CONTROL HNTB Kathy Pinyerd</p> <p>SCHEDULE Hill International Dan Weis</p> <p>QUALITY L.S. Gallegos Kelly Angel</p> <p>LEGAL / COMPLIANCE City of Columbus Attorney's Office</p>	<p>City of Columbus Bud Braughton</p> <p>The Ohio State University Courtney Falato Gregory E. Hitzhusen, M.Div, PhD</p> <p>Department of Energy - NREL Dr. Stan Young et al.</p> <p>Columbus Partnership Alex Slaymaker</p> <p>Navigant John Gartner</p>	<p>City of Columbus Mandy K. Bishop</p> <p>L.S. Gallegos Kelly Angel</p> <p>Columbus Partnership Jordan Davis</p>	<p>City of Columbus Alyssa Chenault</p> <p>Atlas Nick Nigro</p> <p>Engage Marie Kiester</p> <p>Columbus Partnership Jennifer Fening Donna Marbury Jordan Davis McKinzie Harper</p> <p>Fahlgren Mortine Website</p> <p>DCI National Media Relations</p> <p>Paul Werth Associates Media Relations and Social Media</p>	<p>City of Columbus Alana Shockey Tony Celebrezze</p> <p>Clean Fuels Ohio Sam Spofforth</p> <p>Columbus Partnership Jordan Davis</p> <p>Electrification Coalition Ben Prochazka</p>

WORKING GROUPS (*INDICATES CO-CHAIRS)

PROGRAM REPORTING

QUARTERLY INDICATORS AND METRIC TARGETS

The Quarterly Indicators and Metric Targets spreadsheet was used as a way to track actual indicator progress against the established targets/goals for each priority on a quarterly basis. The indicators were provided at the Project, Priority and Initiative level. Performance indicators were addressed at three levels:

1. The overall project level;
2. The five project priorities (grid decarbonization; fleet EV adoption; transit, autonomous and multi-modal systems in the city; consumer EV adoption; and EV charging infrastructure); and
3. The specific initiatives under each priority area.

The project, priority and initiative indicators were hierarchical. Priority indicators contributed directly to a project indicator, and similarly, initiative indicators contributed directly to one of their respective priority indicators. Progress indicators encompassed anything that could be numerically evaluated and reflected progress towards objectives but did not contribute directly to higher level indicators. Methods and data sources for estimating indicators and tracking progress towards targets are described in the Performance Measurement Plan.

See the attached Appendix A – SCC-P7-Quarterly Indicators and Metric Targets.xlsx for more detail.

KEY PERFORMANCE INDICATOR (KPI) DASHBOARD

Smart Columbus created a consolidated KPI dashboard to visualize key program accomplishments and progress towards the Electrification Program goals. The KPIs are arranged by project priority area and can be viewed over time. Visit the [Smart Columbus Key Performance Indicators Dashboard](#) for more details.

METHODOLOGY AND ANALYSES

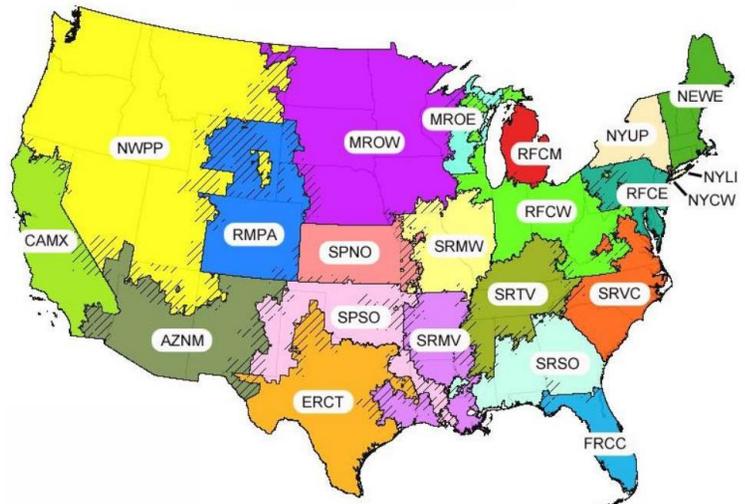
PERFORMANCE MEASUREMENT PLAN

Objective:

- The objective of the *Performance Measurement Plan (PfMP)* is to layout a framework for the reporting of quantitative progress towards accomplishing the objectives of the Smart Columbus Program, the identification and collection of various data sets, and the methodologies to process the data into performance metrics that support the execution, analysis, and reporting of performance indicators at all levels.
- The PfMP informs stakeholders involved in carrying out the Smart Columbus Program of the required reporting and provides the required data that supports documenting the accomplishments of the program.
- The plan encompasses the goals, performance indicators, and trackable initiatives to be quantitatively reported, the requirements of the data that will be collected to support the reporting, and the processing of the data to create an effective performance measure indicating attainment of goals and ultimate GHG reduction to validate the success of the PGAFF grant program.

Decarbonization GHG Methodology:

- Of the five program priorities, Decarbonization of the power grid yielded the most significant GHG savings. The power generated by renewable sources is considered emissions saved since fossil-fuel power production methods would no longer be used. The U.S. Environmental Protection Agency (EPA) releases the Emissions & Generation Resource Integrated Database (eGRID) biennially as a comprehensive source of environmental characteristics of electric power generation by region. The retrospective report is based on plant-level data reported by all U.S. generating plants that provide power to the electric grid. Emissions from the electric power grid for the seven-county region can be estimated using the GHG Annual Total Output Emission Factor for the RFC West sub region. This factor can be applied to estimate the $MTCO_2$ saved by installing and generating electricity from renewable sources.

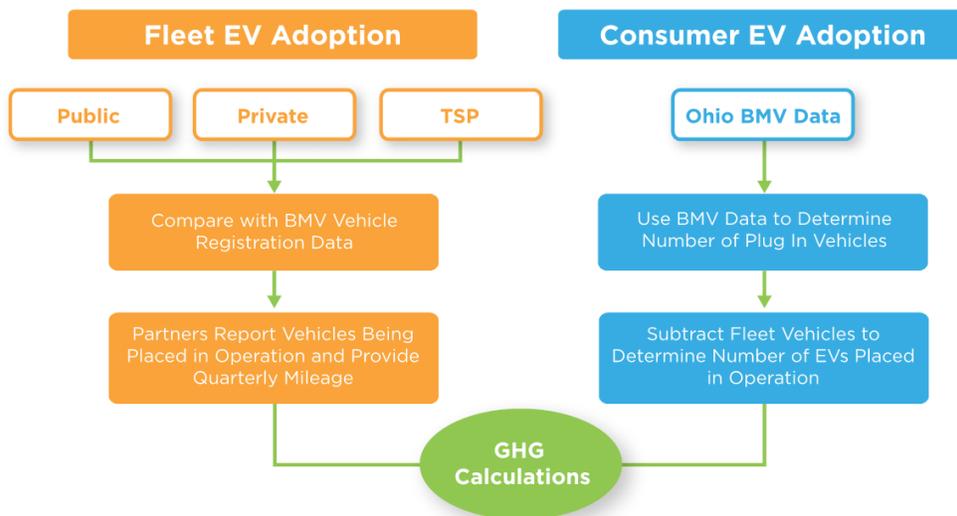


Map of eGRID Sub Regions

$$MTCO_2 \text{ saved} = MWh \text{ generated using renewables} \times eGRID \text{ regional emission factor}^1$$

EV Adoption GHG Methodology:

- EV adoption for this program is comprised of electric fleet vehicles and electric consumer vehicles. The program is tracking three separate types of fleet vehicles: public, private and transportation service providers (TSPs). New fleet vehicles purchased are reported by Smart Columbus partners on a quarterly basis. Information obtained is checked against the vehicle registration data obtained from the Ohio Bureau of Motor Vehicles (BMV) each month. Then, when partners report that the EVs are in operation they are recorded as such and GHG savings begin to accrue.



EV Adoption Flow Chart

- In the case of consumer purchased EVs, the team uses IHS Markit data obtained from the Ohio BMV, to quantify the number of plug-in vehicles purchased. Ohio BMV vehicle registration data includes all vehicles registered in Ohio, so the team sorts out the plug-in vehicles and removes the fleet vehicles registered during the same period so as not to double count them. The resulting number of vehicles are then used to determine GHG savings.
- The following are examples of GHG calculations associated with EVs, applicable for fleet and consumer EV adoption (Priorities 2 and 4). This method for determining GHG reductions from replacing miles travelled by an ICE vehicle with an EV or plug-in hybrid electric vehicle (PHEV) uses the EPA Greenhouse Gas Emissions from a Typical Light Duty Passenger Vehicle calculation to determine the tailpipe emissions. The general method is as follows:

$$EV\ savings\ (MTCO_2) = (ICEV\ emissions) - (EV\ emissions)$$

$$PHEV\ savings\ (MTCO_2) = (ICEV\ emissions) - (PHEV\ emissions)$$

Where,

$$ICEV\ emissions = fuel\ production\ emissions + tailpipe\ emissions$$

$$EV\ emissions = charging\ grid\ emissions$$

$$PHEV\ emissions = fuel\ production\ emissions + tailpipe\ emissions + charging\ grid\ emissions$$

- For tailpipe emission during vehicle operation, an ICEV produces GHGs for every gallon of motor fuel combusted, while an EV has zero tailpipe emissions during vehicle operation. There are however GHG emissions produced from charging an EV. The electricity that is generated to power an EV (energy production) has its own GHG emissions which could be considered as upstream emissions. The GHG savings from an EV and PHEV are averaged to come up with an overall yearly value to be used in calculations.

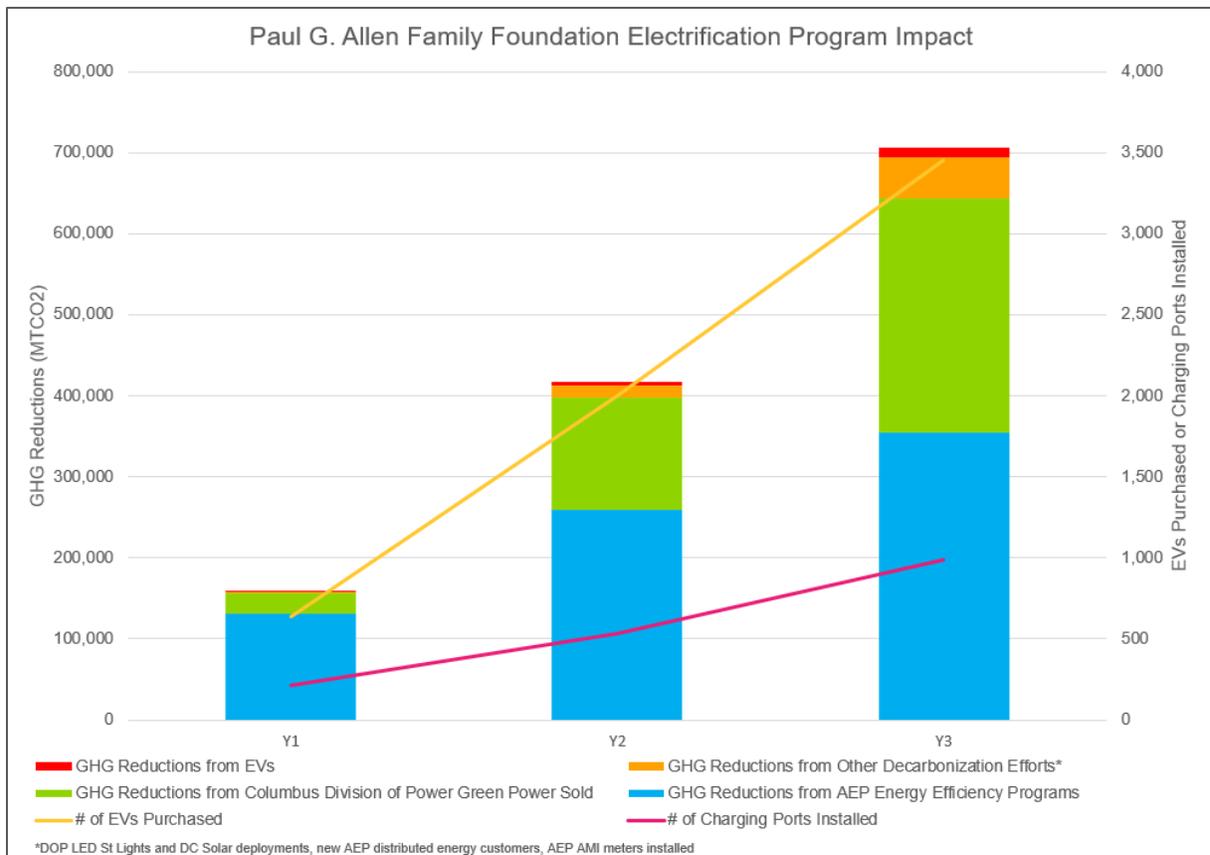
Lessons Learned:

- A strong, well thought out framework for defining performance is important. Specific details should be defined for data collection for each priority, initiative and strategy and a GHG baseline should be established earlier in the program. However, the program was complex and needed to evolve to incorporate new learnings and capitalize on opportunities.
- Early coordination with your utility provider and the National Renewable Energy Lab (NREL) is encouraged. Involvement from AEP Ohio and NREL greatly strengthened our document, specifically the calculation methodology for Priorities 1, 2 and 4.
- Engage an expert from outside your organization to review the PfMP. The International Council on Clean Transportation (ICCT) provided critical feedback and additional supporting references to strengthen the justification of the methodology.

GHG ANALYSIS

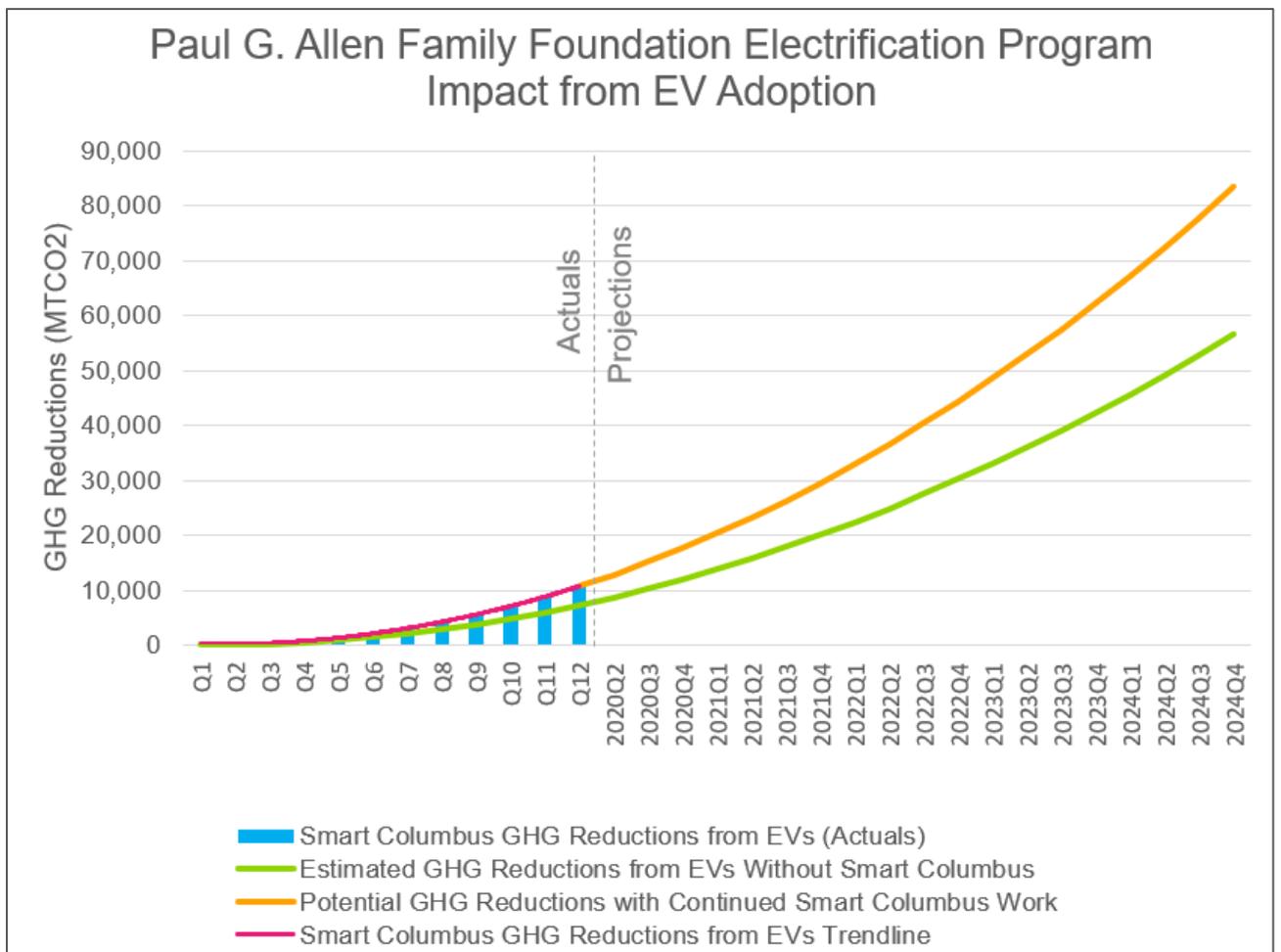
GHG Reduction Methodology:

- The majority of reductions in GHGs (>99%) during the grant period were a result of the Priority 1 decarbonization effort. These short-term efforts were focused around energy efficiency initiatives that reduced the amount of energy that was consumed or allowed utility customers to purchase power from renewable sources. This effort is important in order to move away from fossil fuel sources for electricity and enable all other priorities to be more effective toward GHG reduction.
- EVs placed in operation for fleets (Priority 2) and consumer EV adoption (Priority 4) made up the remaining reductions in GHGs. The GHG reductions associated with Priority 3 were not quantified due to the difficulty in estimating reasonably acceptable metrics for initiatives such as e-bikes deployed, or the number of bike infrastructure lane miles added. Charging infrastructure (Priority 5) is considered an ‘enabling technology’ for EVs so no direct GHG emissions were calculated.
- Greenhouse gas savings, shown below, have come from the:
 - AEP Energy Efficiency Programs, including the installation of over 500,000 Advanced Metering Infrastructure (AMI) smart meters;
 - Sale of Green Power by the City of Columbus Division of Power (DOP);
 - Other efforts such as DOP light-emitting diode (LED) streetlights, solar deployments and new AEP distributed energy customers; and
 - Use of EVs instead of ICE vehicles.



Future GHG Reduction Efforts:

- The energy efficiency efforts during the three-year grant period will continue, but the long-term goals for increasingly higher GHG reductions will come from renewable energy generation through wind, solar, hydroelectric, and co-generation installations.
- Focusing only on the emission reductions from EV adoption (Priorities 2 and 4), a projection of future GHG benefits was developed. The figure below shows the calculated GHG reductions during the Smart Columbus grant period (blue bars), with a trendline shown in pink. As an estimate of what the GHG reductions from EVs would have looked like without the Smart Columbus program, the EV adoption trends in the Cleveland, Ohio, area were used for comparison (green line). The Cleveland area was estimated to have about 68% of the EV adoption of the Smart Columbus area. After the Smart Columbus program ends, continued work on these efforts (pending grant funding) was used to forecast future adoption trends (orange line). This projection assumes the goal of an EV adoption rate of approximately 15% by 2025 for the Columbus region. Note that the graph is displaying cumulative GHG reductions over time and assumes that these reduction benefits from plug-in electric vehicles (PEVs) placed in operation in previous quarters also contribute to reductions in future quarters.



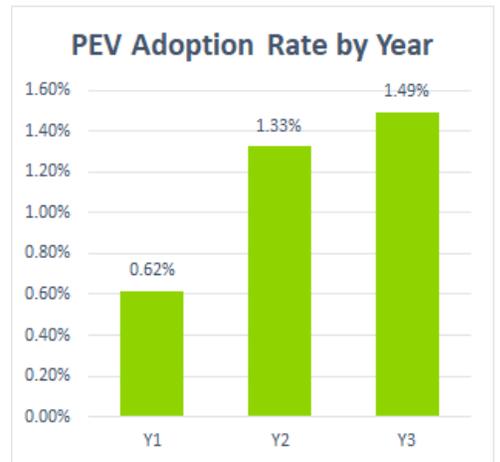
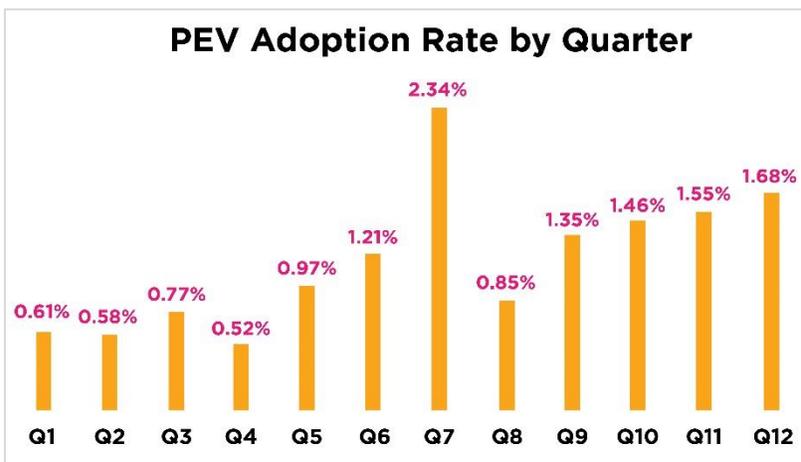
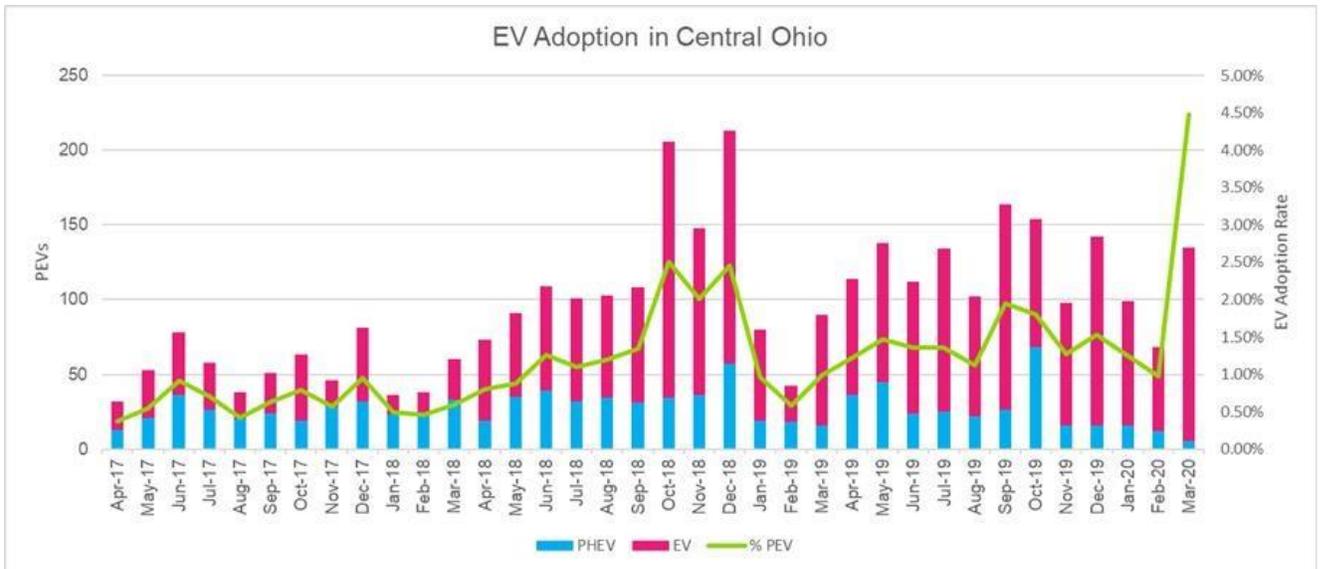
EV ADOPTION – POLK DATA ANALYSIS

EV Adoption Calculation Methodology:

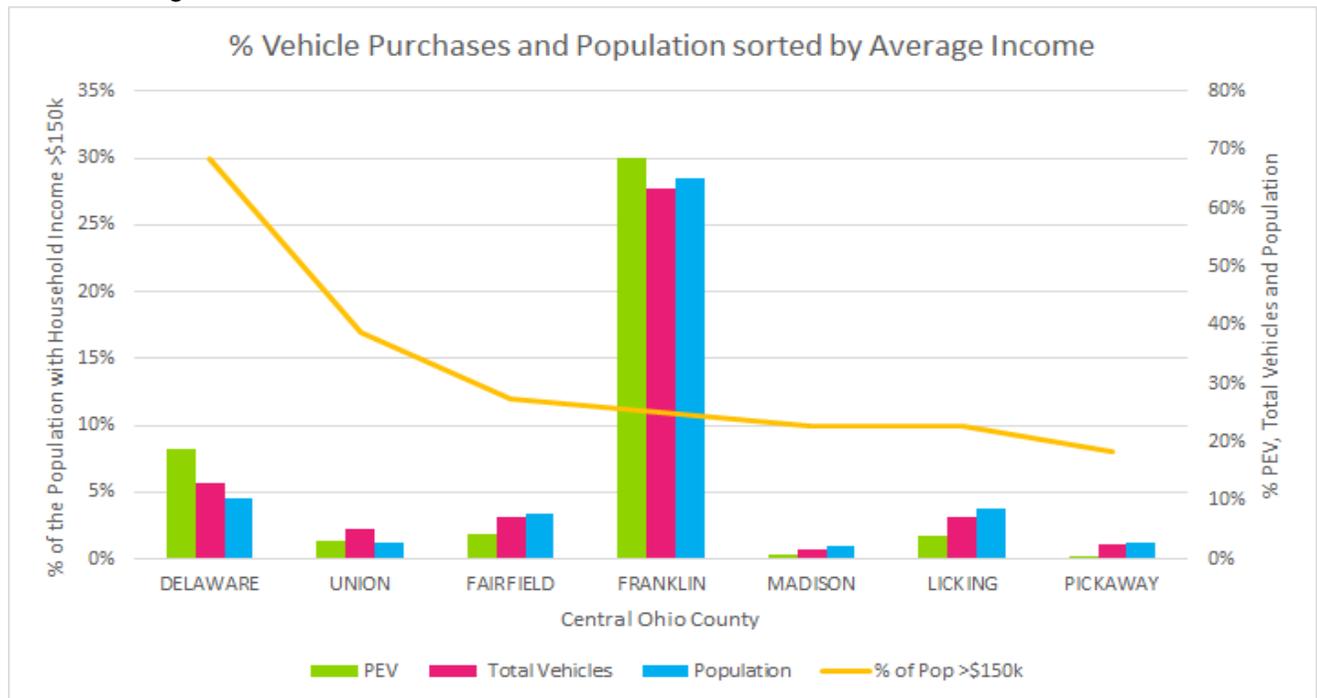
- Data on EV sales by county was purchased from IHS Markit (Polk) and used to understand adoption patterns in the seven-county Columbus region. In June 2018, the Smart Columbus team also began purchasing data on the make and model for new vehicles sales. See Appendix B for a monthly breakdown of IHS data from the program.

EV Adoption Findings:

- The PEV adoption rate for passenger vehicles over the life of the program averaged 1.14%, with 3,458 PEVs sold out of 303,526 vehicles. The adoption rate hit a peak of 2.34% in Q7 when the City of Columbus fleet placed 93 vehicles in operation and the Tesla Model 3 became more widely available.



- Sixty-three percent (63%) of PEVs were purchased in Franklin County, 19% in Delaware county and the remaining 18% in the other five Central Ohio counties.

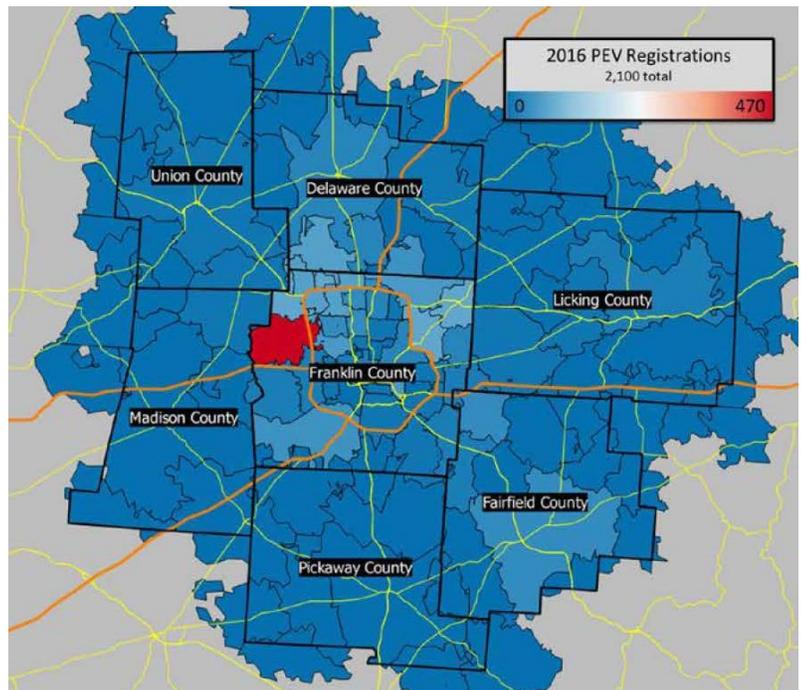


- Twenty-eight percent (28%) of PEVs purchased were made up of:
 - Twenty-eight percent (28%) PHEVs with the top models being the Ford Fusion Energy, Toyota Prius Prime and the Honda Clarity
 - Seventy-two percent (72%) battery electric vehicles (BEVs) with top models being the Tesla Model 3, Tesla Model S, Tesla Model X, Nissan Leaf and Chevy Bolt.
- During the last seven quarters of the program, for which model data is available, 64% of the PEVs sold were Tesla vehicles.
- Of the people purchasing new vehicles in Delaware and Franklin Counties, a higher percentage are buying PEVs (ie: Delaware County has 10% of the population and accounts for 19% of the PEV purchases). Thirty percent (30%) of households in Delaware County have incomes over \$150,000, which is two to three times the rate for the other six counties. This may explain why they purchased a higher share of PEVs. In the case of Franklin County, this is where the majority of the 255 public fleet purchases occurred and boosted their share of PEVs purchased.
- COVID-19: Ohio Governor Mike DeWine declared a state of emergency and asked colleges and universities to switch to virtual learning on March 9, 2020. On March 16, 2020, all grade schools were closed for in-person instruction and did not reopen for the remainder of the school year. On March 18, 2020, Ohio BMVs closed statewide. By March 23, 2020, Ohio was under a stay-at-home order. Consequently, car dealerships, if open, saw limited foot traffic and sold less than a third of the number of vehicles they had the past three years during March. Tesla, with its online sales structure, accounted for 129 of the 135 PEVs sold in March 2020 driving the 4.5% adoption rate in March 2020.

Impacts and Lessons Learned:

- Given the couple months lag between the end of the month and when IHS provided new PEV registration statistics, the Smart Columbus team did two things to better understand the market and new vehicle registration trends:
 - Developed close relationships with the market leader, Tesla, to understand their sales and delivery pipeline; and
 - Worked with the Ohio BMV to obtain the statewide vehicle registration data set. The BMV makes this available five days after the close of each month. Without data sets from other states, it is hard to understand the flow of vehicles between states; however, this data allowed the Smart Columbus team to understand the trends earlier so interventions could be gaged for effectiveness and adjusted, if needed. The data also allowed the Smart Columbus team to compare adoption trends in major metropolitan areas across Ohio and see if the data helped understand how policies like free parking for PEVs in Cincinnati were impacting adoption when compared to Ohio cities without incentives or interventions.

- Initially, Smart Columbus was not paying IHS Markit for vehicle make and model information, just BEVs and PHEVs by zip code. There were a few locations where it was difficult to understand the data. For example, there were many BMWs registered to a zip code in a suburb in on the west side of Columbus (see the 2016 PEV registration zip code map completed by NREL to the right). After further analysis, the Smart Columbus team was able to confirm that BMW Financial, located in the zip code, was registering lease vehicles at their headquarters for employees in a much larger geography. In June 2018, Smart Columbus increased the IHS Markit data purchase to include make and model data as well as used EVs and PHEVs being registered by new owners.



- The Smart Columbus BMV data analysis led to the Ohio Department of Transportation's (ODOT's) DriveOhio program paying to expand this work and develop a dashboard to track alternative fuel vehicle data trends across Ohio that could be shared with universities, national labs, other government agencies, and interested parties.

BASELINE CONSUMER DATA

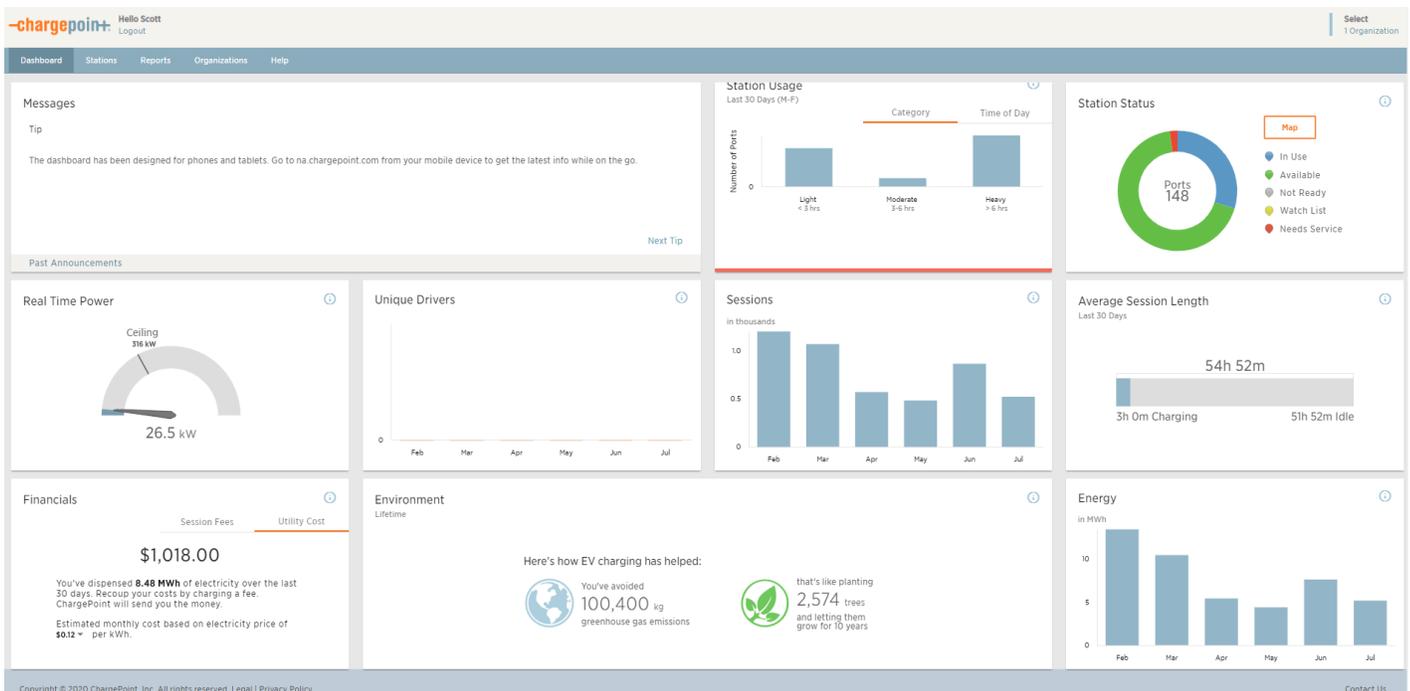
- In March 2018, Smart Columbus and research firm, Navigant, published the findings of a survey of 900 people in the Columbus region who were identified as early adopters or early majority users for EVs, and who were looking to buy a new car in the next four years. The survey measured respondents' vehicle preferences, EV awareness, considerations when buying a car, barriers to purchase, and other consumer characteristics. The goal of the survey was to baseline consumer understanding of and receptivity to EVs in the region. The Smart Columbus team thought it was important to get a clear understanding of the consumer landscape in Columbus, in order to create programs, education and incentives to increase adoption. The survey also helped Smart Columbus better understand opportunities and barriers to EV adoption in the region, and how measures of EV adoption compare to nationwide EV figures. A few key findings from the baseline survey along with survey results are available here: <https://smart.columbus.gov/playbook-assets/electric-vehicle-consumer-adoption/gauging-consumer-awareness-of-evs-in-columbus>. This framework, developed during the baseline research phase, was used in all future phases of work.
- See Strategy 4.1.1 on Consumer Research for more information on this data.

SMART COLUMBUS OPERATION SYSTEM

- Detailed program data is stored and updated on the Smart Columbus Operation System. For information on accessing this data, visit <https://www.smartcolumbusos.com/about/how-to-use-this-site>.

CHARGING STATION DATA

- For many of the EV chargers installed as part of the of Smart Columbus and AEP Ohio EV Charging Station Incentive Programs, sharing EV Charging Data was a main requirement. The Smart Columbus team received this data through a dashboard developed by the EV Charging software companies. Chargepoint was the main software provider for the Multi-Unit Dwelling (MUD) and Fleet charging projects. The level of detail of the data available depended on the type of user login agreed upon with the software provider.
 - Administrative level users had the ability to control chargers remotely, set power share limits for chargers, review near real-time power output, adjust pricing, etc.
 - Data users could review the number of chargers available, in-use and in need of repair; energy use over time; number of and length of charging sessions; charging versus idle time; charging time of day; expected utility costs, etc.
- In the near term, this data can be used to study charging behavior, adjust power share based on demand, reduce utility demand charges, and set or adjust pricing. Over the long term, this data can be used to determine additional charging needs, locations with flexibility for pool vehicles, and budgets for utility costs.
- See *Initiatives 5.1 and 5.4* for more information on charging data from Smart Columbus Multi-Unit Dwelling and Fleet Charging.



PRIORITY OVERVIEW

Progress is detailed below for the following priorities: Decarbonization; Fleet Electric Vehicle Adoption; Transit, Autonomous and Multi-Modal Systems in the City; Consumer Electric Vehicle Adoption; and Charging Infrastructure.

PRIORITY 1 – DECARBONIZATION

Objective: In partnership with power providers, by 2030 install 905 MW of utility scale renewable energy generation capable of serving the Columbus region, procure a minimum of 1.2 million MWh of renewable energy for the City of Columbus between 2017 and 2022, and save 480 GWh consumed through energy efficiency and smart grid programs during the time period of the grant.

Goal Progress:

PRIORITY INDICATORS	GOAL	LIFE OF PROGRAM PROGRESS
MW of renewable energy capacity installed	905 MW	13.53 MW
MWh of renewable energy consumed	1,215,000 MWh	636,519 MWh
MWh of energy saved (new renewable energy or energy efficiency)	480,000 MWh	662,466 MWh

Program Highlights:

<p>552,000+ AEP OHIO AMI METERS INSTALLED, EXCEEDING THE GOAL OF 528,000</p>	<p>32.9% OF COLUMBUS DOP'S ENERGY WAS FROM RENEWABLE RESOURCES IN THE FINAL QUARTER, UP FROM 5.7% AT THE START OF THE PROGRAM</p>	
<p>AEP OHIO INTERCONNECTED 809 NEW CUSTOMERS WITH DISTRIBUTED GENERATION AND INSTALLED 13.53 MW OF RENEWABLE ENERGY CAPACITY OVER THE PROGRAM</p>		
<p>COLUMBUS DOP ADVANCED DESIGN ON THE O'SHAUGHNESSY DAM IMPROVEMENTS PROJECT AND THE JACKSON PIKE CO-GENERATION WWTP</p>	<p>187 LED STREET LIGHTS INSTALLED THROUGH AEP OHIO'S SMART STREET LIGHT PILOT PROJECT</p>	<p>19,000 RESIDENTS PARTICIPATED IN ENERGY EFFICIENCY PROGRAMS THROUGH THE NEIGHBORHOOD COMMUNITY ENERGY SAVERS (CES) CAMPAIGNS</p>

Initiative 1.1 – Utility-Scaled Renewables

Strategy 1.1.1 – AEP Solar and Wind Generation

Program Highlights:

- AEP Ohio filed with the Public Utilities Commission of Ohio (PUCO) “Amendment to the 2018 Long-Term Forecast Report of Ohio Power Company” to demonstrate the need for at least 900 MW of renewable energy in Ohio. On November 21, 2019, PUCO determined that the long-term forecast report of AEP Ohio “fails to demonstrate a need, under any offered definition of the term, for at least 900 megawatts of renewable generating facilities...”. Phase II of the filing to recover development costs for Willowbrook and Highland, two new Ohio solar projects totaling 400 MW, was determined to not be necessary (cases 18-501-EL-FOR; 18-1392-EL-RDR; 18-1393-EL-ATA). See *Appendix C* to review the full PUCO Opinion and Order for this case.

Impacts and Lessons Learned:

- Utility regulatory practices are unique for every circumstance investigated. Complexities around asset ownership and maintenance require thoughtful deliberation and consideration when designing a utility program. Time should be allocated, as this is not typically action that may be immediate.

Strategy 1.1.2 – AEP Research and Development to Advance Clean Energy

Program Highlights:

- AEP contributed \$500,000 to two Ohio universities in 2018 to advance clean energy research:
 - \$250,000 grant to The Ohio State University (OSU) for cyber security research, and <https://engineering.osu.edu/news/2018/05/aep-ohio-funds-research-protecting-power-grids-cyberattacks>
 - \$250,000 research grant to Ohio University’s Voinovich School. <https://www.ohio.edu/compass/stories/17-18/04/aep-ohio-grant-voinovich-solar-research.cfm>

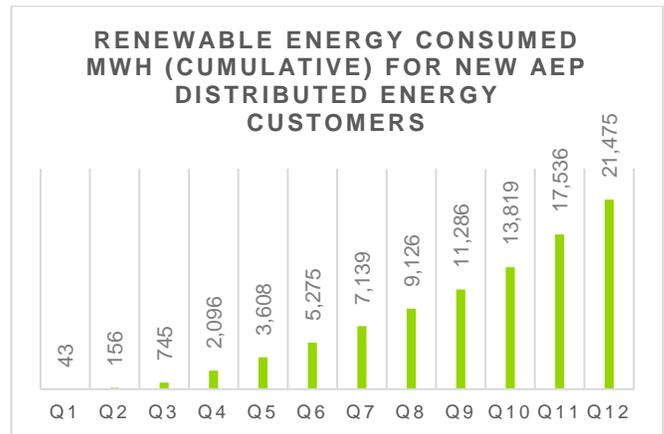
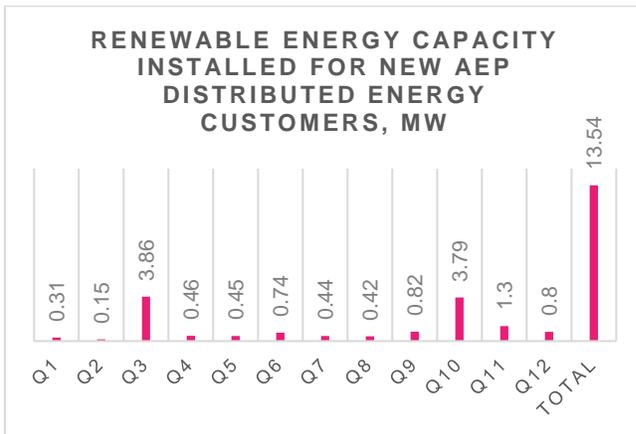
Impacts and Lessons Learned:

- Due to COVID-19, this is unknown at this time.

Strategy 1.1.3 – AEP Distributed Generation Coordination of New Customer Installation

Program Highlights:

- AEP Ohio greatly exceeded its target of interconnecting 300 new customers with distributed generation. By March 31, 2020, 809 new customers with distributed generation systems, all solar, were connected in the Smart Columbus footprint. Interconnection service applications ensure proposer connection and operation of other sources of power to work in parallel with AEP Ohio’s transmission and distribution systems. This provides safety for employees and the public, and maintains reliability and quality of electric service. 13.54 MW of renewable energy capacity was installed over the program and 21,475 MWh of renewable energy was consumed.



Impacts and Lessons Learned:

- Time required for the bidding and contracting processes, along with engineering and equipment specifications and testing add significant time, which should be reflected in initial planning and projections.

Strategy 1.1.4 – Solar Generator Deployment

Program Highlights:

- Portable solar panels were installed at Ohio Dominican University (ODU) in August 2017 and remain deployed. "The Ohio Dominican University community is thrilled and honored to partner with Smart Columbus." said ODU President Robert Gervasi, Ph.D. "We are a Catholic Dominican university, and so we are called to preserve and protect God’s creation. This initiative is a clear demonstration to our campus community as well as the greater Columbus community of ODU's commitment to be good and faithful stewards of the planet."
- Solar units were deployed with Yellow Cab of Columbus, ODOT and the Ride & Drive Roadshow.

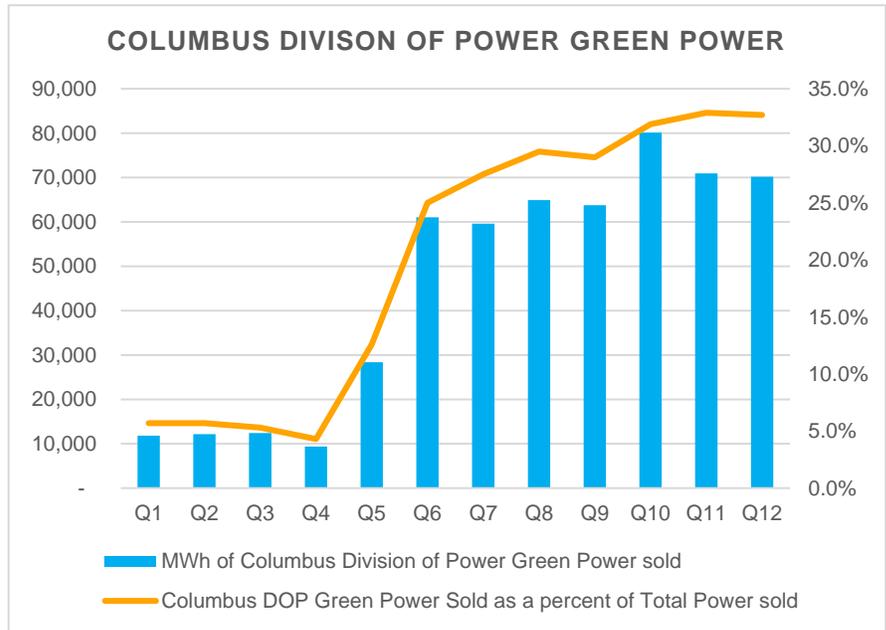
Impacts and Lessons Learned:

- Most solar panel companies were not viable because their business model conflicted with advertising policies in the city’s right of way. Therefore, partnering with an agency that uses advertising as a means to provide sustainable infrastructure was difficult to deploy on city property or right of way due to outlying concerns.
- It was too difficult to find out what the actual GHG emission reduction was through solar energy versus biodiesel fuel used for backup power. The city discontinued monitoring this equipment.

Strategy 1.1.5 – Columbus Division of Power Green Power

Program Highlights:

- Green power was generated primarily from the New York Power Authority (NYPA), the largest state public power utility in the country. Thanks largely to NYPA’s three large-scale hydroelectric plants, New York State is able to produce a substantial portion of statewide power needs. Forty-seven municipal electric systems, including Columbus DOP, and four rural electric cooperatives in communities around the state benefit from NYPA hydropower by being able to purchase its power.



- DOP’s 20% green credits started June 1, 2018.
- DOP created Energy Efficiency kits for customers in zip codes included in the American Cities Climate Challenge. 1,500 kits were distributed to customers with information on how to conduct online home energy audits with partners, AEP and Columbia Gas.
- The Columbus Department of Public Utilities (DPU) received a grant from American Municipal Power (AMP) through the EcoSmart Choice program. Some of the funds will be used to build an online dashboard that will track the DOP’s sustainability efforts (i.e. green power consumption, AMI, LED street lights). The city energy manager and DOP worked with JadeTrack to help build and maintain this platform, it is anticipated that this will be linked to the DOP website in the future.
- Q1 of 2020 was the 2nd highest percentage of green power to date. 32.9% of DOP’s energy was from renewable resources that included the 20% contractual power purchases and voluntary EcoSmart Choice customer program.

Impacts and Lessons Learned:

- DOP remains committed to increasing their green energy purchasing. DOP’s purchase power contract will go from 20% to 50% green power in 2023. Green power means renewable energy certificate (RECs) as defined by the Ohio Revised Code.
- DOP understands the significance of “additionality” and is working with the Department of Public Utilities and consultants on ways to participate in on-site and off-site renewable projects.
- An REC is a market-based instrument that represents the property rights to the environmental, social and other non-power attributes of renewable electricity generation. RECs are issued when one megawatt-hour (MWh) of electricity is generated and delivered to the electricity grid from a renewable energy resource. Because the physical electricity DOP receives through the utility grid says nothing of

its origin or how it was generated, RECs play an important role in accounting, tracking, and assigning ownership to renewable electricity generation and use. On a shared grid, whether from on-site or off-site resources, RECs are the instrument that electricity consumers must use to substantiate renewable electricity use claims. DOP will continue to purchase RECs but has learned the importance of participating in either on-site or local renewable energy facilities as it directly relates to reduced GHG emissions. DOP will work with its consultants on future procurement plans.

Strategy 1.1.6 – City of Columbus Wastewater Treatment Plant, Co-Generation

Program Highlights:

- The goal is to use biogas from City Wastewater Treatment Plants (WWTPs) as fuel for a Combined Heat and Power (CHP) plant, which will consume all biogas being produced and supply half of the power at two WWTPs.
- DOP worked on the development of detailed design plans for the Jackson Pike Co-Generation WWTP over the course of the program. It is estimated that the system will come online in June 2023.
- The Southerly Co-Generation WWTP project was postponed due to a digester expansion project. The preliminary design work at Southerly showed the digesters producing significantly less biogas than the digesters at Jackson Pike due to differences in the way the two plants operate their processes. DOP changed the way the WWTP operates its digesters as a trial, and early indicators are promising that biogas production may be dramatically increased, confirming the City's decision to delay co-generation at Southerly. This project remains on pause until 2026.

Impacts and Lessons Learned:

- The project team recently decided to use smaller genset engines due to considerations for gas fuel blending making the Jehbacher units a better option. The overall MWh estimates remain the same.
- Another lesson learned is that a CHP cogeneration system is really a large boiler more than it is an electrical generator. To improve project costs, the best time to install the system is when the large plant boilers need to be replaced.

Strategy 1.1.7 – Columbus Division of Power Hydroelectric Improvements

Program Highlights:

- Bulkhead installation of the O’Shaughnessy Dam Improvements project was completed at the site in June 2018. Work was performed to bring bulkheads to current design standards. There were two bulkheads, each consisting of four panels, which were removed and replaced. With new bulkheads in place, dewatering could commence, which would allow the project team to dismantle and inspect the turbines and generator.



- DOP completed the design phase of the O’Shaughnessy Dam Improvements Project, beginning design in 2018. The project is currently out for bid and the anticipated schedule is as follows:
 - November 2020: Notice to Proceed (NTP) expected
 - November 2022: Substantial completion (operational)
 - June 2023: Final completion

Impacts and Lessons Learned:

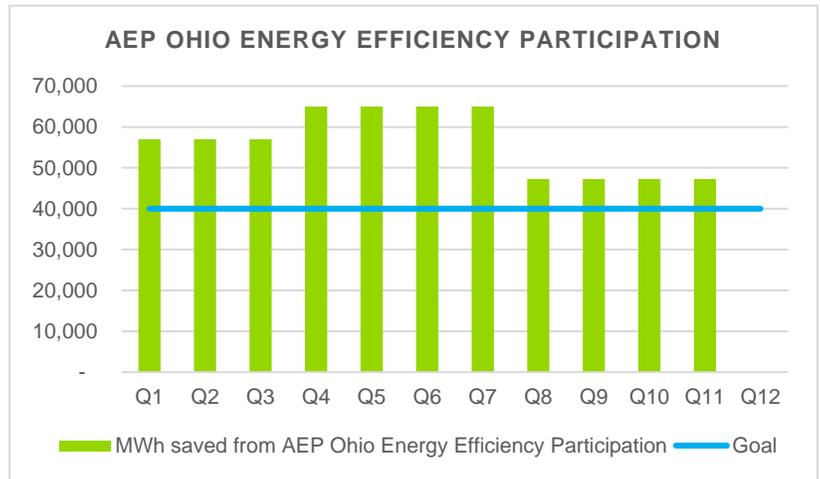
- It is anticipated that this hydroelectric plant will generate 10,000 MWh annually.
- The major lesson learned is to make sure that other cities hire engineers and contractors that have significant hydropower experience, especially with the type of turbines that exist in their facilities.

Initiative 1.2 – Grid Modernization and Efficiency

Strategy 1.2.1 – AEP Energy Efficiency

Program Highlights:

- AEP Ohio’s energy efficiency programs exceeded their goals during 2017, 2018 and 2019. 620,000 MWh were saved through the end of 2019, exceeding the goal of 440,000 MWh saved over the life of the program. Results for the period January 1, 2020 – March 31, 2020, will not be available until the annual compliance report is filed with the Public Utilities Commission in 2021.
- Six Columbus neighborhoods began participating in the [Community Energy Savers \(CES\) program](#): Franklinton, Linden, Hilltop, Milo-Grogan, near-East Side, and the University District/Italian Village. Three neighborhoods set goals to increase residents’ participation in energy efficiency, implemented their campaigns, and met their goals before March 31, 2020, as shown below.



COMMUNITY	GOAL	POINTS ACHIEVED	PARTICIPATIONS	PROJECT TYPE
Franklinton	100 points	102 points	88 Residents	Lighting upgrade at Franklinton Library
Linden	540 points	972 points	473 Residents; 2 Businesses	Installation of exterior lighting at Hamilton Stem School
Hilltop	1,000 points	1,013 points	600 Residents; 5 Businesses	Installation of exterior lighting at Wedgewood Middle School

Impacts and Lessons Learned:

- Commitments from neighborhoods to the CES Program took longer than anticipated. Timelines for the adoption of CES were lengthened to allow time for the community to fully engage.
- In a CES campaign, stakeholder engagement, including the city neighborhood manager, is very important.



Strategy 1.2.2 – AEP Smart City Vehicle to Home Research

Program Highlights:

- PUCO adopted a settlement agreement on April 25, 2018, to establish an electric security plan (ESP) for AEP Ohio through May 31, 2024. As part of the approval, funding of up to \$200,000 in total would be eligible for recovery for research and development to maintain the Smart City program for a four-year term.
- AEP Ohio did not conduct a vehicle-to-grid research project during the grant period. However, AEP Ohio conducted a small technical test with 10 local residential customers who participated in an EV charging demand response pilot. Three objectives were to learn about baseline charging behaviors, to determine whether the technical process was sustainable, and to assess potential demand reduction impacts. The small number of participating customers received a one-time recruitment incentive, a smart switch-enabled load controller and an incentive to participate in eight of 10 demand response events. The test ran from May through September 2019. There was a very small reduction in kW, but results have not been audited and will not be published.

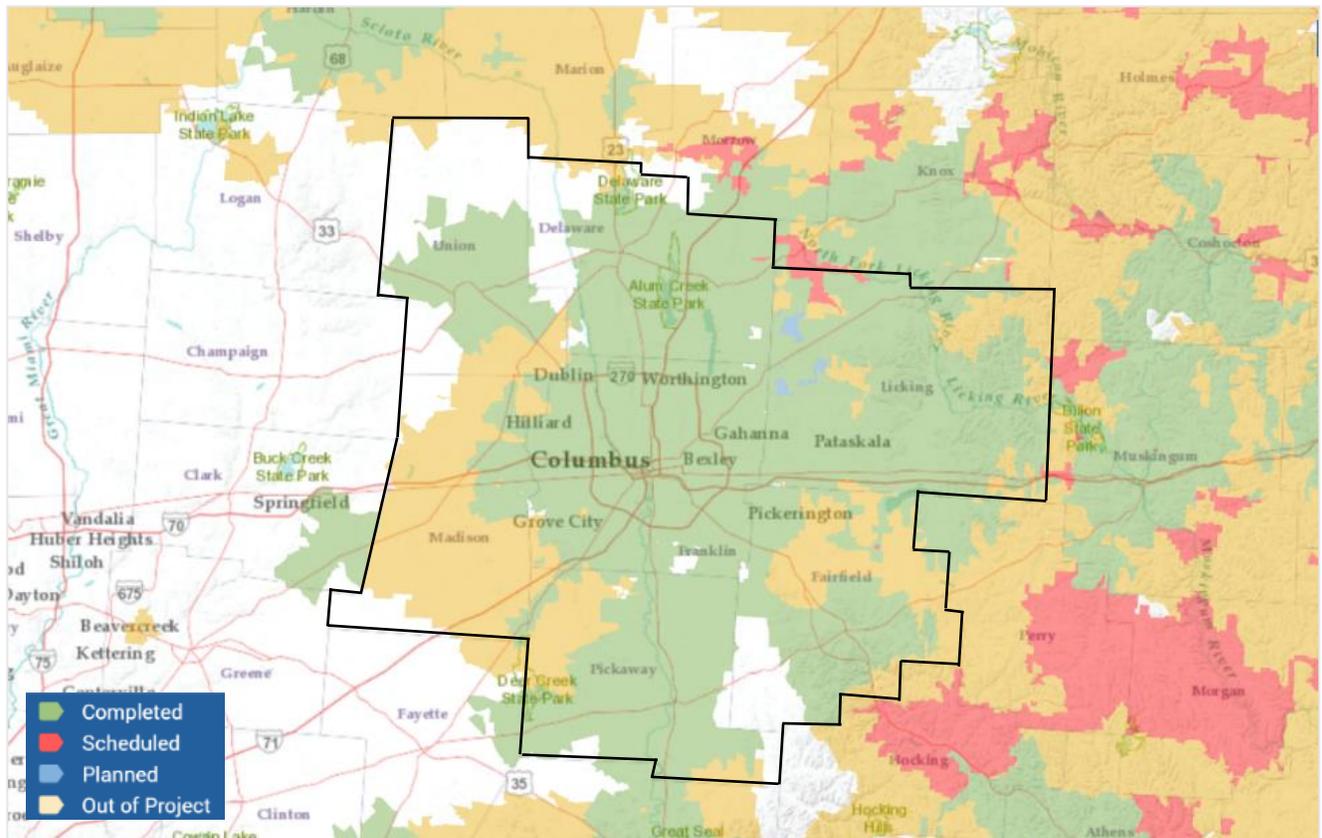
Impacts and Lessons Learned:

- The opportunities to learn about demand response through managed EV charging remain plentiful and may be explored more fully before the more complex subject of vehicle-to-grid charging.

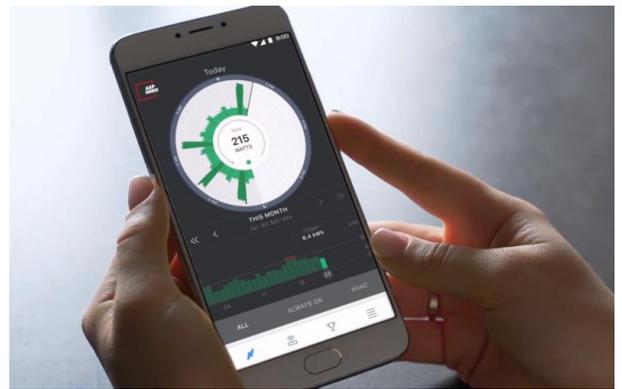
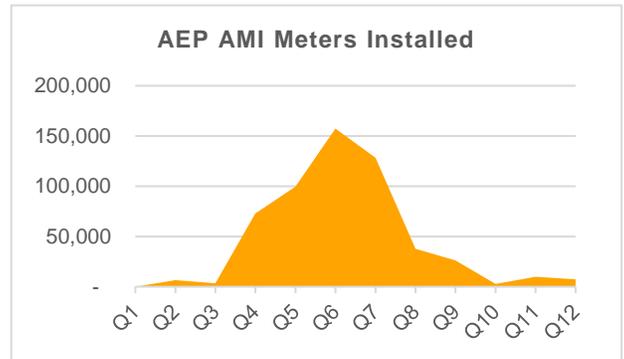
Strategy 1.2.3 – AEP gridSMART 2.0 Advanced Metering Infrastructure (AMI) Deployment

Program Highlights:

- AEP Ohio achieved 104% of its goal to install 528,000 AMI meters in the Smart Columbus footprint. More than 552,000 AMI meters were installed as of the end of the program, as shown on the map.



- With the AMI deployment throughout the seven-county region, AEP Ohio eliminated multiple meter reading and field credit and collections routes, resulting in reduced vehicle mileage equating the reduction of 165 MTCO₂ being released annually to the atmosphere.
- AMI meters support customers' use of real time information to better manage their energy use. Across the AEP Ohio service territory, about 11% of residential AMI customers have downloaded the free IT'S YOUR POWER smartphone app which gives customers tools to look at daily energy usage in 15 minute increments from the preceding day and historically at each day from the time their AMI meter was installed. Over 15,000 customers with the IT'S YOUR POWER app have also installed the energy bridge which displays electricity usage in real time and supports control over installed smart thermostats, switches and lights.



Impacts and Lessons Learned:

- Customers using the IT'S YOUR POWER mobile app along with the Energy Bridge and Thermostat are estimated to save nearly 4% of their annual energy usage and contribute to peak demand reduction.

Strategy 1.2.4 – AEP Microgrids and Battery Storage

Program Highlights:

- PUCO adopted a settlement agreement on April 25, 2018, to establish an ESP for AEP Ohio through May 31, 2024. As part of the PUCO approval of AEP Ohio's ESP filing, funding of up to \$10.5 million for microgrid demonstration projects will be available. <https://www.puco.ohio.gov/media-room/media-releases/puco-adopts-settlement-agreement-in-aep-ohio-electric-security-plan/>
- AEP Ohio released a Request for Proposal (RFP) for engineering, procurement and construction consultants to propose microgrid demonstration projects.
- AEP Ohio selected four microgrid projects, three of which are in the Smart Columbus footprint. Of those three, one was slated to begin construction in March 2020 but the Ohio Stay-at-Home order caused delay. Once construction begins, completion is anticipated within about six weeks. The other projects in the Smart Columbus footprints have anticipated completion dates in the second quarter of 2021.

Impacts and Lessons Learned:

- Time required for the bidding and contracting processes, along with engineering and equipment specifications and testing add significant time, which should be reflected in initial planning and projections.

Strategy 1.2.5 – AEP Smart Lighting

Program Highlights:

- AEP Ohio began conducting three small smart street lighting pilots in late 2019. A total of 187 LED street lights were installed in the cities of New Albany, Lima and Canton in Q11, 27 of which are in New Albany, which is a community within the Smart Columbus seven-county region. Each of the new fixtures have smart control modules (photocells) installed. Each module connects these fixtures through a mesh network that monitors and communicates things such as the location and working status of the fixture, meters and communicates the kWh consumption, and communicates alerts to identify if any service is needed.
- From November 2019 through March 31, 2020, the savings from the lights would be 7,269 kWh or about 59% for that five-month period.

Impacts and Lessons Learned:

- Determining the right technology that will satisfy most of your customers is important. Start with small pilot communities and customers that have expressed interest in the pilot before any type of large scale roll out.

Strategy 1.2.6 – Columbus Division of Power Grid Modernization (AMI)

Program Highlights:

- DOP released an RFP for their AMI project in December 2018 and selected a vendor to perform the work. The project will consist of the implementation of an AMI system to provide meter readings from water, sewer and power meters. The project will include the supply and installation of power meters, the installation of city-issued water meters, and all software required to operate the system and interface with the City of Columbus' systems and applications.
- DOP work is anticipated to start in late 2020 and likely go through part (or all) of 2021.
- The vendor is responsible for purchasing the meters, inventory and installing.

Impacts and Lessons Learned:

- The water portion of the project will be funded out of an Ohio EPA loan and the power portion will be funded from DOP's operating budget.
- DOP's funding will be broken into two years: 2020 and 2021.
- The AMI project is a huge undertaking that involves a great deal of coordination. The city hired an experienced consultant that understands the challenges associated with implementing AMI and Automated Meter Reading (AMR) technologies. This consultant has helped to develop the RFP and technical specifications, and also assisted with RFP proposal reviews and will serve as an assistant to DOP's internal Project Manager throughout the program.
- It takes a significant amount of time to negotiate the contract with the vendor once they have been selected. Expect this to take several months before the contract can be executed.

Strategy 1.2.7 – Columbus Division of Power Street Light Technology Conversion

Program Highlights:

- DOP drafted a *Smart Streetlighting Deployment Plan* in early 2020, prioritizing the implementation of LEDs and smart technologies in 20 phases across the city’s 58,246 luminaires and 823 street lighting circuits.
- RFP for Smart Streetlighting Control System and Communication Network: The City of Columbus is requesting proposals for the implementation of a Columbus Smart Street Lighting System. This system will include features such as: remote monitoring of individual street lights for outages; remote changes in time of operation; and dimming of fixtures by time of day or sensors. The system will accommodate the incorporation of other future smart city applications, such as traffic counters, gunshot detection, environmental sensors, etc. The system will connect to the city’s fiber optic communication network for interagency data exchange. The project will establish an IP based communications network that will allow the city to remotely monitor and control the updated street lighting network and other potential agency smart device operations from their appropriate facilities.
- Construction of luminaire conversion to LED and communications infrastructure upgrades for the Linden area will be bid out in the summer of 2020.

Impacts and Lessons Learned:

- The DOP anticipated utilizing the Ohio Energy Loan Fund as a low interest financing mechanism for the street light conversion project. After further investigation, it was determined that the loan would be administratively cumbersome and would not fully meet the needs of the division. The DOP determined that it would be more beneficial to use capital funds for the LED street light conversion project.
- GHG savings from converting the entire streetlight system to LED fixtures are summarized in the table below. Equivalent terms of home energy usage, gallons of gasoline consumed and passenger vehicles driven in one year as well as other equivalency information can be found at <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>.

GHG SAVINGS FOR LED CONVERSION	
Average GHG Savings (MTCO ₂ /yr) per phase	620
Estimated GHG Savings at completion (MTCO ₂ /yr)	13,000
GHG reduction	56%
Equivalent to the following (per year):	
 <p>1,865 homes' energy use for one year</p>	 <p>1,752,395 gallons of gasoline consumed</p>
 <p>3,306 Passenger vehicles driven for one year</p>	

PRIORITY 2 – FLEET ELECTRIC VEHICLE ADOPTION

Objective: Work with public, private and academic sectors to place in operation 755 EVs into their fleets by the end of the grant period.

Goal Progress:

PRIORITY INDICATORS	GOAL	LIFE OF PROGRAM PROGRESS
2.1 Public Fleet EV Purchases	265	255
2.2 Private Fleet EV Purchases	450	36
2.3 Transportation Service Provider EV Purchases	40	22
TOTAL FLEET PURCHASES	755	313

Program Highlights:

255
 PUBLIC FLEET EV
 PURCHASES, INCLUDING
 200 FROM THE CITY
 OF COLUMBUS



36 PRIVATE FLEET EV PURCHASES

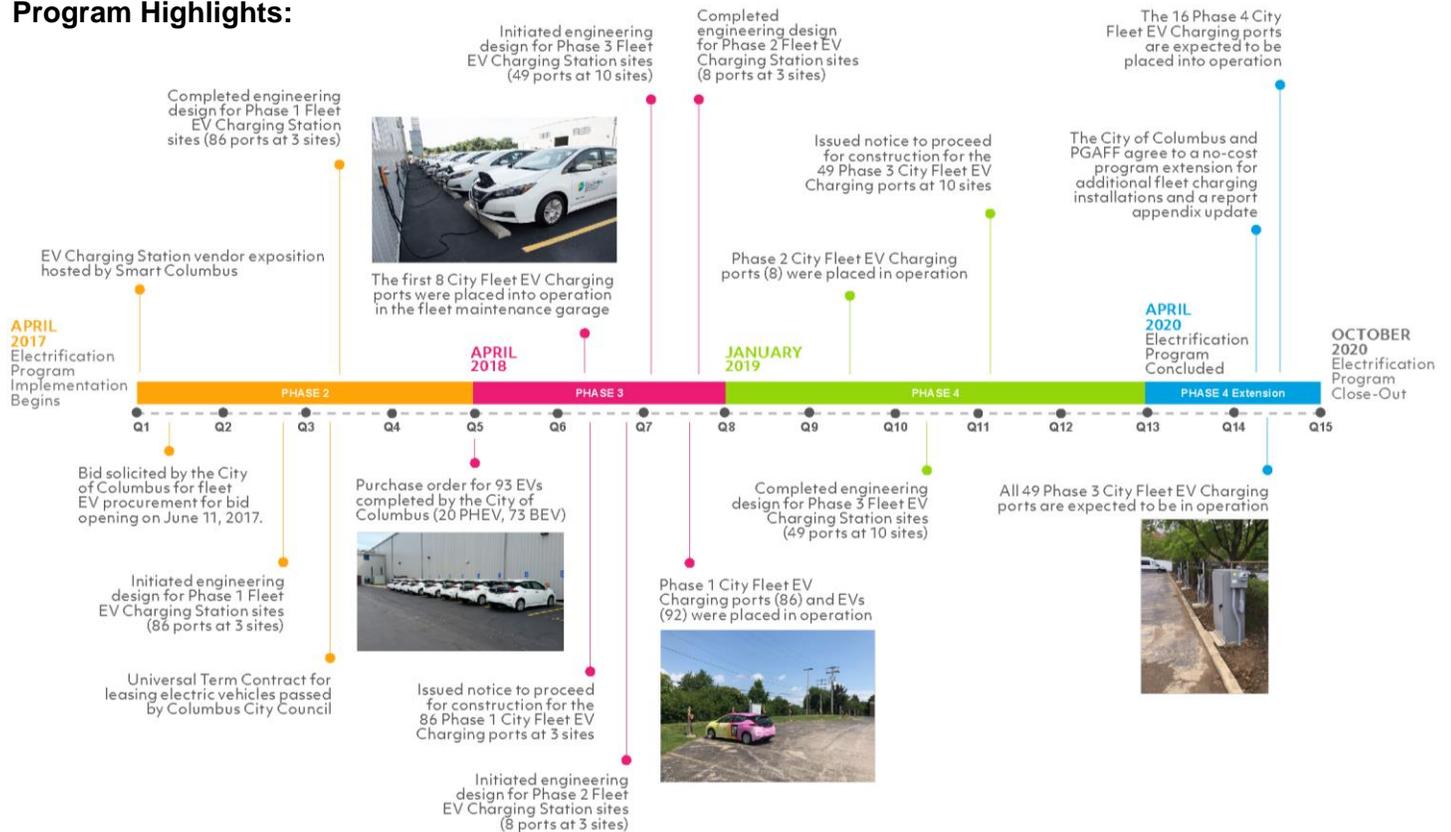
22
 EVS PURCHASED BY
 TRANSPORTATION SERVICE
 PROVIDERS

440,282
 EV MILES DRIVEN BY
 TRANSPORTATION SERVICE
 PROVIDERS



Initiative 2.1 – Public Fleets

Program Highlights:



- Outreach & Education:** Over the three-year project performance period, program staff conducted a wide range of outreach and educational activities to fleets in the seven-county central Ohio region. Outreach included mass emails, newsletters, earned media, social media, and direct contacts via phone calls and face-to-face networking. Educational activities including individual and small group meetings, webinars, group meetings, workshops, presentations to large meetings, and educational sessions at conferences and association events. *See Strategy 2.1.1 for more detail.*
- Technical Assistance:** Program staff worked to provide a diverse set of technical assistance resources to public fleets, including:

 - Analysis and planning assistance to help fleets assess the operational, financial, and environmental performance, cost, and benefits of EVs and charging infrastructure;
 - Informational resources and direct connections to peer fleets with experience and success in operating EVs and EVSE;
 - Showcases, test drives, and demonstrations of various commercially available EV and EVSE products to gain real-world experience and confidence for purchasing decisions;
 - Educational resources and streamlined opportunities for spec'ing, bidding & buying vehicles;
 - Innovative leasing solutions developed by Mike Albert Leasing and the City of Columbus allowing public fleets to garner additional savings and discounts on EV purchases; and
 - Assistance in applying for grant and incentive opportunities available throughout the program.

- Fleet Adoption:** The outreach, education, and technical assistance through this project resulted in 11 public fleets adopting 255 EVs utilizing grant incentive funding (up to \$3,000 per vehicle) throughout the performance period of this project, as shown in the following table. The City of Columbus led the way on this effort, purchasing 200 fleet EVs for 18 different City divisions. See Appendix D for a breakdown of all City of Columbus fleet EVs purchased and the assigned divisions.



FIRM OR MUNICIPALITY	PHEV	BEV	TOTAL
City of Columbus	89	111	200
Columbus Regional Airport Authority (CRAA)	2	-	2
Mid-Ohio Regional Planning Commission (MORPC)	-	2	2
City of Hilliard	-	2	2
City of Dublin	-	10	10
Franklin County	17	-	17
The Ohio State University (OSU)	4	11	15
City of Westerville	-	2	2
City of Whitehall	-	2	2
Franklin County Engineer	1	1	2
City of New Albany	-	1	1
TOTAL	113	142	255

- For more information on considerations for Public Fleet EV Adoption, visit <https://smart.columbus.gov/playbook-assets/electric-vehicle-fleet-adoption/public-ev-adoption-6-things-to-consider>.
- Smart Columbus developed a fleet telematics and charging data dashboard analyzing a subset of the City of Columbus fleet EVs and chargers. This data subset includes approximately one year's worth of data for 88 EVs and their 12 charging locations with 109 charging ports. See the link to explore the dashboard: [City of Columbus Fleet Telematics and Charging Data Snapshot](#).

- **Economic Savings:** Using data from the OSU Environment, Economy Development and Sustainability (EEDS) Capstone Project titled City of Columbus EV Fleet Adoption Analysis, each city fleet BEV saves approximately between \$831 to \$2,617 per year in combined maintenance and fuel costs. With 111 BEVs purchased, the City of Columbus may see approximate savings of \$92,000 to \$290,000 per year in fuel and maintenance costs. The range in savings comes from assumptions regarding vehicle type replacement (sedan vs SUV), vehicle type maintenance, and unit fuel costs for gas and electric. The trade-off to these maintenance and fuel costs savings are the current capital costs of purchasing an EV. Although these prices are coming down due to lower battery prices and there are often incentives, there are still a few situations where an ICE vehicle's total cost of ownership can be similar to an EV, especially in lower mileage situations with low gas prices. This capstone project analyzes these costs and provides insightful considerations for city fleet EV adoption moving forward.

For more information regarding the OSU EEDS Capstone Projects on the Smart Columbus Programs, visit <https://smart.columbus.gov/playbook-assets/osu-students-present-capstones-on-smart-columbus-programs>.

For the OSU EEDS Capstone Project titled City of Columbus EV Fleet Adoption Analysis, visit https://d3hzplpmmz6qe4.cloudfront.net/2019-06/City%20of%20Columbus%20Electric%20Vehicle%20Fleet%20Adoption%20Analysis_0.pdf.

- **Environmental Impacts:** The 255 public fleet EVs purchased throughout this program produced GHG emissions reductions of 655 MTCO₂ during the program. Using the [EPA Greenhouse Gas Equivalencies Calculator](#), this savings is equivalent to taking 142 passenger ICE vehicles off of the road for a year, the electricity used by 111 homes for a year, or the carbon sequestered by 855 acres of U.S. forests in one year.

Impacts and Lessons Learned:

Public fleets have the ability to lead the way in fleet EV adoption. However, public fleets are constrained by a number of factors, including:

- **Vehicle Model Availability:** During the performance period of this project, public fleet adoption was constrained by EV model availability and largely limited to passenger sedans. Nearly all the EVs adopted by public fleets in this project were sedans. These EV passenger sedans offer public fleets opportunities to electrify operations such as pool vehicles, supervisory vehicles, and various services such as meter readers, inspectors, and enforcement. However, majority of most public fleet vehicles and fuel use are represented by vocational vehicles such as ½ ton pickup trucks, utility vans, and a variety of medium and heavy-duty work trucks. The lack of any OEM EV pickups, vans, or vocational trucks significantly limited public fleet adoption to a small subset of sedans in any given fleet.
- **Operational Performance:** While EVs have and are making significant progress in improving range, operational performance, and charge times, these factors still further limit the number of eligible vehicles for EV replacement in any given public fleet. Many fleets are looking at ways to minimize the total number of vehicles in their fleets by sharing and maximizing vehicle uses. EVs are still limited by the combination of usually less range than an ICE vehicle and longer times for charging versus fueling. While vehicles can be spec'd with larger batteries to provide more range or fast charging to provide quicker "fueling" - these factors often add significant cost to vehicles. Therefore, the selection of fleet vehicles eligible for replacement with EVs is constrained by these operational performance

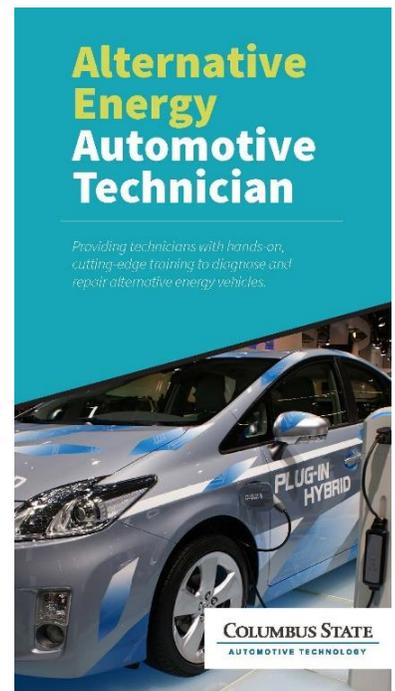
factors. However, all indicators are that these problems will be eliminated in the medium term with innovations, cost savings, and new EV and EVSE technologies coming to market in the next 5-10 years.

- **Fleet Replacement Cycle:** The national average for fleet vehicle replacement is ~7% of inventory. This means that fleets are further constrained by the overall quantity of vehicles they plan to replace in any given year. Even if fleets are fully committed to electrification, they are limited by the sheer number and specific vehicles eligible for replacement in any given year.
- **Capital Budget Cycle:** While not answering to profit motive and shareholder value, public fleets are sensitive to capital budget constraints, both limited by revenue and by optics of fiscal responsibility for any purchase. While EVs have significantly lower total cost of ownership when compared to conventional vehicles, their often higher upfront cost can lead to additional limitations when fleets seek to adopt EVs.
- **Warranty & Service Terms:** Most public fleets are accustomed to robust OEM warranties and to servicing their own vehicle assets. Many of the EV sedans available for purchase during this project performance period were primarily geared to the individual consumer market, with warranties and dealer servicing models built for those end users. EV OEMs and dealerships are evolving to better reflect the needs and operations of fleets in their warranty and service arrangements.
- **Leasing & Financing:** The City executed an innovative hybrid lease-buy contract for procurement under a Universal Term Contract that could also be used for other public entities. The contract captured half of the federal EV tax credit, resulting in a large savings for the City.
- **EVSE Availability:** Lining up fleet procurement schedules with EV infrastructure installations requires vehicle procurement plans to be developed well ahead of charging projects due to project lengths. From the fleet procurement side, additional consideration for PHEVs to allow for additional charging flexibility and model options (Kia Niro, e.g.).
- **Data Gathering:** Confirm early in the process with potential fleets telematics availability and communicate data requirements clearly. City of Columbus divisions could choose whether they wanted to include telematics (GPS) in their vehicles. As of July 2020, 111 out of 133 EVs have a GPS unit.
- For more information on EV Fleet Transitions, visit <https://smart.columbus.gov/playbook-assets/electric-vehicle-fleet-adoption/ev-fleet-transition--what-to-consider>

Strategy 2.1.1 – Training and Technical Assistance Workshops

Program Highlights:

- Conducted a wide range of outreach and educational activities to fleets in the seven-county central Ohio region. In particular, the Smart Columbus program was featured at larger events hosted by MORPC, at regular meetings held by the Ohio Municipal Equipment Maintenance Association, in presentations at the National Truck Equipment Association Green Truck Summit and featured annually in sessions of Clean Fuels Ohio's Midwest Green Transportation Forum & Expo.
- Columbus State Community College (CSCC) provided partnership in the development and implementation of a series of in-depth, technical automotive trainings. CSCC began the three college-level classes in October 2018. The classes were available at a greatly reduced rate to all Municipal Equipment Maintenance Association-OH members (i.e., other public fleets). The City of Columbus formally trained eight EV service technicians through these classes. CSCC continues to offer these courses to both undergrads and as evening courses to supplement training for working technicians.
 - AUTO 2190 - Hybrid Vehicles: Theory and Operation: Presents the theory and operation of hybrid vehicles. This is an informative course designed to provide a general overview of various hybrid vehicle systems. Proper safety precautions and procedures needed to service the basic systems of hybrid vehicles will be discussed.
 - AUTO 2391 - Advanced Alternative Fueled Vehicles: Diagnosis and Repair: Builds on the fundamentals of automotive engine performance and electrical systems building on the information and skills obtained in AUTO 2360/2380. Compressed natural gas, propane, bio-fuel, hydrogen and other alternative fueled vehicles will be explored. System safety, diagnosis, live car servicing and various manufacture's systems are explored through lecture and lab activities.
 - AUTO 2390 - Advanced Hybrid Vehicles: Diagnosis and Repair: This course builds on the fundamentals covered in AUTO 2190 Hybrid Vehicles Theory and Operation. The emphasis of this course will focus on high voltage systems: safety, service, diagnosis and repair. This course is designed to complement the knowledge learned in AUTO 2190, 2280 and 2360 to prepare student to pass the ASE Light Duty Hybrid/EV Specialist Test (L3).



Impacts and Lessons Learned:

- Technician Training and the availability of qualified EV service technicians remains one of the biggest technical barriers for public fleet adoption of EVs. Since many public fleets service and maintain their vehicles "in-house," it is crucial for more training programs such as the CSCC technical college training program be available to train new and working technicians to service EVs.

Initiative 2.2 – Private Fleets

Program Highlights:

- Outreach and Engagement:** Smart Columbus staff conducted deep focus on private fleet engagement over the program’s three-year performance period, garnering specific buy-in and collaboration with Accelerator Partner fleets, Columbus Partnership members, Columbus Region Logistics Council members, and dedicated outreach to more than 200 local and regional organizations and companies with listed private fleet vehicles. Outreach was conducted through a variety of means, including: email, direct phone call, webinar educational series, hosted EV and fleet events, and other coordinated outreach with network organizations.
- EZ EV Fleet Suitability Analysis:** In order to assist organizations with identifying the best fit for EVs within fleet operations for cost and emissions savings, the Electrification Coalition sought partnership with Sawatch Labs to conduct a telematics-based fleet assessment with 45 candidate fleets. By capturing normal fleet operation on a representative sample of fleet vehicles over a period of time, fleet analyses was able to yield specific make and model recommendations for EVs that would be most suited for operation, considering various factors of route characteristics, charging need, and vehicle performance. Fleet analyses were provided for free to candidate organizations, as part of broader private fleet engagement and outreach.

OhioHealth Fleet Evaluation



SUMMARY

Smart Columbus established an initiative to transition 450 non-municipal vehicles to battery electric (BEV) and plug-in hybrid electric vehicles (PHEV) in 201X. OhioHealth has stepped forward as an early participant in this initiative. OhioHealth installed telematics onboard diagnostics on their Nissan Rogues. The operational data for each vehicle was provided to the Electrification Coalition team for analysis by Sawatch Labs. An electric vehicle suitability analysis (EVSA) was completed for each of the vehicles. Many of OhioHealth’s vehicles are excellent candidates for replacement with an EV in the near-term.

RECOMMENDED VEHICLE

NET SAVINGS
\$4,487

OPERATIONAL SAVINGS
\$16,827

COST/MILE → EV COST/MILE
\$0.42 → \$0.36



NISSAN LEAF BEV



SUITABILITY SCORE EXPLANATION

84	96	74	76	100
OVERALL <small>Confidence that a vehicle is well suited for an EV replacement.</small>	ENERGY USE <small>How often could you rely on a single daily charge?</small>	SPEED <small>More time driven at lower speeds increases your score.</small>	ECONOMICS <small>Will you save money by switching to an EV?</small>	CONFIDENCE <small>Do we have enough data to feel confident in our scores?</small>

*Above suitability scores are exploratory in nature and do not represent any OhioHealth Fleet vehicles.



ALTERNATIVE RECOMMENDATIONS

<div style="border: 1px solid #0070c0; padding: 5px; margin-bottom: 10px;"> <p>NET SAVINGS \$5,439</p> <p>OPERATIONAL SAVINGS \$24,199</p> <p>COST/MILE → EV COST/MILE \$0.32 → \$0.28</p> </div>  <p style="writing-mode: vertical-rl; transform: rotate(180deg);">CHEVY BOLT BEV</p> 	<div style="border: 1px solid #0070c0; padding: 5px; margin-bottom: 10px;"> <p>NET SAVINGS \$6,991</p> <p>OPERATIONAL SAVINGS \$28,631</p> <p>COST/MILE → EV COST/MILE \$0.39 → \$0.33</p> </div>  <p style="writing-mode: vertical-rl; transform: rotate(180deg);">CHRYSLER PACIFICA PHEV</p> 
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Impacts and Lessons Learned:

- **Identifying Light-Duty Fleet:** While an initial set of companies had pledged to electrify portions of their fleet at the launch of the program, many of these organizations had neither set aside budget allocation for vehicle purchasing, nor had any specific procurement strategy in place outside of replacing vehicles once maintenance and upkeep costs became too much for continued operation. In this way, many organizations had to start at more basic fleet planning discussions, requiring longer engagement and support from Smart Columbus staff in order to garner fleet commitment and eventual EV fleet deployment. Fleet telematics, for instance, were found to be less deployed than the original program hypothesis, which required further education of organizations to best practices in fleet management, beyond simple vehicle electrification commitment and analysis.
- **EV Model Availability:** While a vast majority of the current EV market is concentrated on light-duty vehicles, much of the fleet space is comprised of medium and heavy-duty vehicle deployment. This meant that relatively few vehicles within each respective fleet had an eligible EV option for replacement, and required engagement of more companies/organizations to build out the program's light-duty fleet commitment.
- **National vs. Regional Fleet Presence:** Many regional and national organizations that were engaged in the program had relatively light Central Ohio fleet deployment, comprised of a nationally dispersed fleet. In this way, while the original hypothesis of change was to build commitment from large, national brands headquartered in central Ohio; a larger percentage of smaller organizations with local/central Ohio-concentrated fleets were committed to electrification by the end of the program.
- **Fleet Data Baseline and Analysis is Key:** Conducting an analysis of fleet, such as through the EV Suitability Assessment, is critical to identify and unlock cost and emission saving potential of fleet electrification. Without consideration of daily drive cycles and vehicle miles traveled, for instance, to build out a baseline of operational performance and costs; electrification of fleet is very difficult to quantify for exact savings earned.
- For more information, view the article on Lessons Learned in Private Fleet Electrification: <https://smart.columbus.gov/playbook-asset/electric-vehicle-ev-fleet-adoption/challenges-and-future-of-fleet-adoption>.



Strategy 2.2.1 – Secure Purchase Pledges

Program Highlights:

- 225 fleet vehicle electrification commitments garnered across 38 companies, with 36 EV purchases throughout the program.
- 13 companies created procurement plans, integrating fleet electrification, with support from Smart Columbus program staff.

Impacts and Lessons Learned:

- Fleet procurement cycles happen on a rolling basis, with different organizations and companies operating on various budget and procurement cycles. In addition, planning for fleet electrification was found to be most effective when staged at least one, if not two, budget cycles out, in order to allow for sufficient discussion and decision-making to allocate additional fleet funds for procurement.

Strategy 2.2.2 – Network Development

Program Highlights:

- Smart Columbus staff presented and attended at variety of fleet-focused conferences and events, including the Midwest Green Fleet Forum, Work Truck Show, NAFA Fleet Expo, Advanced Clean Transportation (ACT) Expo, and other regional events including fleet attendance.



- Created and leveraged partnership with Columbus Region Logistics Council, Columbus Chamber of Commerce, Grandview Chamber of Commerce, Whitehall Chamber of Commerce, Licking County Chamber of Commerce, Fairfield County Chamber of Commerce, Upper Arlington Chamber of Commerce, and Hilliard Chamber of Commerce for soliciting fleet interest and engagement.

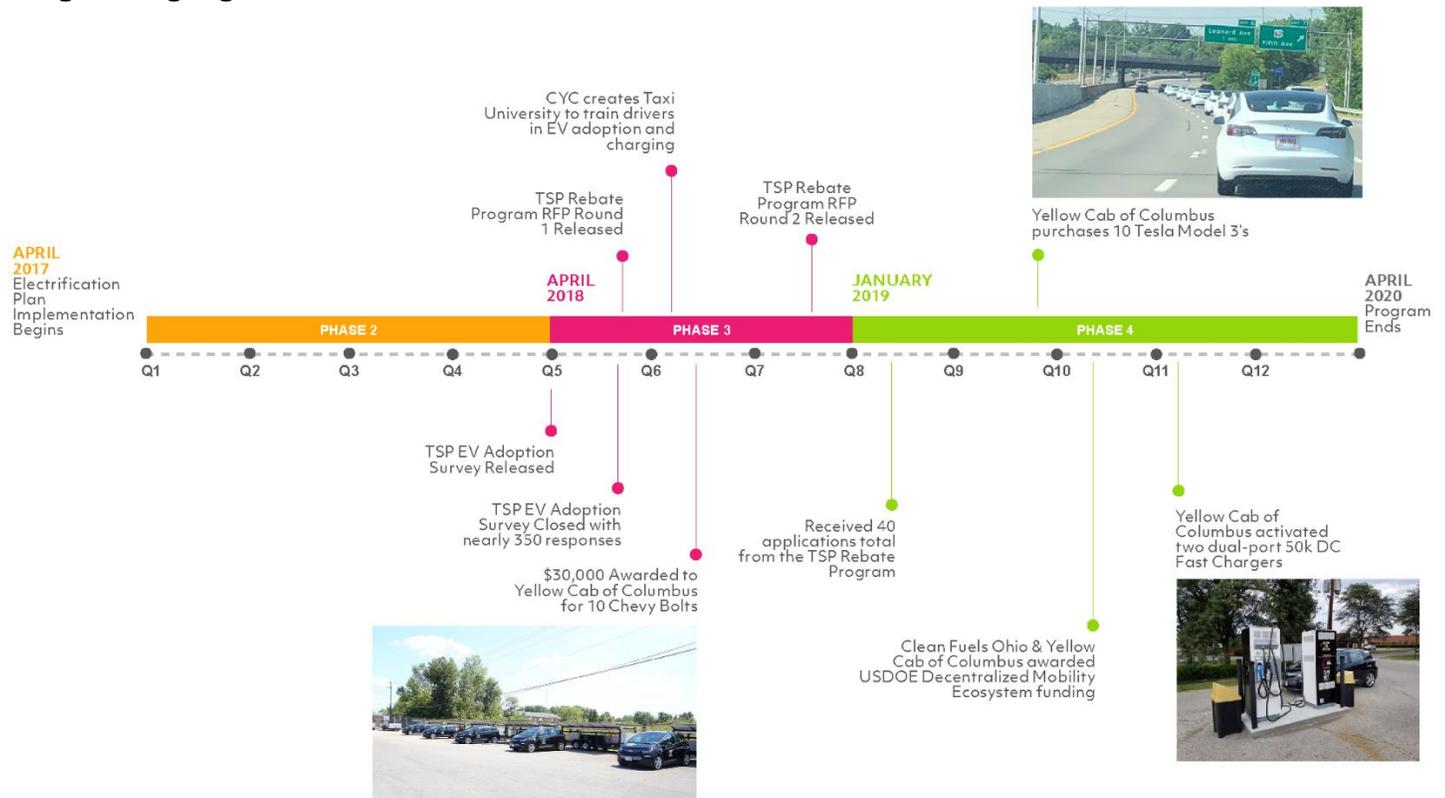


Impacts and Lessons Learned:

- Membership-driven organizations, such as Chambers of Commerce, can provide a meaningful link to identify private fleets and organizations that would otherwise be difficult to identify as having prospective fleet operation.

Initiative 2.3 – Transportation Service Providers (TSPs)

Program Highlights:



- The Smart Columbus team conducted outreach and data gathering through a web-based Taxi and TSP Electric Vehicle Survey designed to gather information on levels of interest, barriers and incentives needed to spur TSP EV adoption throughout central Ohio. Smart Columbus worked with Yellow Cab of Columbus, Uber and Lyft to distribute this survey among its seven-county central Ohio drivers. Nearly 350 TSP drivers took the survey.
- Smart Columbus created the TSP rebate program RFP, with the first round of \$30,000 focused on traditional TSPs. This rebate program was launched in June 2018 to help incentivize the purchase of additional TSP vehicles in the seven-county central Ohio region. Ten rebates of \$3,000 were available to TSPs that purchase an all-electric vehicle for their fleet who could successfully demonstrate that they would maximize EV miles driven, trips taken and number of passengers per trip. Round 1 was awarded to Yellow Cab of Columbus, Central Ohio’s largest taxi fleet, who purchased 10 Chevy Bolts. For more information on Columbus Yellow Cab fleet electrification, visit <https://smart.columbus.gov/playbook-assets/electric-vehicle-fleet-adoption/case-study--columbus-yellow-cab-fleet-electrification>.
- Round 2 was designed to offer rebates to both traditional taxi service providers and drivers for Transportation Network Companies (TNCs), such as Uber and Lyft, to spur TSP EV adoption throughout central Ohio. Awards were given to both Yellow Cab of Columbus and TNC drivers, as displayed in the table below. Overall, this project resulted in 22 EVs adopted in transportation service operations, driving over 440,000 miles while transporting 49,238 passengers. This represents ~1.5

years of operations, with EVs expected to operate for at least three more years, with mileage and service levels expected to increase.

TSP EVS PURCHASED				
Firm or Driver	Quantity Purchased	Model	Miles Driven	Number of Passengers
TSP Rebate Round I				
Yellow Cab of Columbus (Taxi)	10	2018 Chevy Bolt	165,019	13,147
TSP Rebate Round II				
Justin Eckard (TNC Driver)	1	N/A	N/A	N/A
Eric Kasper (TNC Driver)	1	Tesla Model 3	12,000	1,925
Yellow Cab of Columbus (Taxi)	10	Tesla Model 3	263,263	34,166
TOTAL	22		440,282	49,238

- Yellow Cab of Columbus operated two DC Fast Chargers and four Level 2 chargers at their headquarters to support their EV fleet.

- **Economic Savings:** Using data from the OSU EEDS Capstone Project titled Fuel Source Impacts on Greenhouse Gas Emission Reduction by EVs, each Yellow Cab of Columbus fleet BEV saves approximately \$748 to \$5,920 per year in combined maintenance and fuel costs. With 20 BEVs, Yellow Cab of Columbus may see approximate savings of \$14,960 to \$118,400 per year in fuel and maintenance costs. The range in savings comes from assumptions regarding vehicle type replacement (Prius vs Crown Victoria), vehicle type maintenance, and unit fuel costs for gas and electric. The trade-off to these maintenance and fuel costs savings are the current capital costs of purchasing an EV. Although these prices are coming down due to lower battery prices and incentives, there is often not enough cost savings to warrant an entire fleet replacement up front, especially for ICE vehicles still early in their lifecycle. This capstone project analyzes these costs and provides insightful considerations for TSP fleet EV adoption for Yellow Cab of Columbus moving forward.



For the OSU EEDS Capstone Project titled Fuel Source Impacts on Greenhouse Gas Emission Reduction by EVs, visit https://d3hzplpmmz6qe4.cloudfront.net/2019-06/Fuel%20Source%20Impacts%20on%20Greenhouse%20Gas%20Emission%20Reduction%20by%20Electric%20Vehicles_0.pdf.

- **Environmental Impacts:** The 22 TSP fleet EVs produced GHG emissions reductions of 66 MTCO₂ during the program. Using the [EPA Greenhouse Gas Equivalencies Calculator](#), this savings is equivalent to taking 14 passenger ICE vehicles off of the road for a year, the electricity used by 11 homes for a year, or the carbon sequestered by 86 acres of U.S. forests in one year.

Impacts and Lessons Learned:

- While EVs offer great potential for economic, energy security, and sustainability benefits, transportation services fleets (taxi, TNCs, and car sharing services, etc.) have not identified a business model to minimize financial and operational risks for users while maximizing vehicle usage and return on investment (ROI) for the financial viability of owners. Each of the different transportation service provider models have implicit structural barriers that make vehicle electrification a challenge.
- The following table provides a summary of these structural challenges faced by transportation service/mobility as service providers:

STRUCTURAL BARRIERS TO TRANSPORTATION SERVICE PROVIDER ELECTRIFICATION		
Type of Service Provider	Assets Ownership Model	Key Electrification Barrier
Traditional Taxi Fleet	Central Fleet Ownership and Centralized Vehicle Hub	Central hub doesn't facilitate needed EVSE network; central hub & spoke model limits range and driver profit
Taxi Owner-Operator Franchise	Individual Owners in franchise model; owners park vehicles at residences	Individual Owners unwilling to take on financial risks of EV and EVSE.
Transportation Network Company	Individual Owners operating under a single app-based platform	Individual Owners unwilling to take on financial risks of EV and EVSE.
Car-Sharing Service	Central fleet ownership; distributed vehicle hubs	Limited vehicle utilization (personal use) prevents ROI for EV & EVSE.
Car Rental Company	Central fleet ownership; distributed vehicle hubs	Primary use longer range travel; no core ROI for local EVSE investment.

- To address these barriers, Yellow Cab of Columbus partnered with Clean Fuels Ohio to apply for USDOE funding on June 19, 2019, and was awarded \$670,000 in federal funding to implement the following project from January 2020 – December 2022:

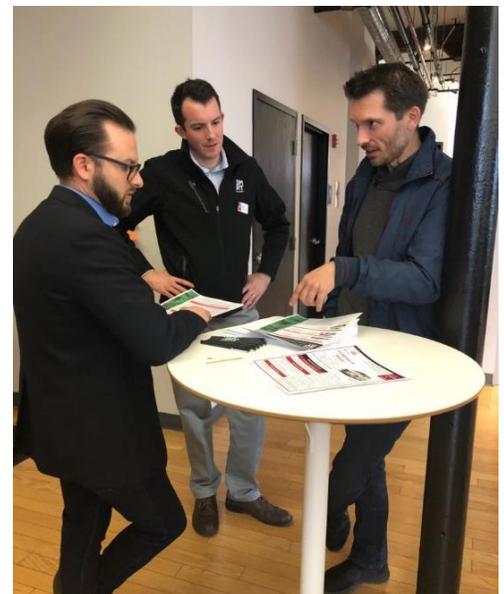
- **USDOE Decentralized Mobility Ecosystem** – Working with Columbus Yellow Cab to pilot a decentralized EV fleet throughout Columbus allowing EVs to be used by traditional taxi drivers, TNCs, on-demand delivery drivers, and for car-sharing applications – maximizing utilization and ROI and providing a competitive business model for other to scale and replicate nationwide.
- This project is designed to provide proven pathways to overcome these barriers with innovative solutions and impactful models for replication. The Decentralized Mobility Ecosystem project will deploy EV mobility hubs to provide solutions to minimize financial risks of EV usage for drivers (both personal and professional), while strategically locating mobility hubs to maximize EV utilization across all possible use cases (taxi, TNC, delivery, car-sharing). This innovative project is designed to demonstrate solutions to the main barriers to vehicle electrification in the mobility and transportation services sectors, enable replication, and scale nationwide.



Strategy 2.3.1 – Recruit TSP Partners

Program Highlights:

- Conducted a wide range of outreach and educational activities to taxi fleets and TNC operators in the seven-county central Ohio region. Outreach included mass emails, newsletters, earned media, social media, and direct contacts via phone calls and face to face networking. Educational activities included individual and small group meetings, webinars, group meetings, workshops, presentations to large meetings, and educational sessions at conferences and association events.
- Provided a diverse set of technical assistance resources to taxi fleets and TNC operators, including:
 - Analysis and planning assistance to help fleets assess the operational, financial, and environmental performance, cost, and benefits of EVs and charging infrastructure;
 - Informational resources and direct connections to peer fleets with experience and success in operating EVs and EVSE;
 - Showcases, test drives, and demonstrations of various commercially available EV and EVSE products to gain real-world experience and confidence for purchasing decisions;
 - Educational resources and streamlined opportunities to for spec'ing, bidding and buying vehicles; and
 - Assistance in applying for rebate and incentive opportunities available throughout the project period.



Impacts and Lessons Learned:

- Direct engagement with local managers, such as Yellow Cab of Columbus, yielded the greatest progress towards EV adoption by TSPs. Small incentives and public charging helped spur additional adoption.
- Coordinating with TNC companies, such as Uber and Lyft, for incentives was more difficult than expected. TNCs did not have the operational staff capacity locally to facilitate any incentive administration (with no plans to hire staff) and saw complications administering any vehicle-based incentives. Since most TNC drivers utilize multiple platforms (i.e. drive for both Uber and Lyft with the same vehicle), TNC companies did not see a pathway to administering any vehicle-based incentives because it would force coordination with competitors to gather the types of verification and usage data the Smart Columbus TSP program envisioned. A neutral third-party administrator, such as Smart Columbus, was recommended to coordinate any vehicle-based incentives with drivers across multiple TNC platforms. Because of this, Smart Columbus broadened the eligible applicants for the TSP Rebate Program beyond traditional taxi companies to include individual drivers for TNCs.
- Individual TSP drivers needed more lead time and flexibility for purchasing vehicles. Many indicated interest in purchasing EVs but were locked into leases or car payments and could only purchase EVs once those time and financial constraints were finished. TNC drivers also fell into two broad categories:
 1. Drivers who fully understood their ROI and worked the TNC driving job like a business; the majority of drivers in this category operated as "select" (i.e. Uber Select) TNC services to maximize revenue per trip. However, only the Tesla and other high price EV models qualify under the "select" TNC service options. Therefore, drivers in this category, while highly interested in EVs for TNC operational cost savings, were presented with additional challenges of possibly having to lose some revenue per ride (by no longer being designated "select").
 2. Drivers who were more focused on TNC revenue as supplemental or temporary. Drivers in this category were generally not as swayed by opportunities to use an EV for operational cost savings and were more concerned about current vehicle lease or payment commitments.

PRIORITY 3 – TRANSIT, AUTONOMOUS AND MULTI-MODAL SYSTEMS IN THE CITY

Objective: Ensure a comprehensive, multi-modal approach to decarbonizing the Columbus region’s mobility options.

Program Highlights:



**LAUNCHED THE SMART CIRCUIT,
THE FIRST DEPLOYMENT OF
SELF-DRIVING SHUTTLE
TECHNOLOGY IN OHIO**

**LAUNCHED THE LINDEN ELECTRIC
AUTONOMOUS SHUTTLE, CALLED
THE LINDEN LEAP (LINDEN
EMPOWERS ALL PEOPLE).
THIS WAS THE FIRST
RESIDENTIAL SELF-DRIVING
DEPLOYMENT ON PUBLIC
STREETS IN THE COUNTRY**



**6
ELECTRIC BIKES
DEPLOYED WITH THE
COLUMBUS POLICE
DEPARTMENT**

**30
STATION-BASED
ELECTRIC BIKES**

**33.04
MILES OF CITY
BIKE INFRASTRUCTURE
ADDED**

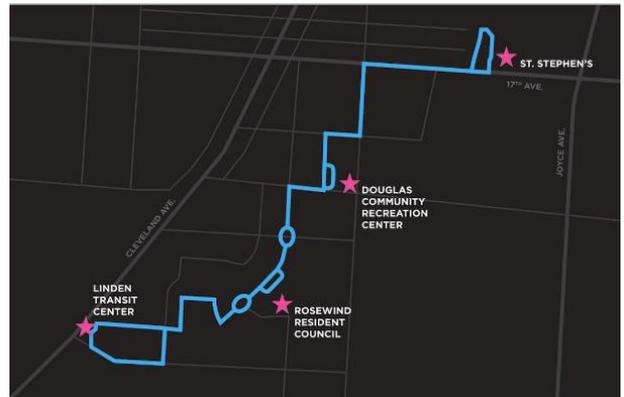
**INTRODUCED NEW SHARED MOBILITY
PROVIDERS, WELCOMING
OVER 3,500 SHARED BIKES AND
ELECTRIC SCOOTERS SINCE 2018**



6 Connected Electric Autonomous Vehicles (CEAVs)

Program Highlights:

- In December 2018, Smart Columbus launched Smart Circuit, the first deployment of self-driving shuttle technology in Ohio. Funded by DriveOhio and private donations to Smart Columbus, three low-speed electric shuttles staffed by trained operators circled the Scioto Mile, transporting passengers to Columbus' premier educational and leisure destinations: COSI, the National Veterans Memorial and Museum, the Smart Columbus Experience Center and Bicentennial Park. The shuttles offered Columbus residents and visitors a hands-on experience designed to educate local innovators on the capabilities and potential of autonomous vehicle technology, and inspire the community to envision how self-driving vehicles can transform our community's future. The deployment ran through September 2019. During this time, more than 16,000 people rode aboard Smart Circuit to experience autonomous vehicle technology firsthand, and begin to envision the role this technology will play in our lives in the future.
- Learnings from Smart Circuit are informing autonomous activity around the state and the country. It laid the groundwork for the design of the Linden LEAP (Linden Empowers All People), the first self-driving shuttle operating daily on public residential streets. This demonstration funded by the USDOT grant was designed to build on the learnings of Smart Circuit to provide free rides to people traveling between St. Stephens Community House, Douglas Recreation Center, Rosewind Resident Council Building and the Linden Transit Center.



Impacts and Lessons Learned:

- Lessons on deploying electric, self-driving shuttles include:
 - The charging location should be near the route to be served, at least 0.5 mile away but ideally 0.25 mile away.
 - Cold and hot weather do impact the range of the vehicles due to the battery's ability to hold a charge in extreme cold, and the draw of a heating, ventilation and air conditioning (HVAC) system used for passenger comfort in hot temperatures.
 - Be cognizant of the service time requested and the range of the battery charge. An additional vehicle may be required if battery limits are pushed, especially in the more extreme temperatures.
- On February 20, 2020, a Linden LEAP vehicle traveling at 7.1 miles per hour came to a sudden stop, causing a passenger to slip to the floor. Investigations by Smart Columbus and the National Highway Transportation Safety Administration (NHTSA) concluded that the incident was triggered by a slight deviation in the steering of the shuttle. Other factors, such as small or unseen objects in the vehicle's path, weight distribution, or road conditions also can cause the vehicle to brake. Smart Columbus is working with our partners to make adjustments that would reduce, but not entirely prevent, sudden stops. Smart Columbus supports NHTSA's additional safety enhancements including providing seatbelts and additional passenger instruction. With these enhancements, every passenger can be confident that everything in our power was done to ensure their ride is safe. Smart Columbus is evaluating opportunities to redeploy the Linden LEAP shuttles in a way that comply with social distancing guidelines related to COVID-19. More details on the Feb 20th incident and subsequent actions, [click here](#).
- See Playbook post on developing a safety management play for self-driving shuttle deployments: <https://smart.columbus.gov/playbook-asset/connected-electric-autonomous-self-driving-shuttle-incidentvehicles/smart-columbus-response-to-linden-leap>.



Electric Bikes

Program Highlights:

- In August 2018, Smart Columbus placed the six e-bikes procured through the Electrification Program into operation with the Columbus Police Department (CPD). The e-bikes' pedal-assist electric motor enables officers to travel more quickly—up to 28 miles per hour—and arrive at calls while conserving energy for their work.
- Legislation passed City Council on November 18, 2019, authorizing the purchase of 30 station-based electric bikes for \$75,000. The station-based electric bikes were delivered in June 2020 and launched in Columbus with 250 other e-bikes on June 30, 2020. This particular purchase was to deploy e-bikes at the Smart Mobility Hubs as part of the Smart Columbus project. This ensured that e-bikes were provided as a first-mile/last-mile solution in the Linden opportunity neighborhood. Five of the six Smart Mobility Hubs have CoGo bike-share and will receive the e-bikes: Columbus State Community College, Linden Transit Center, St. Stephen's Community House, Columbus Metropolitan Library – Linden Branch, and Easton Transit Center.

Impacts and Lessons Learned:

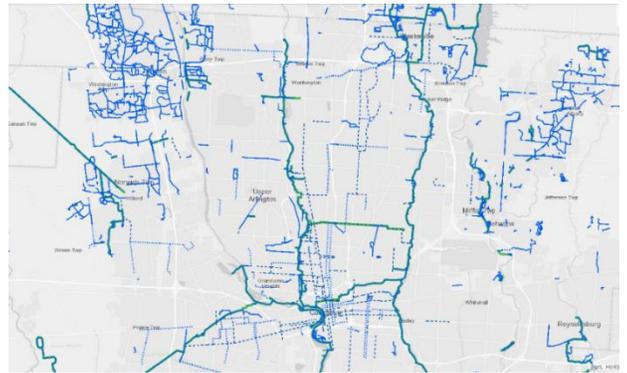
- The cost of the e-bike is not the only consideration. Depending upon how it is going to be used, as in the case of CPD, the bikes may need to have other equipment included in the cost.



City Bike Infrastructure

Program Highlights:

- The city added 33.04 miles of bike infrastructure since the program inception, surpassing the goal of adding 25 miles. Several bikeway projects were completed including, but not limited to, Long Street Bike Lanes, Arcadia Avenue Bike Lanes, Clintonville Neighborhood Bikeways, and Dierker Road Shared-Use Path. Visit <https://apps.morpc.org/bikemap> for a detailed Columbus Metro Bike Map.



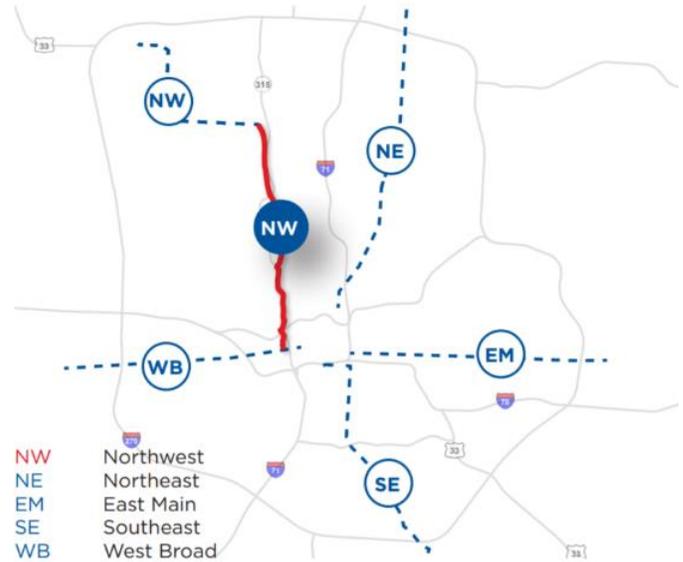
Impacts and Lessons Learned:

- In order to implement bikeway projects:
 - A Bikeways Master Plan should be created. It is a valuable tool for bikeway planning and implementation;
 - Bikeways should be considered at the onset of every transportation project; and
 - Funding for bikeways should regularly be included in annual transportation budgets.
- Challenges/barriers included:
 - Funding;
 - On-street parking vs. bike lanes;
 - Lane width and Average Daily Traffic (ADT) requirements;
 - Posted speed limits on certain roads;
 - Crossing treatments at certain locations; and
 - Implementing bikeways in the built environment in general.
- Things that worked well included:
 - Implementing bikeways as part of road improvement and resurfacing projects;
 - Installing buffered bike lanes, including the narrowing of travel lanes when feasible;
 - Installing shared-use paths instead of sidewalks where it made sense to do so; and
 - Implementing relatively low-cost neighborhood bikeways using signs and pavement markings.

New & Next in Mobility

Program Highlights:

- Central Ohio is expected to grow by up to one million people by 2050. To prepare for this growth, a comprehensive scenario analysis – Insight2050 – was designed to identify ways to accommodate growth while minimizing impacts to the region’s quality of life. Today, most people in central Ohio rely on cars to get to and from their destinations. If this approach persists, by 2050 our region may experience significant travel delays, reduced transportation reliability, and impacts to our economic competitiveness. The next step is to tackle one of the most challenging corridors identified in the Insight2050 Corridor Concepts study, the Northwest Corridor, to best determine how to move large numbers of people quickly, efficiently and safely. Visit <https://www.columbus.gov/Templates/Detail.aspx?id=2147513042> to learn more about the Northwest Corridor Mobility Study.



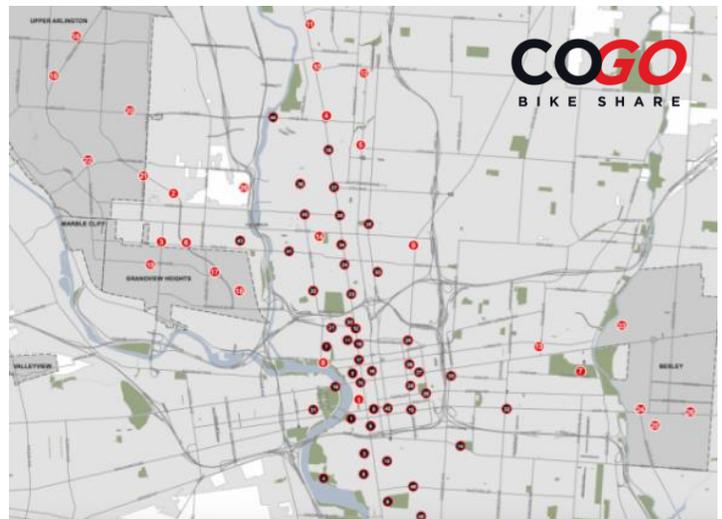
Impacts and Lessons Learned:

- None at this time.

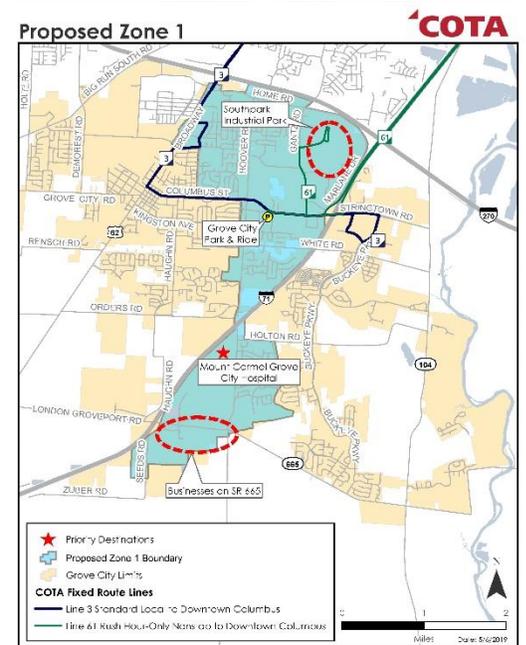
Expanded Shared Mobility

Program Highlights:

- Through a convergence of market trends and the efforts of Smart Columbus and our regional partners, 3,500+ shared bikes and electric scooters have landed in Columbus since 2018, growing and electrifying our mobility options.
- Almost 30 new stations in the shared docked bike network called CoGo were added to the region, about half of which are located in the City of Columbus.
- The Ohio State University selected shared bike and scooter services to operate on campus.
- During the grant, Columbus, and many other medium-sized markets across the country, lost Car2go services as they consolidated into the largest markets, which discontinued the only floating car-share program in the region.



- Electric scooters were deployed by Bird, Lime, Spin and Lyft. Lyft pulled scooters from the Columbus, Nashville, Atlanta, San Antonio, Dallas and Phoenix markets on November 22, 2019. The Smart Columbus team was in contact with Lyft and the City of Columbus to discuss messaging and next steps.
- During the program, Chariot (micro-transit) and Lime bikes were introduced and removed from all markets nationwide (including Columbus).
- The first EV carshare, deployed by SWAY Mobility, was launched with a MUD in June 2020. The program serves tenants of a mixed-use building near downtown.
- Zipcar announced a partnership with Honda and the expansion of its Columbus shared vehicle fleet from eight to 30 vehicles.
- The Central Ohio Transit Authority (COTA) launched COTA Plus, an on-demand micro-transit service leveraging a technology platform from Via that will provide first-mile/last-mile service in partnership with a suburb of Columbus, Grove City. This route services a foodbank, job centers, healthcare facilities, and more.
- Launched during the Smart Cities Challenge after participation in an affiliated incubator, micro-transit start-up service SHARE has risen to popularity and prominence serving multiple employers, schools, and municipalities in central Ohio. SHARE provides critical first-mile/last-mile service to COTA lines and also fills in existing mobility option gaps. The company has since expanded outside the state. Smart Columbus works closely with employers and SHARE to increase adoption and operational success. Another local micro-transit start-up named EmpowerBus launched and folded during the four-year grant period.
- A bold and innovative [program](#) in downtown Columbus has doubled the use of transit among eligible downtown employees and prevented more than 6.8 million pounds of GHG emissions per year. Launched in June 2018, the Downtown C-pass program enables eligible companies to offer free, unlimited transit access to employees. Although the creation of this program was not led by Smart Columbus, the team works with downtown employers to increase use of the benefit.



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- With funds from the USDOT grant, Smart Columbus built and launched the beta version of Pivot, a first-of-its-kind mobility app that makes it easier for central Ohioans to get around. Utilizing the Smart Columbus Operating System, the app integrates trip planning, booking, electronic ticketing and payment so residents can easily move from bus, to bike, to taxi, to ride share, to scooter and get where they need to go conveniently, affordably and safely.
- With funds from the USDOT grant, a [Wayfinder application](#) for increased independent travel via fixed-route bus systems for people with cognitive disabilities was customized for Central Ohio.

Impacts and Lessons Learned:

- Without ample medium to high comfort networks with neighborhood links for scooters and bicycles across the region, mass adoption cannot be achieved. Policies like [Complete Streets](#) and investments in building out a regional [trail network](#) are critical to advancing this need.
- The work of advocacy and education organizations like [YayBikes!](#) is critical to advance adoption of cycling in Central Ohio.
- Working with [events](#) in central Ohio to promote alternative modes of mobility to reach the event is an important tactic to encourage mode shift, since a trip to a weekend event for example is a lower risk trip than a commute.
- Ensuring a comprehensive, multi-modal approach to decarbonizing the Columbus region's mobility options requires market development, service attraction, and continued support for businesses offering multi-modal solutions. Key activities included:
 - Reach out to prospective companies for one-on-one conversations to discuss the Columbus market, and coach them on the process of obtaining a permit to operate in Columbus;
 - Proactive outreach to assist new companies in launching bike and scooters service within the city;
 - Support the launch plans of new services and promote service provider campaigns in the community; and
 - Create and convene a supportive professional group of service providers to enable collaboration and bolster multi-modality.
- Like many cities across the country, Columbus and surrounding municipalities were surprised by guerrilla marketing tactics of bike and scooter companies that dropped hundreds of devices in communities with little to no notice. Regulating the new devices was not as simple as passing one new law or expanding current ones. Have the proper network to be able to react quickly to mobility changes and deployments, and actively seek to establish rules and regulations for oncoming technologies. City of Columbus Department of Public Service provided a swift response to electric scooter deployment. Working with Smart Columbus, the City created [regulations](#) on e-scooters in a short amount of time. This regulation and approach was benchmarked by cities across the country. One of the unique elements of the regulation required vendors to locate a percentage of devices in low-income neighborhoods and offer alternative payment options for people who may be unbanked. This promotes access to transportation for city residents who need it most, including those who use micro-mobility devices to get to school or work.

PRIORITY 4 – CONSUMER ELECTRIC VEHICLE ADOPTION

Objective: Increase EV market adoption as evidenced by the percentage of light duty EV registrations in Columbus and the surrounding seven-county region, attaining 1.8% of all new and used light duty vehicle registrations by the end of the three-year grant period, representing a 486% increase from the 2015 baseline of 0.4%.

Goal Progress:

PRIORITY INDICATORS	GOAL	LIFE OF PROGRAM PROGRESS
EV Market Penetration (EVs purchased divided by total vehicles purchased)	1.80%	2.34%
Estimated equivalent number of EVs purchased	2,998	3,458
Number of Executives Driving EVs	50	50

Program Highlights:



OVER
30,000
PEOPLE VISITED THE
EXPERIENCE CENTER

22
AWARDS OF IGNITE
ACTION FUNDS

11,956
TEST DRIVES COMPLETED THROUGH
THE RIDE & DRIVE ROADSHOW
453
TEST DRIVES COMPLETED AT THE
EXPERIENCE CENTER



CERTIFIED
32
ELECTRIFIED
DEALERS



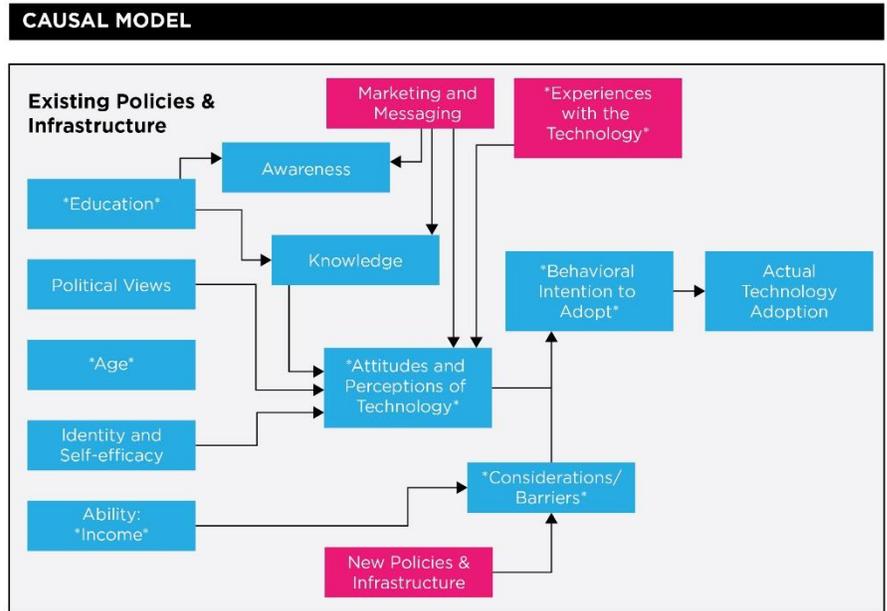
23
EV MODELS IN
THE COLUMBUS
MARKET

Initiative 4.1 – Research and Assessment

Strategy 4.1.1 – Consumer Research

Program Highlights:

- In March 2018, Smart Columbus and research firm Navigant, published the findings of a survey of 900 people in the Columbus region who were identified as early adopters or early majority users for EVs, and who were looking to buy a new car in the next four years. The survey measures respondents' vehicle preferences, EV awareness, considerations when buying a car, barriers to purchase and other consumer characteristics. The goal of



the survey was to baseline consumer understanding of and receptivity to EVs in the region. Our team thought it was important to get a clear understanding of the consumer landscape in Columbus, in order to create programs, education and incentives to increase adoption. The survey also helped Smart Columbus better understand opportunities and barriers to EV adoption in the region, and how measures of EV adoption compare to nationwide EV figures. A few key findings from the baseline survey along with survey results are available here: <https://smart.columbus.gov/playbook-assets/electric-vehicle-consumer-adoption/gauging-consumer-awareness-of-evs-in-columbus>. This framework developed during the baseline research phase, was used in all future phases of work as well.

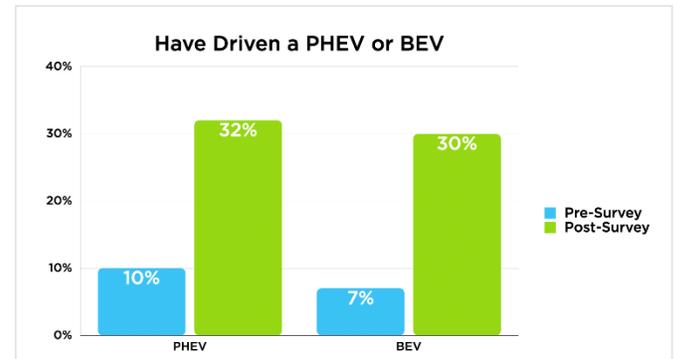
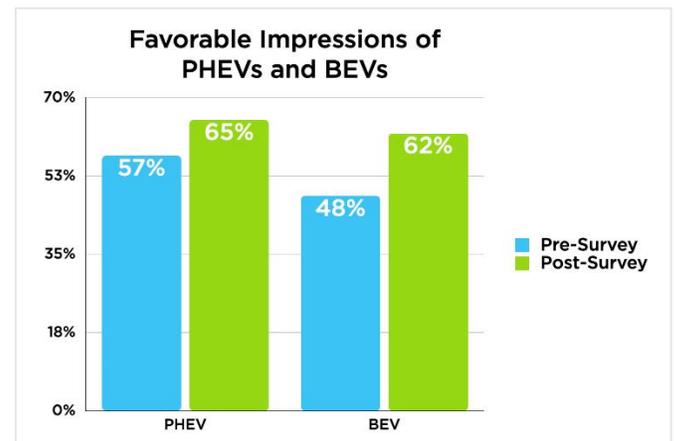
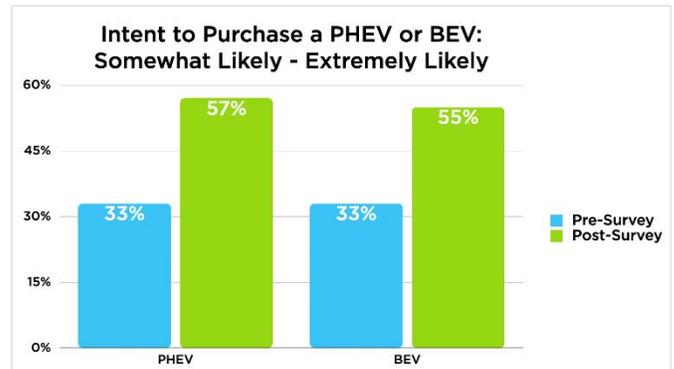
- In-between the baseline survey and the follow-up survey, Navigant also completed work on a logic model and developed evaluation questions to help the Smart Columbus team evaluate impact and iterate programs in real-time.
- The survey was then repeated at the conclusion of the Smart Columbus Electrification Program to measure changes in EV perceptions. Overall follow-up survey results reveal high levels of interest in PEVs and high levels of exposure to the Smart Columbus brand and Smart Columbus activities among members of the target population in the Columbus area. Respondents were most likely to be exposed to information about Smart Columbus via social media and 70 to 75% of respondents indicated that they support Smart Columbus goals. Large proportions of respondents indicated that they were aware of the Smart Columbus workplace campaigns, ride and drive events, and the Experience Center and many had visited the Smart Columbus website. Despite the growing

awareness, concerns about BEVs remains high while knowledge about BEVs remains limited as discussed in more detail below.

Customer’s vehicle preferences remain largely unchanged with small SUVs and large sedans among the most popular vehicle types while fuel economy, handling and all-wheel drive are among the most important vehicle features. Interestingly, when asked about the importance of various vehicle features in determining their interest in purchasing or leasing a PHEV or BEV, respondents’ top five features were ability to charge at home, fuel-cost savings, environmental friendliness, maintenance cost savings, and financial incentives. Brand preferences were a little different in the post-survey where Honda, Ford and Audi were respondents’ top three favorite brands. Another change was found in the larger proportion of respondents who indicated that they planned to purchase or lease a vehicle with a value of \$30,000 to \$50,000.

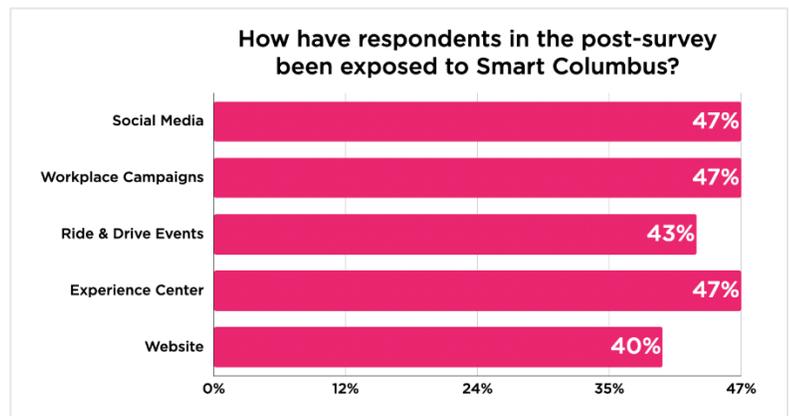
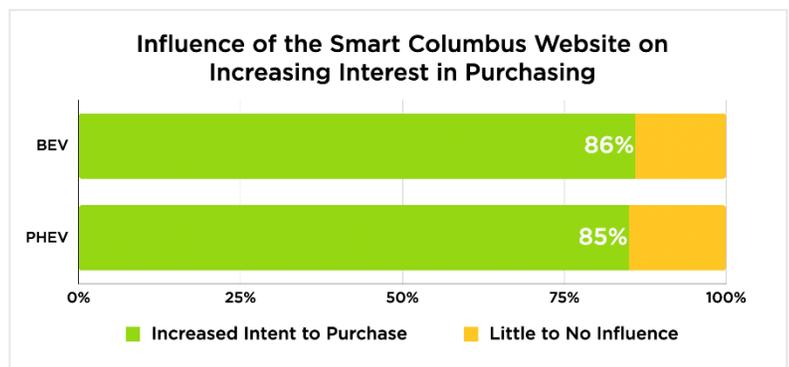
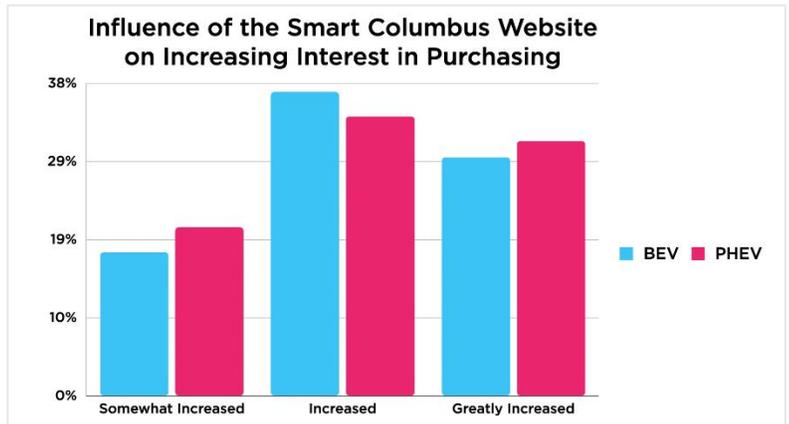
The findings indicate that people who were aware of or participated in the following activities expressed greater intentions to purchase or lease a new BEV or PHEV.

- Having heard of Smart Columbus workplace campaigns;
- Having visited the Smart Columbus website;
- Having heard of Smart Columbus Ride and Drive events;
- Having participated in a Smart Columbus Ride and Drive event;
- Having heard of the Smart Columbus Experience Center;
- Having visited the Smart Columbus Experience Center;
- Having visited a dealership with the intention of seeing or driving a PEV;
- Supporting Smart Columbus’ promotion of improved access to reliable, affordable transportation;
- and
- Supporting Smart Columbus’ promotion of EVs.



Impacts and Lessons Learned:

- The baseline consumer market awareness survey was reaffirming of initial assumptions and, based on the amount of data collected, provoked a great deal of new questions that would have required additional research. An additional deep dive was not budgeted.
- Smart Columbus reframed the Ride & Drive survey questions to align with the baseline survey. Changing survey questions after the program already launched created data analysis complexities during final reporting and ingestion of the data set in the Operating System.
- Collecting consumer data and sharing this data with the industry adds immense value.
- Commissioning research projects can be a time-consuming endeavor if procurement processes or other issues extend timeline requirements and needs to be done while interventions and strategies are already underway.
- Evaluation efforts should be planned for and budgeted when a program launches to ensure adequate support. Smart Columbus applied for additional grant funding to support the execution of an Evaluation Plan to determine the effectiveness of consumer adoption strategies. Grant funding was not awarded, and the team had to determine what they had capacity to measure without additional capacity or financial support. Deep scientific program evaluation for lean non-profit work is dependent on adequate grant funding.



Initiative 4.2 – Increase Consumer Awareness for EVs

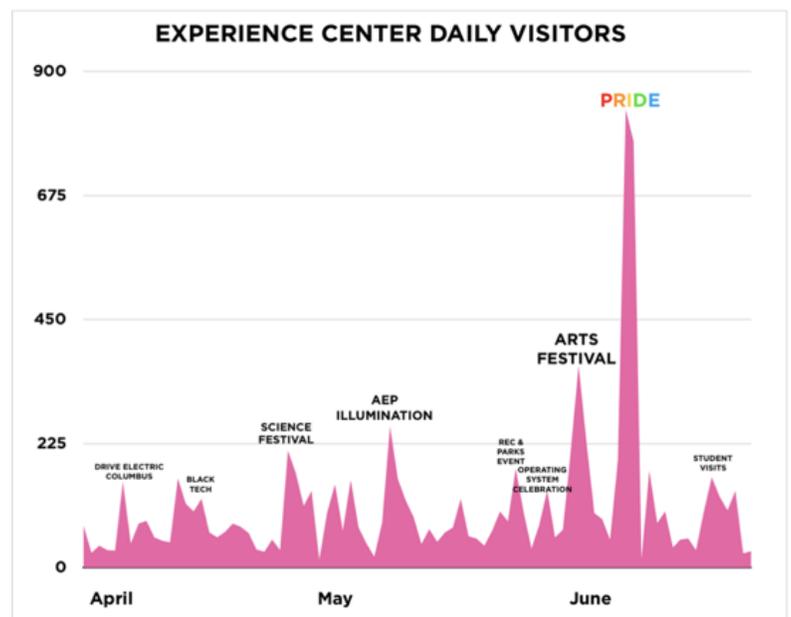
Strategy 4.2.1 – Community Events

Program Highlights:

- In 2018, Smart Columbus launched a series called Smart Columbus Live, where Acceleration Partner representatives, public sector officials and the public were invited to learn about the Smart Columbus initiative and the future of mobility. The series engaged more than 1,500 people, provided a launchpad for the Smart Columbus message and helped to inform the experience design of the Smart Columbus Experience Center.



- The Smart Columbus Experience Center’s location on the Scioto Mile was particularly ideal given it was within the footprint of several major Columbus festivals and events. During these events, including the Columbus Arts Festival, PRIDE, the Jazz and Ribs Fest, WinterFest and more, Smart Columbus opened its doors to the public to teach thousands of residents about EVs and smart mobility. The center was also frequently used as a venue for private events, which included professional development events, networking events, Mobility Monday education events, helmet giveaways in partnership with scooter providers, and more.
- Smart Columbus participated most actively in festivals and hosted the most private events during the summer of 2019. Festivals and events hosted at the Experience Center provided a consistent traffic flow of 80 to 200 visitors per day. On average that summer, our team welcomed 108 visitors to the center daily with a minimum of 14 and a maximum of 831.



- When engaging in events throughout the region, the Smart Columbus team prioritized collaborating with mobility partners to create smart transportation activations. This helped to reduce costs in sponsorship fees while broadening the reach of key messages from Smart Columbus and partners.



Impacts and Lessons Learned:

- For large community events, the Smart Columbus team created a mobility map showing residents the various alternative modes that could be used to travel to and from the event. This helped to decrease traffic congestion, while advertising Smart Columbus and its mobility partners.
- Engaging a network of community volunteers was crucial to having a strong presence at community festivals and events. Smart Columbus volunteers varied from students to retired community members and were each passionate about improving the lives of all Columbus residents by transforming how they move. Volunteers engaged in at least one information session on the overall Smart Columbus program, and received talking points for each shift.

**SUSTAINABLE STEPS
LAUNCH PARTY**

DATE: JULY 21, 2019
TIME: 12 PM - 4PM
LOCATION: LAND GRANT; 424 W. TOWN ST.

Join Smart Columbus as we celebrate the launch of Sustainable Steps by opting for a smarter, more sustainable way to move. In an effort to reduce congestion and promote the vitality of our city, Smart Columbus is committed to promoting existing and new mobility options. Check out the mobility map to find the nearest bus stops, CoGo stations and suggested scooter parking.

After hopping off your bus, bike, or scooter, let Smart Columbus take you on a ride into the future. The Smart Circuit, Ohio's first self-driving electric shuttle, will have a pick-up and drop-off point at Land Grant connecting you to Gravity, National Veterans Memorial, and COSI. Shuttles seat up to 5 passengers and are free and run every 10 minutes.



- Community events and festivals offer an opportunity for large-scale engagement and education. A staffing and resource plan was developed and vetted for each event. This was translated into an online volunteer sign-up for Smart Columbus staff members and our network of community volunteers. Supplementing staff volunteer hours with engagement by local EV owners and advocates proved extremely successful.
- One downside of community festivals was that crowds and the sale of alcohol usually made it impossible or undesirable to host EV test drives. Instead, the events were more of an awareness tool for Smart Columbus, and interested attendees were invited to return to the center for a test drive after the festival concluded.
- Having activities and interactive displays were crucial to grabbing attention among the excitement of a festival or community event.
- In 2017 and 2018, Smart Columbus representatives traveled to host displays and engage attendees at some events outside the Experience Center, such as the Dublin Irish Festival and Ohio State Fair. The team found these events to be less effective relative to resources compared to engagements at the Experience Center. This was generally because it was more onerous to transport EVs to these remote locations, and to stand out among other exhibitors in a small tabling footprint.
- All Smart Columbus community event engagement was paused in mid-March 2020, when all community events began to be cancelled to limit the spread of COVID-19. Smart Columbus is evaluating ways to engage the public digitally during the remainder of 2020.

Strategy 4.2.2 – Local Media Relations

Program Highlights:

- From July 2017 to March 2020, Smart Columbus generated more than 97 million media impressions, 34 million of them local media impressions.
- The Smart Columbus team leveraged program and partner milestones to continue to make electrification a newsworthy topic, in order to stay in front of Columbus residents with a steady drumbeat of positive endorsements of EVs, decarbonization and alternative mobility. Milestones, announcements, events and the publication of Smart Columbus thought leadership and resulted in local coverage such as:
 - Establishment of the MUD rebate program - [Columbus Dispatch: Apartment complexes can apply for rebates on electric car chargers](#)
 - Dedication of the DC Solar units to Ohio Dominican University - [Columbus Dispatch: Portable solar tech donated to Ohio Dominican through Smart Columbus](#)
 - Launch of the Acceleration Partners program - [Columbus Business First: Driving to work solo? Smart Columbus wants you to think about other options](#)
 - Launch of the Smart Columbus Operating System - [Columbus Dispatch: Columbus building technological 'heartbeat' of future smart cities](#)
 - Public EV fleet procurement: Smart City grant - [Columbus Business First: Columbus buys first electric vehicles, adding more charging stations](#)

- Launch of the Electrified Dealer Program - [Daily Reporter: Smart Columbus Will Certify Dealers Selling Electric Vehicles](#)
- Launch of the Ride & Drive program - [OSU News: Smart Columbus Ride and Drive event brings electric cars to campus](#)
- Launch of the TNC incentive program - [WOSU: Smart Columbus Offers Rebates To Taxi Companies That Go Electric](#)
- The Grand Opening of the Smart Columbus Experience Center - [Columbus Dispatch: Smart Cities 'experience center' opens Downtown on Saturday](#)
- Creation of the MUD rebate program - [Columbus Dispatch: Smart Columbus offers cash for builders of apartments, condos to add vehicle-charging stations](#)
- Deployment of the Columbus Police Department e-bikes - [10TV: Smart Columbus provides pedal power for police](#)
- The launch of Smart Circuit - [Columbus Dispatch: Ohio's first autonomous shuttle will start accepting passengers](#)
- Mobility service expansions - [Columbus Dispatch: Zipcar expands Honda fleet in city](#)
- Helmet giveaways - [NBC4: Free helmet today, but no e-scooters allowed at BOOM!](#)
- Opening of the downtown DC Fast charging station - [NBC4: Public fast charging stations for electric cars unveiled in Columbus](#)
- Launch of the Linden LEAP - [Columbus Business First: Photos: Smart Columbus self-driving shuttle starts rolling in Linden](#)
- Realization of the EV adoption goal - [Columbus Dispatch: Sales of electric vehicles tick up in central Ohio](#)

Impacts and Lessons Learned:

- The Smart Columbus team believes it is critical to identify and leverage program milestones and achievements, service launches, procurements, etc. in order to maintain program newsworthiness and continue to earn media coverage.

Strategy 4.2.3 – Social Media

Program Highlights:

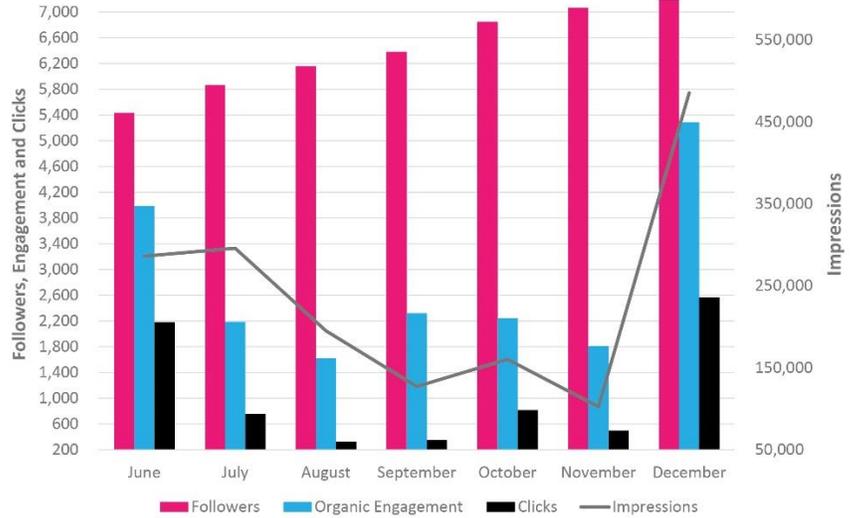
- Smart Columbus launched and maintains a presence on Facebook, Instagram, Twitter, LinkedIn and YouTube. As of the end of May 2020, the organization has 13,680 followers across channels and achieved more than six million social media impressions through social posts not associated with the education campaign (see 4.3.3.2).
- The brand's best month for social media impressions was July 2019, with 659,700 impressions. Topics generating significant engagement that month included the EV advertising campaign, the first Mobility Innovation Test, Smart Circuit, a new discount on the Mitsubishi Outlander, the USDOT-funded Mobility Assistance for People with Cognitive Disabilities App, and a promo for the Smart Columbus Experience Center.

2018 social media summary

There continues to be a steady increase in followers across all social channels.

The cumulative increase in engagement across all social channels is **67%** (June – December).

Month	Organic Content	Engagement Rate
June	99	309.29%
July	63	-11.11%
August	41	-18.63%
September	68	5.07%
October	46	8.82%
November	48	-17.41%
December	79	192%



2019 social media summary

	Posts	Followers	Engagement	Avg. Engagement Per Post	Impressions	Impressions MOM Δ	Link Clicks	Ad Spend
January	58	8,129 (+371)	2,086	36	190,443	-53.7%	743	\$2,873.23
February	46	8,523 (+394)	1,538	33	366,532	92.5%	1,299	
March	47	8,734 (+211)	2,085	44	549,170	49.8%	3,791	
April	45	8,964 (+230)	1,718	38	375,409	-31.6%	2,467	-
May	105	9,263 (+299)	2,805	27	628,380	67.4%	3,628	\$348.82
June	115	9,465 (+202)	3,283	29	426,237	-32.2%	2,058	\$751.91
July	83	9,899 (+434)	9,684	117	659,700	53.7%	2,602	\$656.13
August	93	10,304 (+405)	8,089	87	482,920	-26.8%	1,569	\$959
September	143	10,597 (+298)	6,561	46	510,800	5.7%	1,615	\$1,299 (\$650 was incorrectly charged on a Twitter ad. Working to reverse charges.)
October	135	10,902 (+305)	5,205	39	238,829	-53.2%	1,124	\$681
November	83	11,141 (+238)	4,960	60	327,223	37%	875	\$428.16
December	73	11,548 (+406)	22,531	309	469,284	43%	1,760	\$778
YTD Total	1026	11,548	70,545	72.1	5,224,927	---	23,531	\$8775.25

Impacts and Lessons Learned:

- Paid boosts are critical to amplifying social media messages to achieve broad reach.
- See 4.3.3.2 for an assessment across communications channels.

Strategy 4.2.4 – Electric Asset Branding

Program Highlights:

- AEP Ohio and Smart Columbus co-branded wraps were installed on 210 charging stations as part of the AEP Ohio EV Charging Station Incentive Program.
- Smart Columbus distributed fleet window clings to public and private fleets when they were deployed/doing driver training.
- One City of Columbus fleet EV was wrapped with Smart Columbus branding.
- The most visible EV asset branding project Smart Columbus pursued was the Greenspot charger, which was shrouded in public art created by Columbus College of Art & Design (CCAD) students. The art design was funded by the Columbus Foundation.



Impacts and Lessons Learned:

- Including AEP Ohio and Smart Columbus branding on EV chargers was a requirement of the AEP Ohio EV Charging Incentive Program and was most successful approach for securing EV asset branding.
- The City of Columbus most widely adopted EV bumper stickers/window clings on their fleet vehicles. Other fleets did not widely adopt the clings provided by Smart Columbus.

Strategy 4.2.5 – Smart Columbus Experience Center

Program Highlights:

- In June 2018, the [Smart Columbus Experience Center](#) opened, located in the heart of Columbus' downtown along the newly transformed Scioto Mile. This public, interactive venue provides a first-of-its-kind learning destination about how mobility technology and innovation can improve people's lives and the communities where they live. The Experience Center is built on a strong foundation of public-private partnerships, reflecting [the Columbus Way](#) philosophy that guides Smart Columbus. Because Smart Columbus is active in educating the private sector on mobility options, many of our 70 partner companies frequent the Experience Center for test drive events and lunch and learn events for their employees.

Funding for construction was provided by PGAFF, the State of Ohio Capital Bill, the City of Columbus, and private investors. The majority of technology and exhibits are donated by local and national partners. Vehicles for display and test drives are generously provided by local car dealerships and vehicle manufacturers in coordination with the [Smart Columbus Electrified Dealer program](#).

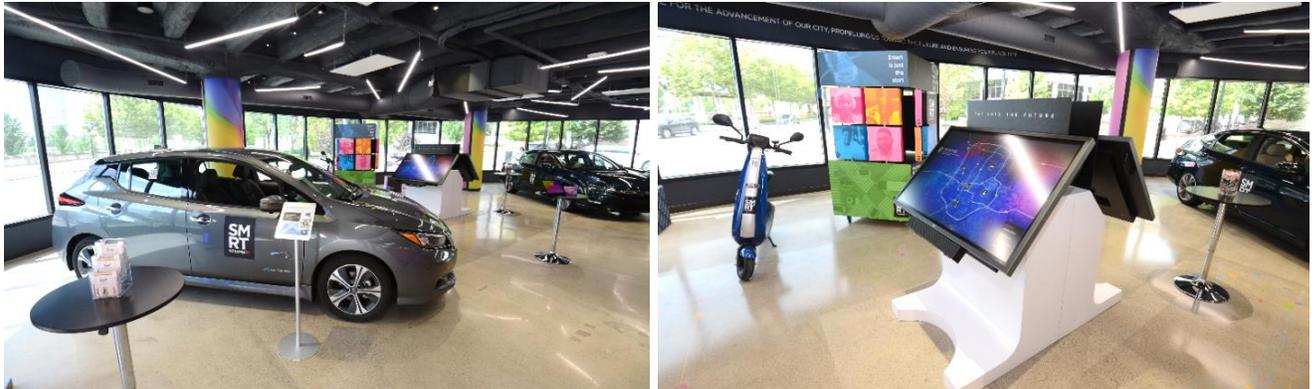
Behind the showroom, an additional 5,000 square feet is dedicated meeting and open collaborative office space with staff and consultants representing six different organizations.

Guests can engage in a variety of exhibits including an interactive touchscreen module outlining Smart Columbus' project portfolio, a story tower that shows how new technologies will benefit real residents, EV charging education, video-as-a-sensor technology, innovative utility collaboration, real-time energy use information and more.

- Since the Experience Center opened in July 2018, over 30,000 visitors from the Columbus region and around the globe have visited the 3,000 square-foot showroom and over 450 test drives have been completed with over 225 additional passengers. Hosting, co-hosting, or serving as a venue for events proved an extremely effective strategy for attracting people from many sectors and walks of life to the Center. Events are a particularly important tactic in colder months when people are less likely to walk by the center.



- Many visitors were intentionally engaged through more than 145 events hosted by Smart Columbus within the space. The communications team worked to host original events that would support the core pillars to Electrify, Empower, and Educate the Columbus region. Smart Columbus hosted an original event series, Mobility Monday, to bring the community together to discuss and experience the future of mobility starting in our own backyard, highlighting shared mobility services. The team welcomed local K-12 students for field trips, global thought leaders for learning exchanges, statewide leaders for fleet electrification workshops, and local companies and organizations for tours, test drives, and lunch and learns.



Impacts and Lessons Learned:

- Managing an Experience Center is a job that would ideally require at least ½ full-time equivalent (FTE) and would be best led by a person with experience/expertise managing public education spaces and a team of educators.
- Creating a digital and print troubleshooting document and cross-training team members to address technological challenges or reboot all devices after a power outage is important to keep a high-tech center up and running smoothly.
- If designing a similar space, leveraging donations is critical. However, it is also critical to ensure the donations accepted fit together to tell a cohesive story with a smooth and clearly navigable user experience within the space.
- Hosting a robust volume and variety of events within the space enabled our team to get in front of diverse audiences, sharing our message more broadly. As more visitors entered the space, requests for use of the space grew, bringing opportunities to grow and innovate event processes. First and foremost, additional dedicated staff was needed to host external groups and partners. An External Affairs Fellow was hired who would assist with maintaining the Experience Center activity calendar, intaking event requests, marketing the space as venue, coordinating event logistics, and being on-site for event support. Throughout the past two years, the online event request form was improved, and a digital brochure was created in order to market the Experience Center as a venue to our partners.

Initiative 4.3 – Drive Consumer Consideration for EVs

Strategy 4.3.1 – Test Drives

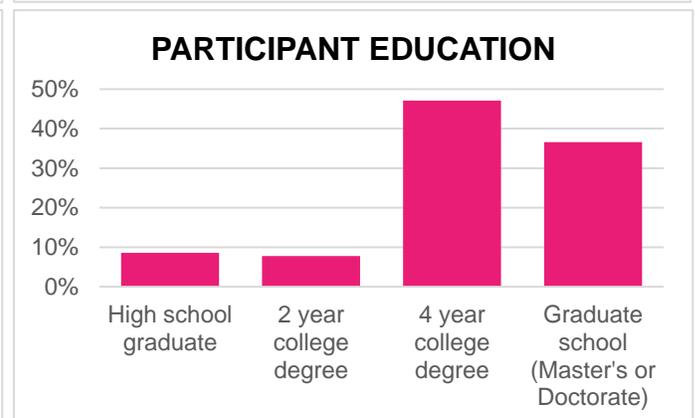
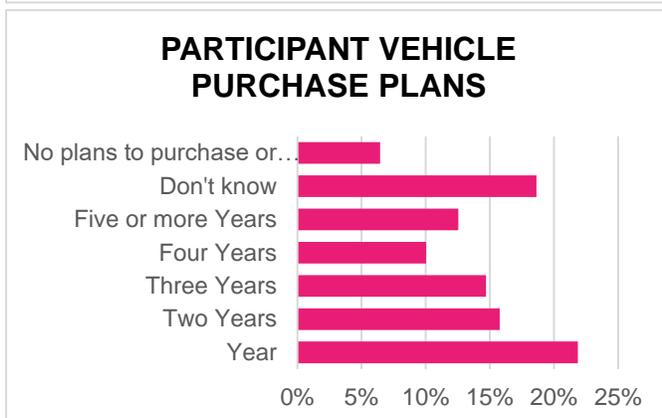
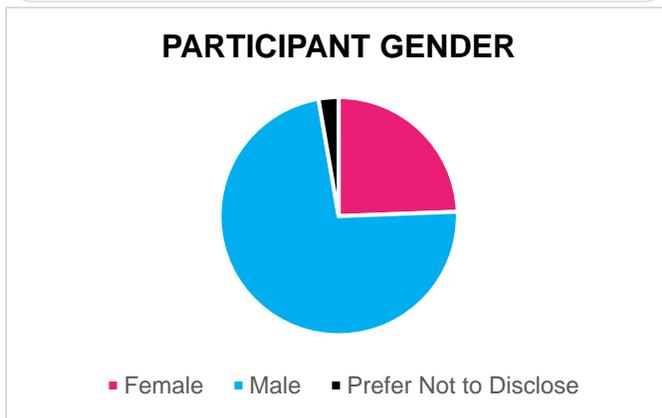
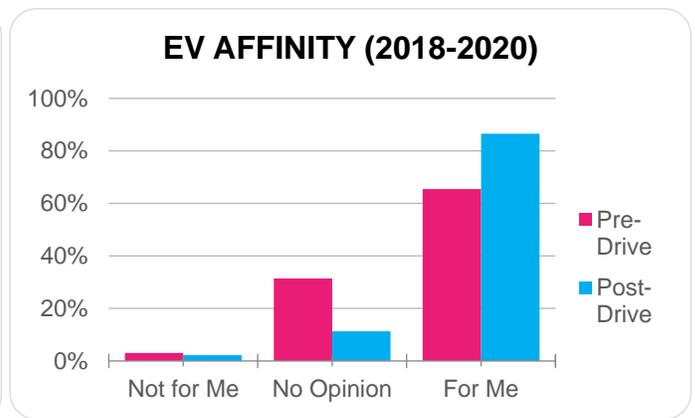
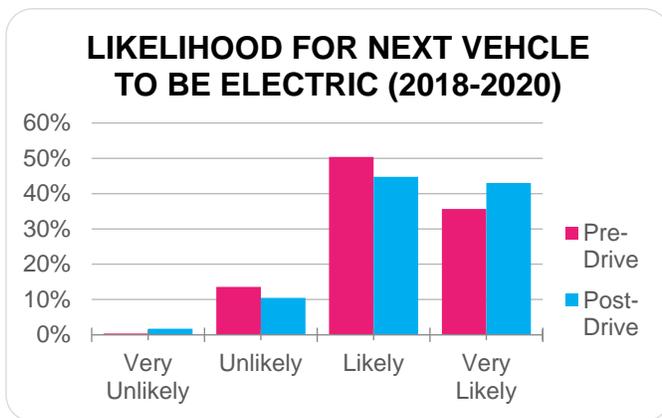
Substrategy 4.3.1.1 – Test Drives at the Smart Columbus Experience Center

Program Highlights:

- Since the Experience Center opened in July 2018, over 450 test drives have been completed with over 225 additional passengers. Approximately 30% of test drivers who completed a survey opted in to be contacted by a dealer about the vehicle they test drove and approximately 40% of test drivers fit the early adopter demographic of making over \$100,000 a year and over 80% have a four-year college or advanced college degree.
- An ambassador educates guests on EV technology and the benefits of going electric, rather than selling a certain vehicle. The ambassadors are trained by the Smart Columbus team and OEMs who provide in-depth information on their EV models. Ambassadors also have to be knowledgeable on the wide range of projects that Smart Columbus is currently working on, which allows for a wider understanding of sustainable transportation to be shared with community members. The ambassador team typically has 4-5 members and each work about 1-2 shifts a week in teams of two. Ambassador roles are typically filled by college students and are paid contractor positions.
- People are encouraged to test multiple EVs and are provided with take-home information about all EVs available in the Columbus region. The Smart Columbus Experience Center fleet has between four to six EVs of the latest models on site, allowing for test drivers to experience several different vehicles in one day. Level 2 residential and commercial charging displays within the showroom donated by Electrify America and EV United also provide hands-on learning opportunities. In addition, the app PlugShare is featured on an iPad to showcase the ample availability of public charging in the region.
- Each participant's experience starts with signing up online or on an iPad at the center for a specific vehicle and time. The registration platform was built from scratch in partnership with Pillar Technologies (now Accenture Industry X.0) and includes a variety of functions beyond registration including an administration portal with data analysis and fleet management functions. Participants are given the option to sign-up as a driver or rider.



- Participants complete a digital pre- and post-drive survey via the portal including questions about demographics, EV attitudes/preferences, and their next vehicle purchase. Survey results are anonymized and analyzed to optimize program impact, support cutting-edge research and to discern market insights.
- In the post-drive survey, participants have the opportunity to opt-in to be contacted by a local dealership about the vehicle they test drove. This critical feature ensures the test drive program is delivering value back to the vehicle manufactures and dealerships partnering with Smart Columbus and donating vehicles to the test drive program.
- <https://smart.columbus.gov/playbook-asset/our-journey/smart-columbus-experience-center-education-through-brand-agnostic-ev-test-drives>



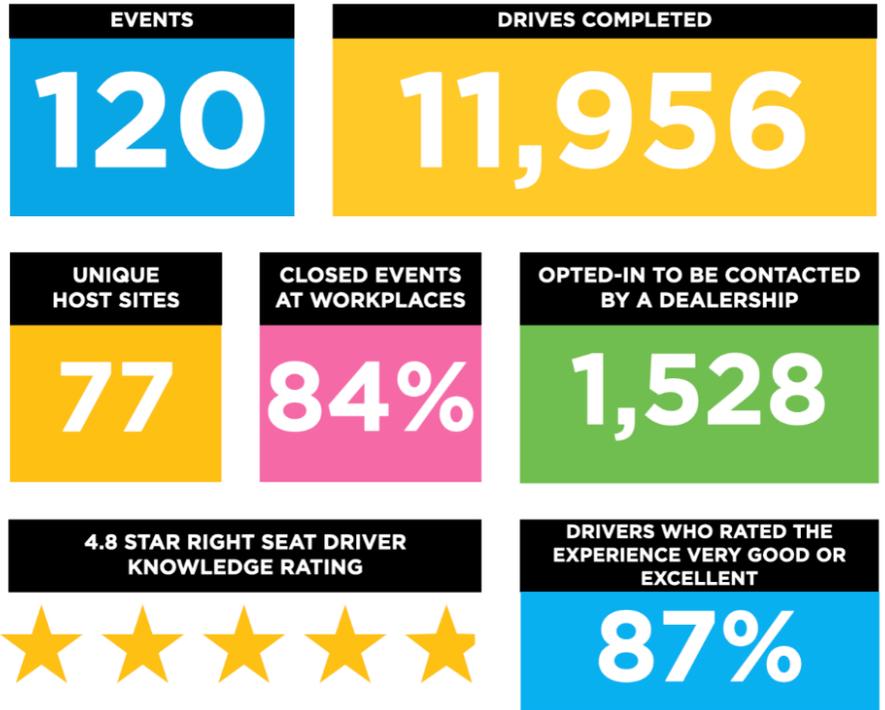
Impacts and Lessons Learned:

- A quality orientation and ongoing ambassador training is critical to the success of the Experience Center and test drive program. Ambassador on-boarding should start before the busy season to ensure adequate time for training.
- The safety of staff and guests should be top of mind when designing a space similar to the Experience Center and/or a test drive program. Safety protocols were created for test drive accidents and uncomfortable situations, along with emergencies in the center itself.
- In addition, test drive routes were strategically designed for optimal safety, with majority right turns and low-risk highway merging included. Ambassadors are trained to adapt routes as needed to detour around accidents/rush hour and/or avoid the highway if a test driver isn't comfortable driving at high speeds in a new vehicle.
- Proactive risk mitigation and emergency planning is important to a successful public test drive program. All participants are required to sign a waiver created by Smart Columbus prior to their drive and some vehicle manufacturers require an additional waiver. A separate waiver is required for minors to ride, but no one under 18 years of age can test drive. Drivers are required to have personal auto insurance and the vehicles are also insured by Smart Columbus.
- In case of an emergency involving a test drive vehicle, there is a guidance document with emergency protocol steps for various scenarios in each test drive vehicle. This document includes an accident report template. Route design, waivers, insurance, regular vehicle checks, and an accident protocol are critical components of putting safety first in a test drive program.
- Providing personalized quarterly reports to OEMs on their vehicle performance in the test drive program along with feeding leads on a regular basis are important touchpoints to maintain a healthy mutually beneficial relationship.

Substrategy 4.3.1.2 – Ride & Drive Roadshow

Program Highlights:

- Smart Columbus developed a Ride & Drive (R&D) strategy that put 11,956 people behind the wheel of an EV within 24 months, 13% of participants opting in to be contacted by a dealer about the vehicle they drove. In addition, over 700 participants registered as a passenger for their experience. These outcomes make our test drive program the largest of its kind with best practice opt-in rates.
- The success of our R&D depended on committed partners stepping up to work with Smart Columbus to plan the event and get their employees registered for test drives. Larger hosts had multi-day events at one location or hosted events at multiple locations.

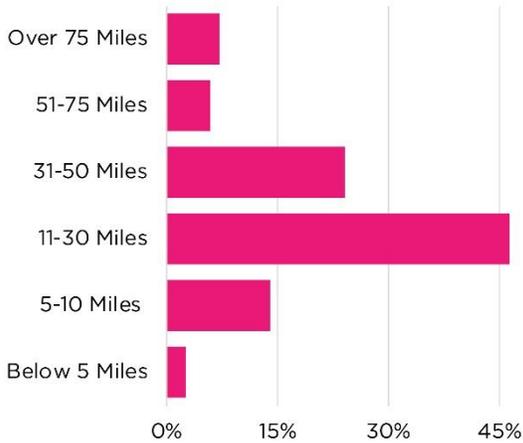


TOP 10	TOTAL DRIVES	# EVENT DAYS	HIGHEST OPT-IN % PER EVENT
JPMorgan Chase	2,243	14	35% VORYS 
Cardinal Health	698	6	
The Ohio State University	655	4	
Huntington Bancshares	651	4	
Alliance Data	519	4	
Columbus International Auto Show	466	4	
American Electric Power (AEP)	440	5	
L Brands	413	2	
CAS	348	2	
Nationwide Children's Hospital	280	2	
Grange Insurance	279	2	

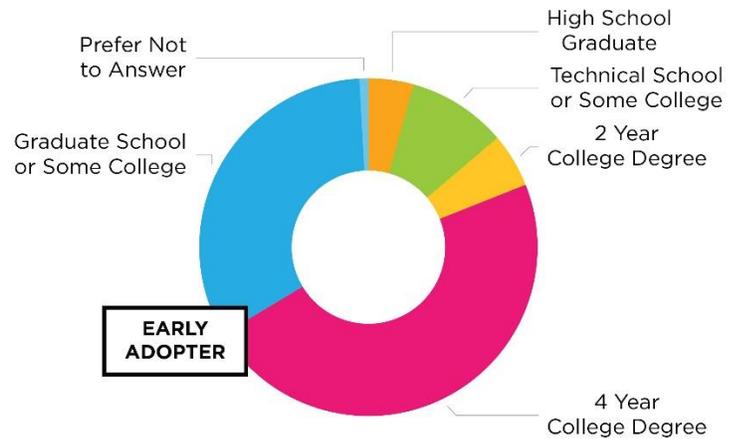


- By bringing the R&D to 77 unique locations over two years, a diverse group of drivers were encouraged to go electric. Drivers lived in a variety of locations in Ohio (and a few across the U.S.), but the highest concentration lived in Franklin County, with most others in the surrounding regions. Of those who participated, 62% identified as male and 35% identified as female. Also, 14% of participants already drove an EV but were interested in trying other models.

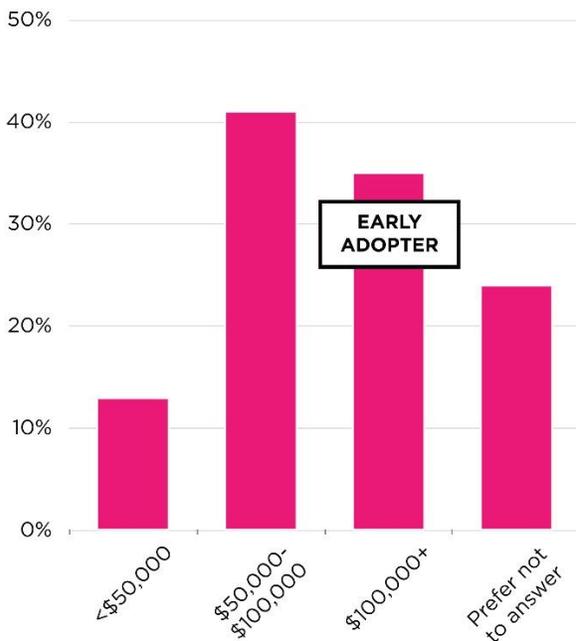
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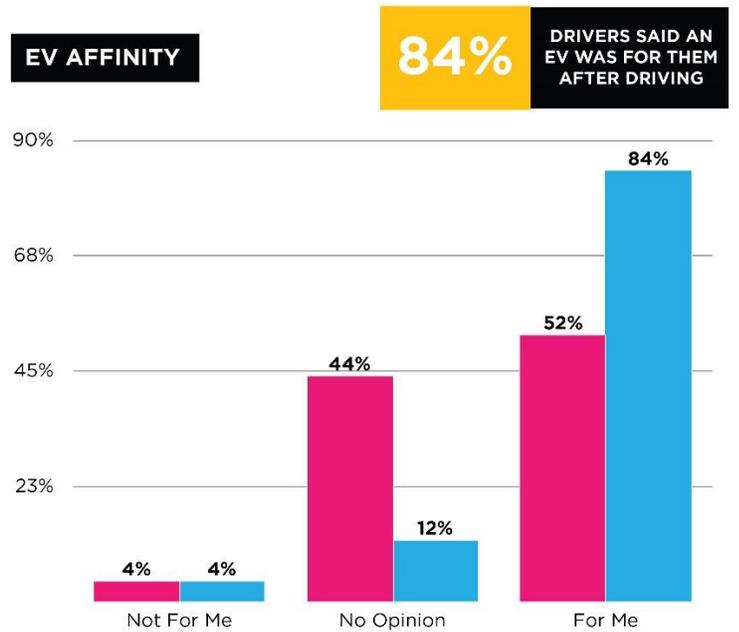
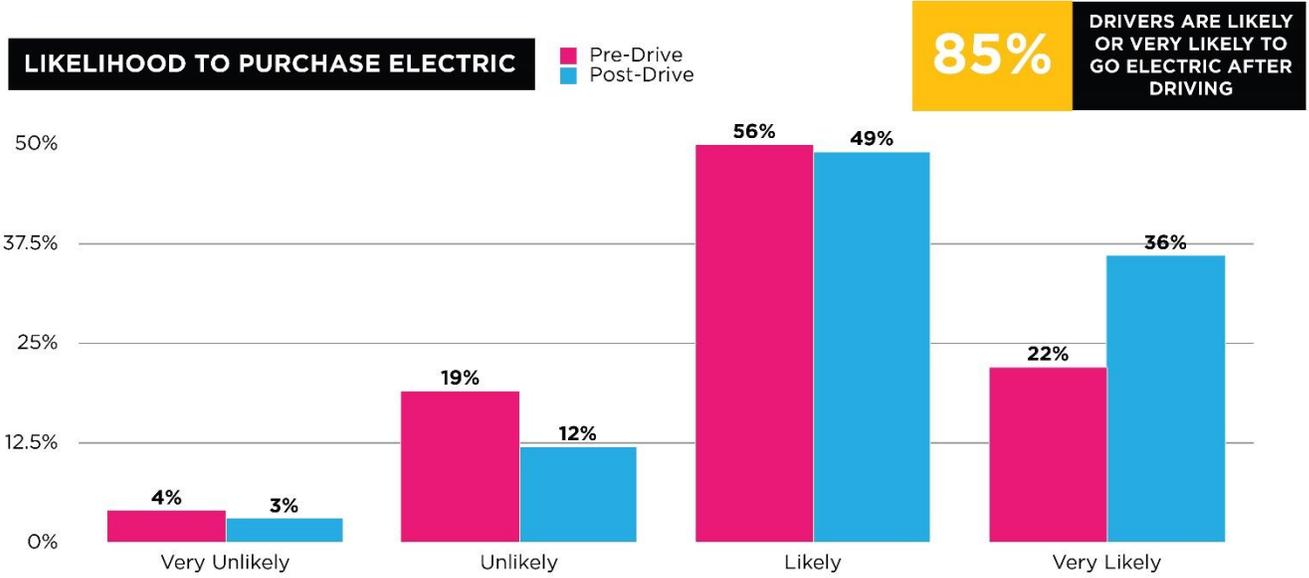
EDUCATION



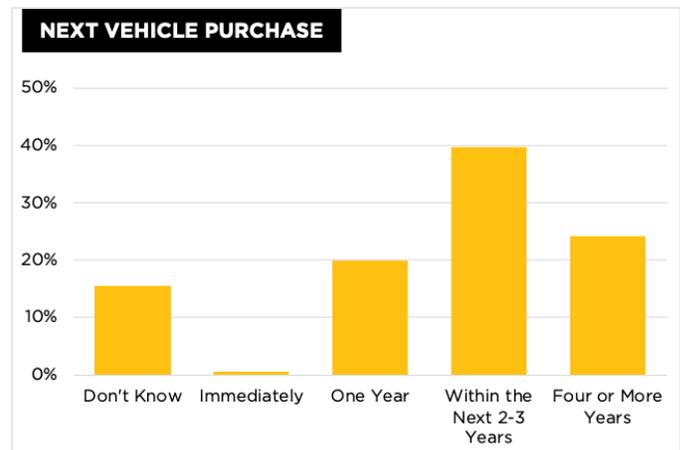
INCOME



- The data suggests the test drive experience successfully changed mindsets about EVs. Below you will find the pre-drive and post-drive attitudes of participants as it related to preference, charging habits and likelihood to purchase an EV. During the program there were a few drivers who bought an EV the next day (one even bought the EV they drove the same day).



- Our survey data suggests drivers are far more likely to go electric after their test drive experience with Smart Columbus. At each event, drivers had the opportunity to elect or “opt in” to be contacted by a dealer or vehicle provider for more information on the car they drove. Approximately 13% of total test drivers opted-in to be contacted by a dealer about the vehicle they test drove. When taking into account only 50% of participants completed the post-drive survey, this percentage is even more impressive. The amount of dealership leads generated through the events also supports the idea that many participants are seriously interested in going electric within the next year. Interestingly, opt-ins are most correlated to drivers that had one of the following characteristics:
 - Completed a four-year degree;
 - Identified as a female;
 - Reported a salary of over \$100,000; or
 - Drove the Jaguar I-Pace.
- In addition, 60% of participants are planning to purchase a vehicle in the next three years. This data validates the program changed minds and will continue to increase EV adoption for years to come.



Impacts and Lessons Learned:

- The Ride & Drive Roadshow Final Report is available [here](#).
- Ride & Drive Roadshow events are a critical platform for education, awareness, lead generation, and market assessment.
- Identifying areas of improvement throughout the program is important. Smart Columbus updated Product Specialist trainings and created incentives for post-drive survey completion.
- After partners have hosted two Ride & Drive events within 12 months, they are substantially less likely to be interested in hosting again. The market for this event becomes saturated at repeat hosts. Consider a smaller event footprint with a condensed fleet once you get to this point to enable more community events and smaller locations that have not yet been served.
- Special events outside of the regular workday Ride & Drive framework (i.e. conferences) can lower participation.

Strategy 4.3.2 – Workplace Electric Vehicle Adoption Campaign

Substrategy 4.3.2.1 – Acceleration Partners Program

Program Highlights:

- The program launched with 38 partners in late 2017 and has since grown to 70 organizations from diverse sectors including finance, consulting, healthcare, non-profits, higher education, insurance, consumer goods, restaurants, industry, energy, communications, and technology. Of our partners, 11% are non-profits. Partners are distributed across the region and over 95% of their facilities with 200+ employees are located within Franklin County. There is a large concentration of partners in the downtown Columbus area and adjacent multi-modal friendly neighborhoods. About 1/4 of partners are located in transit friendly suburban locations. Over 3/4 of total partner facilities are located in areas with safe convenient access to transit or other modes beyond a personal automobile.

WHY IS YOUR ORGANIZATION INVOLVED IN SMART COLUMBUS?	
CEO/ Leadership Interest	95%
Community Engagement / CSR	89%
Sustainability/ Environmental Stewardship	84%
Mobility Innovation is Strategically Important	53%
Positive PR	47%
Regional Competitiveness	42%
Talent Attraction/ Retention	21%

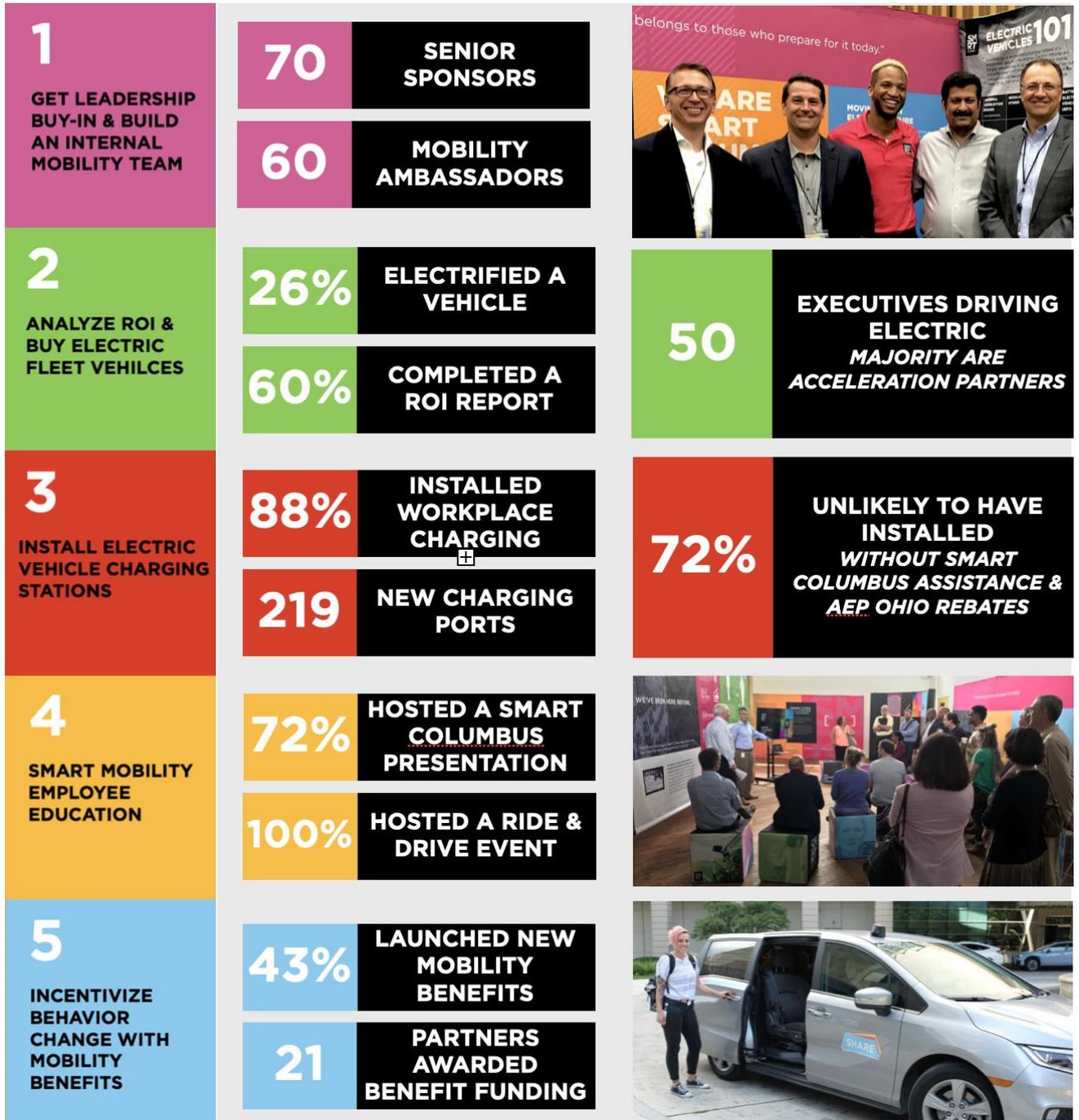


- Acceleration Partners were challenged to complete the five goals below by the end of 2020. Current goals include:
 - Designate a senior sponsor to empower an internal, cross-functional team that uplifts program commitments.
 - The senior sponsor serves as the internal sponsor of Smart Columbus engagement on behalf of their company, providing updates to C-Suite leadership and removing internal barriers that delay progress.
 - Senior sponsors select an individual or group of individuals from different departments to serve as a [Mobility Ambassador](#) for the organization. The Mobility Ambassador(s) serve as an empowered project manager responsible for helping their organization meet Acceleration Partner Goals.
 - Conduct a feasibility assessment for fleet electrification and encourage senior leaders to model the way by driving electric.
 - Telematics is leveraged to provide data-based electrification recommendations for specific use cases.
 - Install EV charging infrastructure at all major workplaces with over 200 employees.
 - According to the Department of Energy, employees are 600% more likely to go electric with access to workplace charging. A best practice is to provide charging access at two percent of parking spaces and lay conduit in new parking structures to cost effectively prepare for future demand.
 - Educate employees about driving less and driving electric.
 - At a minimum, partners are invited to host a presentation with Smart Columbus staff, and an EV Ride & Drive event for employees to test drive in a low-pressure educational environment.
 - Incentivize employee behavior change by implementing a mobility benefit package based off employee commuting behavior and preference data.

Impacts and Lessons Learned:

- These outcomes speak to the power of collective action to achieve real results quickly. Methodology used to mobilize change makers within partner organizations is detailed in subsequent sections. As of March 2020, these partners completed all five program goals: The Columbus Zoo & Aquarium, AEP, Huntington Bancshares, Denison University, Alliance Data, OhioHealth, and CAS. An additional 20% of partners have completed four of five original goals.





- The final report the Acceleration Partner Program complete with case studies, key considerations, and lessons learned is available here. <https://smart.columbus.gov/electric-vehicle-consumer-adoption/acceleration-partner-program-final-report>

Substrategy 4.3.2.2 – Workplace Campaigns (Ignite Action Fund)

Program Highlights:

- The Smart Columbus 'Ignite Action Fund' (IAF) is a tool for Acceleration Partner Program organizations to fund new incentives and/or projects that motivate respective company associates to drive electric and/or drive less. The purpose of the fund is to accelerate the timeline for launching new mobility benefits by reducing a barrier- cost. The IAF aims to empower individual companies to take ownership of their

	SOV Commute Reduction Incentives	Electric Vehicle Adoption Incentives	
Battelle	Funding Awarded Source: Smart Columbus Acceleration Fund	Funding Awarded Source: Paul G. Allen Philanthropies	Alliance Data *Two Applications Approved
The Columbus Zoo & Aquarium	\$106k	\$122k	The Columbus Zoo & Aquarium
CoverMyMeds			AEP & AEP OHIO
Denison University			The Columbus Partnership
Steiner + Associates	Applications Approved	Applications Approved	Dispatch Media Group
State Auto Insurance	13	10	A&R Creative Group
OhioHealth			JadeTrack
White Castle			Cardinal Health, Inc.
Huntington Bancshares	Actual Funds Reimbursed	Actual Funds Reimbursed	Advanced Drainage Systems, Inc.
JPMorgan Chase	\$61k	\$63k	
Chemical Abstracts Service (CAS)			
Fahlgren Mortine			
Encova Insurance			

contribution to achieving the goals of Smart Columbus and create a portfolio of best practices across multiple companies that can be shared with other cities, NGOs and employers. Organizations who are part of the Smart Columbus Acceleration Partner Program with an active Executive Sponsor and Mobility Ambassador are eligible to receive funding. Funding must go towards associates in the central Ohio seven-county region to align with the Smart Columbus project area.

- The Acceleration Partner Program and the first round of IAF funding model was inclusive to both drive electric and drive less projects. Electrification projects were generously funded by PGAFF while 'drive less' projects were funded through the Smart Columbus Acceleration Fund. The Acceleration Fund is made up of contributions and aligned investment from private sector partners. For more details on program design, view the Acceleration Partner Program final report <https://smart.columbus.gov/electric-vehicle-consumer-adoption/acceleration-partner-program-final-report>
- Pilots and programs deployed with Ignite Funding provide benefits and/or education. Examples include:

- 80% discounted transit passes for full- and part-time associates;
- New or used EV purchase/lease rebate from \$1,000 to \$4,000 per person, \$200 home EV charging station rebates, and \$125 electric/non-electric commuter bicycle rebates;
- Per-day incentives to reduce single occupancy vehicles (SOVs) leveraging carpool and mode shift smart phone app, Gohio, provided by MORPC at no cost;
- Expanding or deploying tech-enabled micro-transit shuttle routes with a local start-up, SHARE; and
- Educational events highlighting the importance of driving less and embracing smart mobility.



Impacts and Lessons Learned:

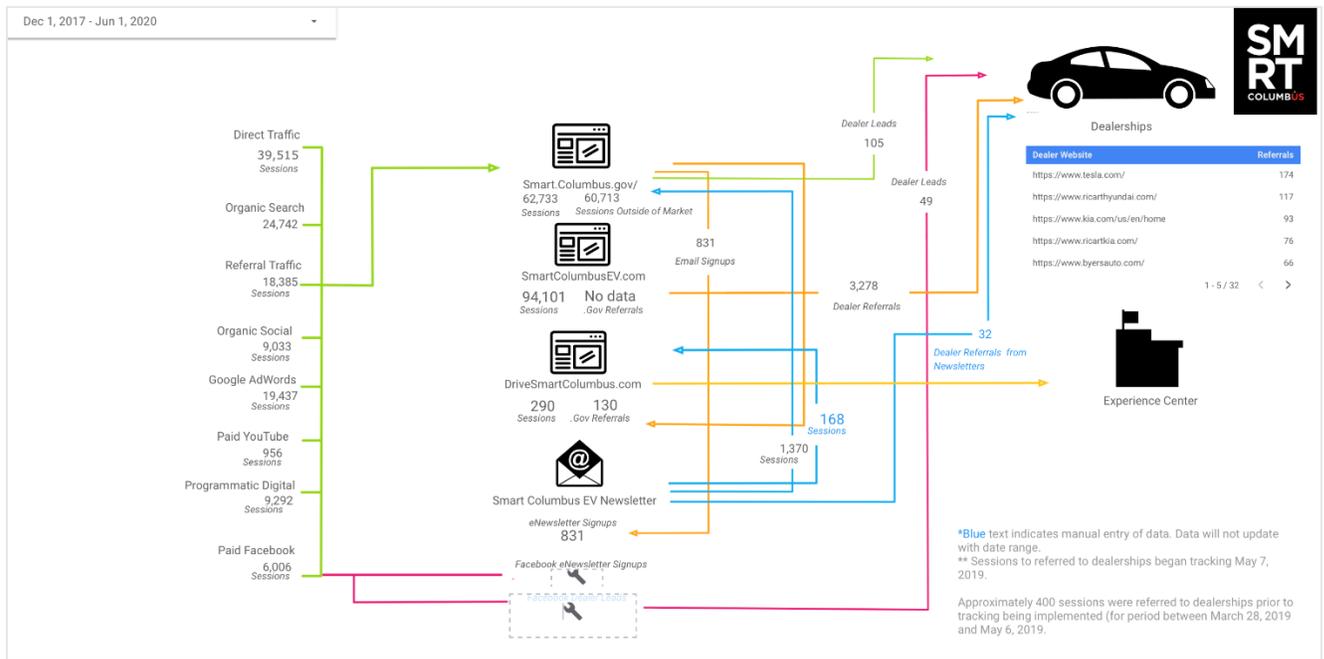
- More than \$105,650 of funding has been awarded to 'drive less' projects at 13 partner companies to reduce SOV commutes and the average award was \$8,000. An additional \$121,850 was awarded to help associates of nine partner organizations 'drive electric' and the average award was \$12,000. Alliance Data was awarded funding to support an EV rebate twice: first in Round 1 and again in Round 5. All EV rebate projects are complete and a total of 55 vehicles were purchased/leased. There are two projects underway in 2020 focused on SOV reduction.
- EV rebates are a strategic tactic for employers to increase workplace satisfaction and retention, while reducing commuter emissions and embracing the future of mobility. This benefit was offered by companies of all sizes including A&R Creative Group, a small Columbus-based restaurant group, who generously offered a \$4,000 rebate to their employees through a program called 'Too Legit to Emit'.
- Alliance Data was an early adopter of workplace charging, with over 20 stations at one complex. They offered a \$2,000 (post-tax) EV rebate for all their associates in the Columbus region, and a \$1,000 (post-tax) rebate enterprise-wide. Their internal team leading this program included representatives from HR, event planning, and communications.
 - Alliance Data hosted a Ride & Drive Roadshow event and an EV 101 lunch and learn with Smart Columbus team announcing the program. After the launch, Alliance Data promoted their program heavily and proactively shared residential charging rebate info and frequently asked questions on their intranet. Alliance Data was the first partner to offer an EV rebate, and they helped build a template for other partners to follow.
- Additional funding proved a successful method to increase associate EV adoption on an accelerated timeline. However, less than half of Ignite Action Fund-supported EV Rebate participants self-reported they bought or leased an EV within 12 months because of the employer rebate program. Other program managers designing incentive programs for mobility innovation may have a higher ROI investing in SOV reduction projects than personal EV purchase/lease rebates.

Strategy 4.3.3 – Consumer Focused Education Campaign

Substrategy 4.3.3.1 – Website

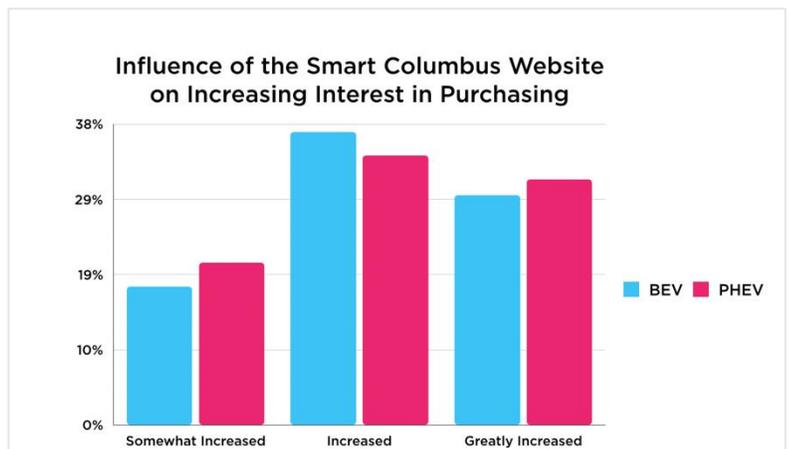
Program Highlights:

- The Smart Columbus website had over 115,000 visits during the Electrification Program. The site drove more than 3,200 clicks to Electrified Dealer websites, helping to spread awareness of and demand for EVs available in central Ohio.



Impacts and Lessons Learned:

- The Navigant/Guidehouse research found that 70% of early adopters who visited the Smart Columbus website said it either Increased or Greatly Increased their interest in BEVs or PHEVs.
- The site’s original content management system (CMS), Ektron, was preferred by the City of Columbus Department of Technology, because it is the CMS that the rest of the city’s website is built in. However, the Smart Columbus team found the CMS dated and onerous to develop in and maintain. The team incurred significant setbacks to timeline and budget based on the time and effort it takes to code a website in Ektron. Smart Columbus rebuilt the website in Drupal, which was significantly easier and more affordable to develop in and for the team to maintain without agency assistance.



Substrategy 4.3.3.2 – Digital Education

Program Highlights:

- The Smart Columbus education campaign, “A Vehicle to BelIEVe In” had a budget of \$900,000 for creative development and media. The campaign ran in the seven-county Columbus region from September 7, 2018, through December 31, 2019.
- Campaign performance compared to industry benchmarks:
 - The campaign’s YouTube “View Rate” (how many YouTube users chose to watch the ad vs. the “skip”) of 42% exceeded the industry range of 15-30%
 - The Paid Search campaign exceeded Google’s automotive industry benchmark. Paid Search generated 17,258 clicks to site with a 5.19% overall CTR, exceeding Google’s automotive industry benchmark of 4%
 - The programmatic click through rate (.08% for the year) slightly exceeded the automotive industry benchmark (.06%)
- The campaign was named a finalist in PProve Media’s North American SABRE Awards, the largest PR award program in the world.

CAMPAIGN KPI SUMMARY							
KPI Goals	Goals	Jan – Mar 2019 Actuals	Apr – Jun 2019 Actuals	Jul – Sep 2019 Actuals	Jan 2020 Actuals	Campaign Total	+/-
#15 Campaign Impressions	14,195,000	10,288,761	9,727,490	3,841,147	4,186,470	28,043,868	+13,848,868
#16 Campaign Engagements	931,152	459,101	288,489	136,477	407,680	1,291,747	+360,595
#17 Smart.Columbus.gov Website Referrals	74,000	7,400	22,168	10,420	5,254	45,242	-28,758
#17.2 SmartColumbusEV.com Website Referrals	11,900	n/a	n/a	7,473	292	7,765	-4,135
#18 Dealer Leads (forms)	153	14 Unique 15 Total	4 Unique 4 Total	5 Unique 5 Total	0 Unique 0 Total	55 Unique 104 Total	-98 Unique -49 Total
#18.2 SmartColumbusEV.com Dealer Referrals (clicks to dealer)	1700	692 Total 622 Unique	1,318 Total 1,214 Unique	1,008 Total 936 Unique	109 Total 102 Unique	3,127 Total 2,874 Unique	+1,427 Total +1,174 Unique
#18.3 SmartColumbusEV.com View Deals	235	525 Totals 295 Unique	560 Totals 326 Unique	396 Totals 201 Unique	47 Totals 21 Unique	1,528 Totals 843 Unique	+1293 Total 808 Unique
eNewsletter Signups	191	88 Total 81 Unique	130 Total 129 Unique	134 Total 133 Unique	54 Total 54 Unique	717 Total 705 Unique	+526 Total +514 Unique

Impacts and Lessons Learned:

- Smart Columbus convened a group of industry advisors to inform the development of the EV Consumer Education Campaign. Advisors helped to inform three pillars of messaging: 1) Range and charging availability, 2) Total cost of ownership, and 3) Fun to drive. The creative campaign was calibrated based on advisor feedback to include more people and lifestyle shots.
- Ad spending should consider added value opportunities. Our consumer education campaign spend was leveraged with Sinclair Media Group (local ABC and FOX affiliates) to secure significant added value media. Sinclair provided four on-air segments on Smart Columbus Electrification Topics and an incredible 6-to-1 ratio of added value to paid spots, helping Smart Columbus' media budget to stretch much further.
- Rather than prioritizing lead capture, create a landing page for all digital campaign traffic that drives clicks to the websites of Electrified Dealers. This will allow users' digital journeys to continue closer to the moment of sale, but in a more self-directed way.
- Throughout the campaign, no single creative concept performed above the rest. Analyzing the final results, it was found that 60% of Programmatic conversions had more than 1x interaction and 68% of all Programmatic conversions came 12-30 days after the first interaction. Our hypothesis is that this long delay matches the length of the EV buyer journey. This shows the importance of retargeting and having a variety of creative versions and placement options.
- The campaign's media mix and messaging succeeded in reaching early adopters in the seven-county region and inspiring them to take further action online. The research on audiences was leveraged to target individuals through paid tactics and to speak to the barriers of purchasing an EV.
 - In terms of driving measurable dealer intent actions, the combination of paid search, programmatic digital advertising and Advanced TV (streaming) had the best overall cost-per-action.
 - The overall best value came from local partnerships (radio influencer and local broadcast). Not only did both mediums provide the largest reach and frequency at the lowest cost, they delivered significant added value impressions and in-kind production.
 - Testing lead generation ads on Facebook far exceeded our expectations. The tactic was continued for the remainder of the campaign.
 - Videos on paid social fell below our expectations for dealer intent actions generated, as it was expected that this tactic would perform on par or better than Programmatic.
 - Waze generated 156 navigations to the Experience Center, though there are no comparable benchmarks to measure this performance against.



Strategy 4.3.4 – EV Loyalty Program

Program Highlights:

- Smart Columbus distributed all 1,000 EV owners' gifts to new EV owners via Electrified Dealers. The gifts included:
 - A Smart Columbus-branded water bottle;
 - A Smart Columbus-branded blanket;
 - A Smart Columbus-branded tote bag;
 - An EVIP window cling;
 - A packet of gift cards and coupons from local retailers and restaurants offering EV charging; and
 - A brochure for new owners that included information on Smart Columbus as well as how to install home charging and find charging on the go.

Impacts and Lessons Learned:

- Effectiveness of this program was not tracked, as responses were not collected by the dealerships that distributed the owner's gifts. Anecdotally, it was successful.

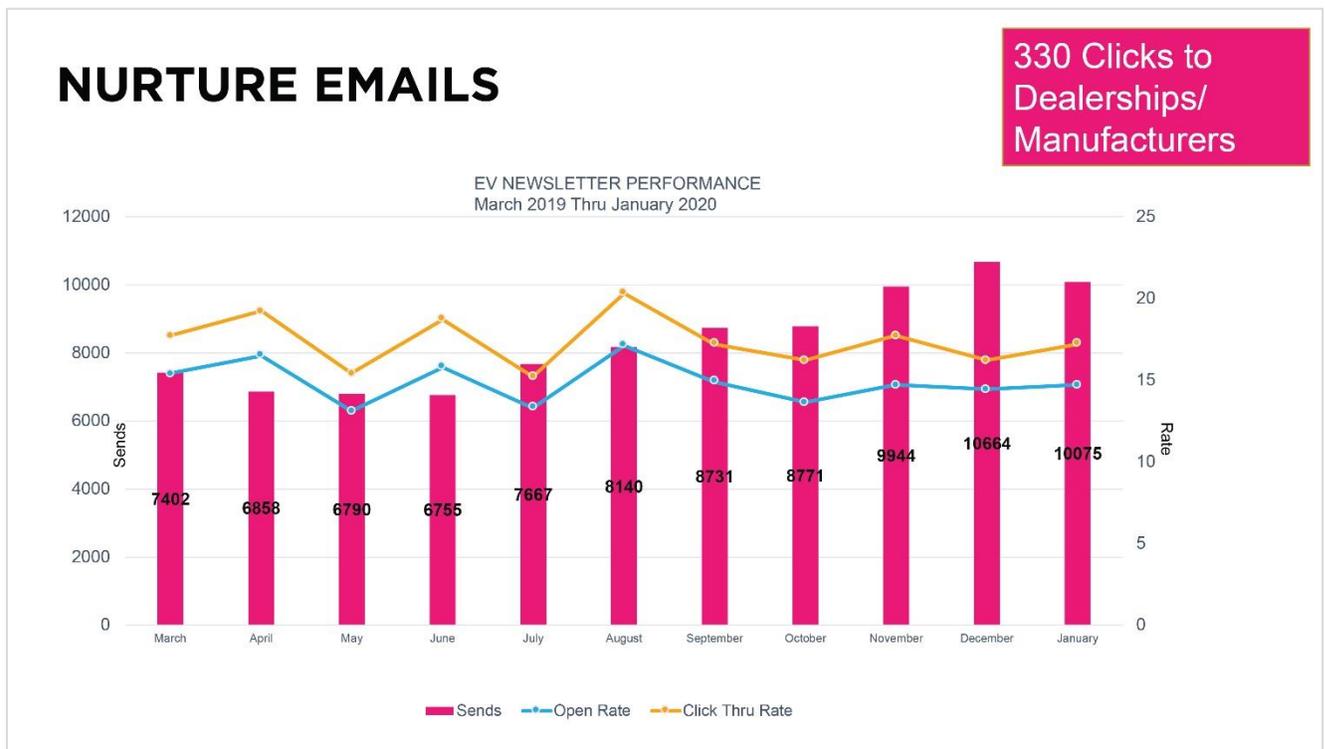


Initiative 4.4 – Improving Consumer Sales Experience of EVs

Strategy 4.4.1 – Lead Management and Sales Support

Program Highlights:

- The Smart Columbus lead management platform drove 3,605 referrals to dealer websites. This was accomplished through multiple avenues; however, the most impactful was the SmartColumbusEV.com website, which produced 3,275 of the total referrals.
- Tesla and larger dealerships with multiple brands were the dealerships that received the most referrals.
- Of the total 3,606 dealer referrals, 154 were direct leads from the Smart.Columbus.gov website.
- The Smart Columbus Ride & Drive Roadshow converted 1,528 people to opt-in to be contacted by a local dealer or OEM. This was a huge plus to dealerships, who saw increased sales interest.
- Test drives at the Smart Columbus Experience Center and the Ride & Drive program captured 10,230 valid email addresses. These addresses were put into an email nurturing program to continue to reach test drive participants with education on EVs. Participants received a monthly email featuring news on EV model releases and charging station openings, owner testimonials, special offers from Electrified Dealers, and invitations to test drive a vehicle at the Smart Columbus Experience Center. The 11 email newsletter sends resulted in 330 clicks to dealer websites.



Impacts and Lessons Learned:

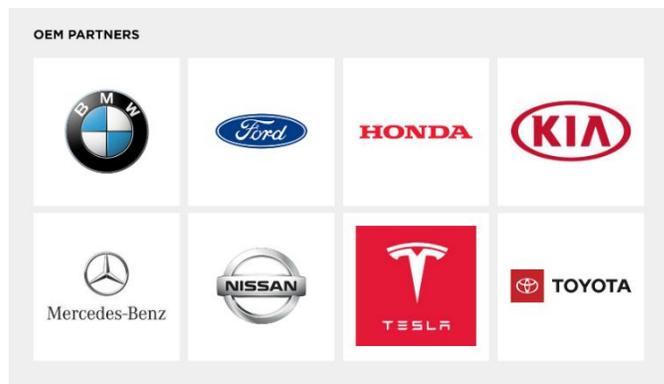
- Dealerships observed that customers were increasingly arriving with their mind already made up about what car they want to buy based on independent research and vehicle experience separate from the dealership. Smart Columbus proposed an online education and marketing strategy for Year 2 that meets the customer where they are in the consideration phase and added a co-promotion component to the proposed Smart Columbus dealer certification program to increase the advertising activity of EVs in the region.
- When a sales lead is generated through a Ride & Drive event or other interventions, the turnover of the lead is critical, but it needs to be thoughtfully done. Smart Columbus bought a file transfer protocol (FTP) site for secure transfer of contact information and conducted direct follow-up with OEMs and dealerships to ensure sales leads were received and follow-up was being conducted.
- Our initial lead generation strategy did not gain traction, likely due to the fact that people were asked to share their personal information with a dealer. A critical pivot was made to use the Smart Columbus website and other platforms to refer people to the dealer's websites and drive traffic in that manner. This was a game-changer in strategy; the program completed with over 3,000 digital referrals to dealer websites, dwarfing the 154 leads that required personal information.

Strategy 4.4.2 – Dealer Preparedness and EV Readiness

Substrategy 4.4.2.1 – Dealer and Original Equipment Manufacturers (OEM) Engagement

Program Highlights:

- Through a two-pronged approach engaging with OEMs and dealerships, Smart Columbus increased the number of models available in the region from 18 to 25, an increase of nearly 40%.
- Through a deep engagement with OEMs and dealers, many vehicles were able to be acquired on loan at no cost, which were made available for test drives at the Smart Columbus Experience Center and the Smart Columbus Ride & Drive Roadshow.



Impacts and Lessons Learned:

- Because the State of Ohio does not utilize a ZEV program, the Smart Columbus team had to develop strategies to influence consumer behavior, such as leveraging relationships and connections to top leadership at OEMs to make the case for why the supply of EVs should be increased for Columbus. In addition, regular and ongoing meetings with OEMs and dealers were held to monitor inventory levels and advocate for increased supply.
- Engagement with both dealers and OEMs was critical to the overall success of the program. OEM's often wanted to be sure dealers were engaged and included in the programming before they engaged, and dealers often wanted OEMs involved before they began participating. The key takeaway being, a two-pronged approach is required when engaging dealers and OEMs, it will be difficult to get anything out of one without the participation of the other.

Substrategy 4.4.2.2 – Dealer Certification

Program Highlights:

- Smart Columbus certified 32 local dealers, or 40.5% of all the dealers in the seven-county Smart Columbus footprint. See Appendix E for a full list of dealers.



- Smart Columbus created an entire suite of resources for dealers, called the “Dealer Toolkit.” This included materials that dealers were required to use as part of certification; however, many of the resources provided were also optional, but would add value to the dealership.
- Through a program audit, our team learned that customer experience ratings improved 37% when they spoke to Smart Columbus trained staff at Electrified Dealers.



Impacts and Lessons Learned:

- Dealers latched onto short-term incentives. It was important to emphasize the leads and marketing value to dealers throughout the entire program.
- Dealers required a high level of touch and a lot of attention to execute objectives. This is in many ways due to the incentives that employees have, like salespeople who do not have any incentive to sell EVs. The naturally short-term goals of the organization are also a tough barrier to get through, as educating on EVs takes a more long-term approach.
- It required engaging all levels of the organization to drive results. Even if an owner or general manager is on board, it is important to engage mid-level management and sales floor employees to truly drive results.



Substrategy 4.4.2.3 – Smart Columbus Dealership Certification EV Sales Training

Program Highlights:

- Dealer staff made clear that they felt more comfortable and confident on the topic of EVs and EV charging after completing the Smart Columbus training.
- Smart Columbus Electrified Dealer training raised dealer staff general knowledge on EVs by 40%.

Impacts and Lessons Learned:

- The dealer survey environment was highly protected and including Smart Columbus research questions on existing surveys or adding a new survey to the environment was not preferred. Smart Columbus pivoted the measurement focus to the sharing of data about sales performance and customer demographics and applied a survey and assessment framework to the dealer trainings.
- OEMs have varying approaches and beliefs on how to best market, educate and sell EVs. This manifests itself in their approach to dealer training (i.e. some brands intentionally avoid all conversation about charging, while others embrace it and ensure it is a part of their conversation with every customer.)

- Dealer staff needed constant engagement to keep EVs present; therefore, Smart Columbus conducted the EV training twice a year, rather than just one training event.
- The EV space and the program was constantly evolving and improving. This required our team to keep the sales training dynamic and adjust to the current needs of the industry and the program. The training presentation was modified often throughout the program.

WHAT DO STAFF THINK?

QUESTIONS ON THE EFFECTIVENESS OF THE TRAINING	Yes	No	Unsure
Do you feel you have a more complete understanding of EVs after completing these trainings?	100%	0%	0%
Do you feel you have a more complete understanding of charging after completing these trainings?	100%	0%	0%
Overall, do you feel more confident in selling EVs after completing these trainings?	97%	0%	3%

Staff increase knowledge by 40% on key EV topics during training. The data also shows staff are finding value in the presentation and are better understanding the most important questions customers ask.



Strategy 4.4.3 – Group Purchase Programs

Program Highlights:

- Created six group purchases over the period of the program.
 - AEP Ohio launched a \$3,000 discount for their customers on the purchase of an all-electric 2018 Nissan LEAF at participating Ohio Nissan dealerships;
 - Buckeye Honda or Lindsay Honda launched a \$2,000 discount on the Honda Clarity if the customer mentioned Smart Columbus;
 - Nissan created an incentive for \$2,500 off a 2019 Nissan LEAF e-plus for residents in Franklin County or the six contiguous counties;
 - Nissan created a \$3,500 incentive for residents of the seven-county region for the 2019 Nissan LEAF when they mention Smart Columbus;
 - Mitsubishi North Columbus created an incentive for \$6,500 off a 2018 Mitsubishi Outlander PHEV; and
 - Ricart Kia created an incentive for \$500 off a Kia Niro.



Get \$6,500 off MSRP on the 2018 Mitsubishi Outlander Plug-in Hybrid from Mitsubishi North!

Mention Smart Columbus for discount information; see Dealer for details.
columbusmitsu.com

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Drive your Ambition

SM
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COLUMBUS

Impacts and Lessons Learned:

- Incentives matter when people consider purchasing an EV but incentives are close to non-existent in the state of Ohio for EVs. Worked out specific incentives with dealers and OEMs for the market to increase adoption.
- While group purchases can provide good discounts, they are often difficult to negotiate and sometimes difficult to market to consumers without the advertising budgets of OEMs and dealers. Overall, group purchases were found to be better suited for fleet conversions rather than consumer adoption. In simple terms, the ROI for sales was not there.

PRIORITY 5 – CHARGING INFRASTRUCTURE

Objective: Support the acceleration of EV adoption through installation of charging infrastructure, with the goal of 925 new charging ports by the end of the grant period.

Goal Progress:

PRIORITY INDICATORS	GOAL	LIFE OF PROGRAM PROGRESS
5.1 – Residential EV Charging Ports	150 Level 2	88 Level 2
5.2 – Public Access EV Charging Ports	175 Level 2 75 DCFC	160 Level 2 36 DCFC
5.3 – Workplace EV Charging Ports	260 Level 2	39 Level 1 374 Level 2 6 DCFC
5.4 – Fleet EV Charging Ports	265 Level 2	207 Level 2 4 DCFC
TOTAL EV CHARGING PORTS INSTALLED	850 Level 2 75 DCFC 925 Total	39 Level 1 829 Level 2 46 DCFC 914 Total
5.5 – Building & Zoning Changes to Support EV Charging	12 site plan test cases	28 site plan test cases

Program Highlights:

88 MULTI-UNIT DWELLING (MUD) CHARGING PORTS INSTALLED AT 21 SITES THROUGH THE CITY'S PROGRAM



REDUCED THE CITY'S BUILDING & ZONING SERVICES STANDARD PERMITTING PROCESS FOR EV CHARGING STATIONS FROM 20 DAYS TO 10 DAYS



321 LEVEL 2 PORTS AND **32** DC FAST CHARGING PORTS WERE ACTIVATED TO DATE THROUGH AEP OHIO'S EV CHARGING STATION INCENTIVE PROGRAM

NREL completed an [EVI-Pro Analysis report](#) on charging EVs in Columbus in February 2018. The maps below show existing and potential future charging locations in August 2017.

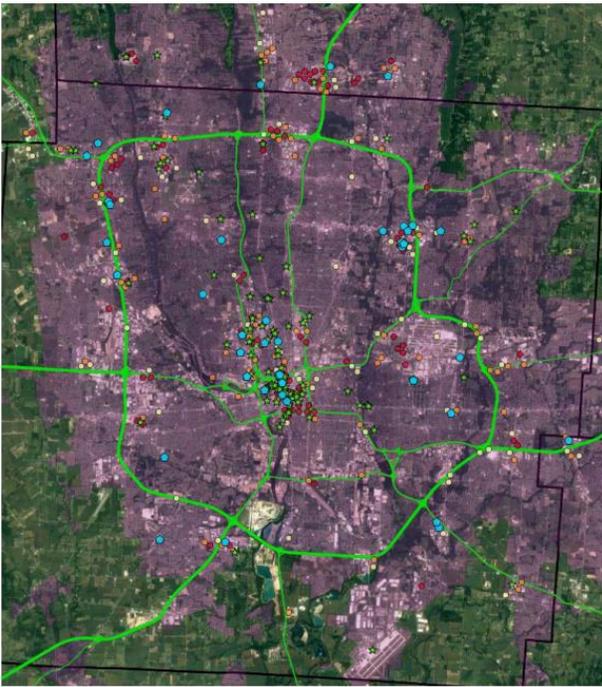


Figure 24. Simulated PEV charging "hot spots" for L2 public charging (0.3-mi diameter) color coded by tier (1st tier = red, 2nd tier = orange, 3rd tier = yellow), existing L2 EVSE (blue pentagons), and future sites under consideration by local planners (green stars). Purple outline denotes Columbus urban area.

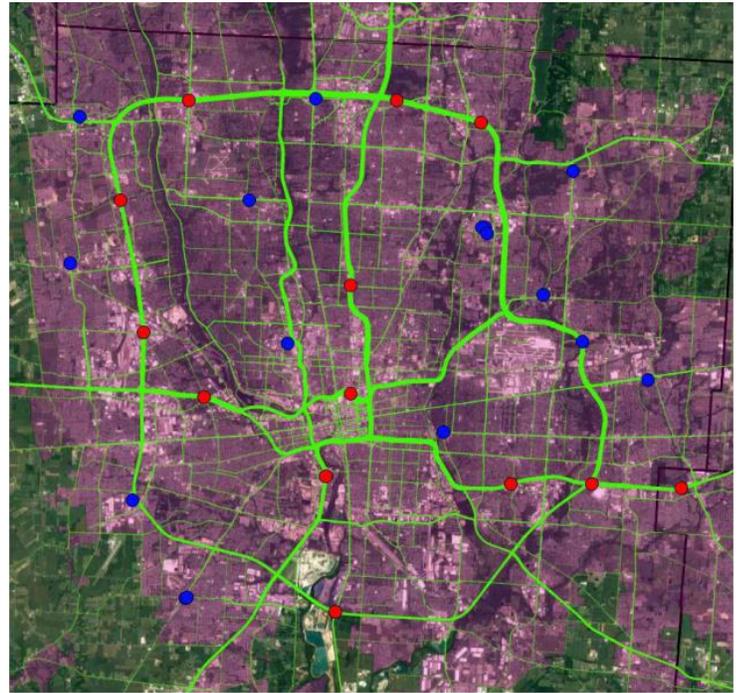
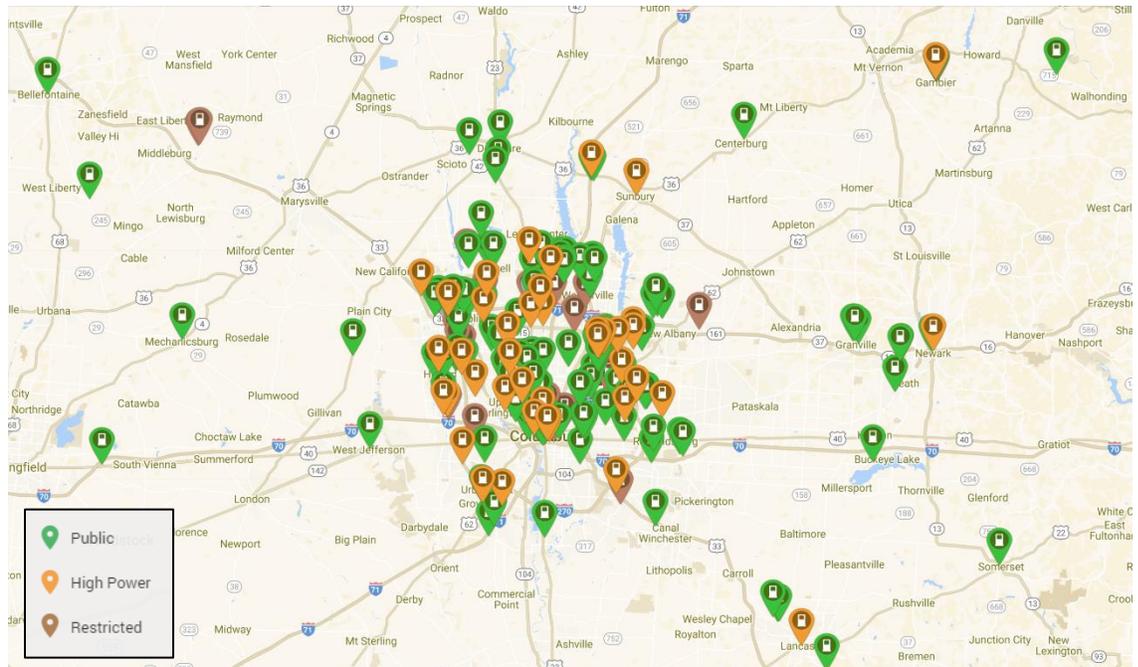


Figure 25. Sixteen existing DCFC station locations in Columbus as of August 2017 (blue dots) and 13 hypothetical future locations to improve DCFC coverage (red dots). Purple outline denotes Columbus urban area.

As of July 2020, PlugShare reported over 560 public, workplace and MUD charging stations in Columbus. More information and the interactive map can be found [here](#).



Columbus Charging Stats

- ▶ 562 Total Stations
- ▶ 20 Free Stations
- ▶ 47 New Stations (90 days)
- ▶ 106 Fast Chargers
- ▶ 46 CHAdeMO Plugs
- ▶ 56 CCS Plugs
- ▶ 46 Superchargers
- ▶ 353 J-1772 Plugs

Top Charging Networks in Columbus

- ▶ ChargePoint 187 stations
- ▶ Supercharger 46 stations
- ▶ Tesla Destination 36 stations
- ▶ Greenlots 22 stations

Lessons Learned:

- Smart Columbus needed to promote the installation of EVSEs prescribed to open data standards for charging networks (open network protocol) because the EVSE hardware purchased and installed during the program needed to remain functional as networking companies change pricing and services offered. Smart Columbus required an open network protocol in the Public Access Charging RFP. Research should continue to determine if other forms of charging will benefit from requiring an open network protocol.
- Incentive programs can and will, unintentionally or not, compete against one another if the programs are not coordinated and presented in partnership. The Smart Columbus MUD charging program showed a temporary drop-off in applicants due to the timing and offering of the AEP EV Charging Incentive Program. Once the charging programs coordinated and worked out how applicants could apply for funds from both programs, applications increased.
- Mapping of charging installations is a key tool in tracking progress. There are many ways to go about this, but it seems the least complex and most accessible options work the best. GIS, Google Earth and Google maps are tools used in this project to assist with mapping of charging data in some form. Google maps has been used more as information is shared out to a broader audience because of ease of use for all parties involved.

AEP Ohio EV Charging Station Incentive Program

Program Highlights:

- AEP Ohio's EV Charging Station Rebate Program was authorized by PUCO in April 2018 and launched in August 2018. The program initially targeted the installation of 300 L2 stations and 75 DCFC stations through its four-year duration. Of the \$9.5M total program funding for rebates, \$3.7M is allocated for L2 stations, and \$5.8M is allocated for DCFC stations. The program incentivizes installations of network-connected charging infrastructure at government, commercial and multi-family locations. The program is currently working with three EVSE vendors: ChargePoint, Greenlots, and EV Connect.

LOCAL GOVERNMENT



Incentives for Level 2 Chargers – Max 6 Ports/Customer
Lesser of \$50,000, 100% eligible project costs, or \$10,000 per port.

Incentives for DC Fast Chargers – Max 2 Stations/Customer
Lesser of \$100,000, 100% eligible project costs, or \$100,000 per station

WORKPLACE CHARGING



Incentives for Level 2 Chargers – Max 6 Ports/Customer
Lesser of \$30,000, 50% eligible project costs, or \$5,000 per port

Incentives for DC Fast Chargers – Max 2 Stations/Customer
Not eligible

OTHER PUBLIC CHARGING



Incentives for Level 2 Chargers – Max 6 Ports/Customer
Lesser of \$50,000, 80% eligible project costs, or \$10,000 per port

Incentives for DC Fast Chargers – Max 2 Stations/Customer
Lesser of \$100,000, 80% eligible project costs, or \$50,000 per station

MULTIFAMILY COMPLEX



Incentives for Level 2 Chargers – Max 6 Ports/Customer
Lesser of \$45,000, 75% eligible project costs, or \$7,500 per port

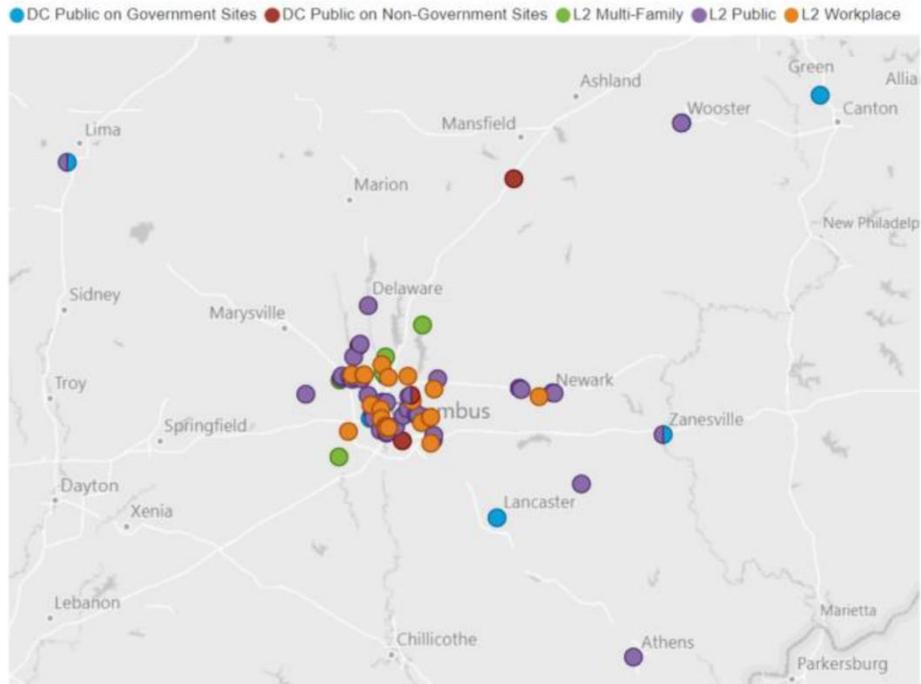
Incentives for DC Fast Chargers – Max 2 Stations/Customer
Not eligible

- Incentives vary with the type of project, whether multifamily, public or workplace and can be applied to offset charging infrastructure costs, including initial installation costs and hardware, and EVSE network service costs. Incentives are reserved upon submittal of complete applications and are paid after projects are activated and complete final applications are submitted. *See Appendix F for the application.*
- The earliest applications were submitted in mid-to-late August with the first activated sites providing charging sessions in May 2019. The program is essentially fully subscribed and has activated 321 Level 2 ports and 32 DC fast charging ports as of July 2020.

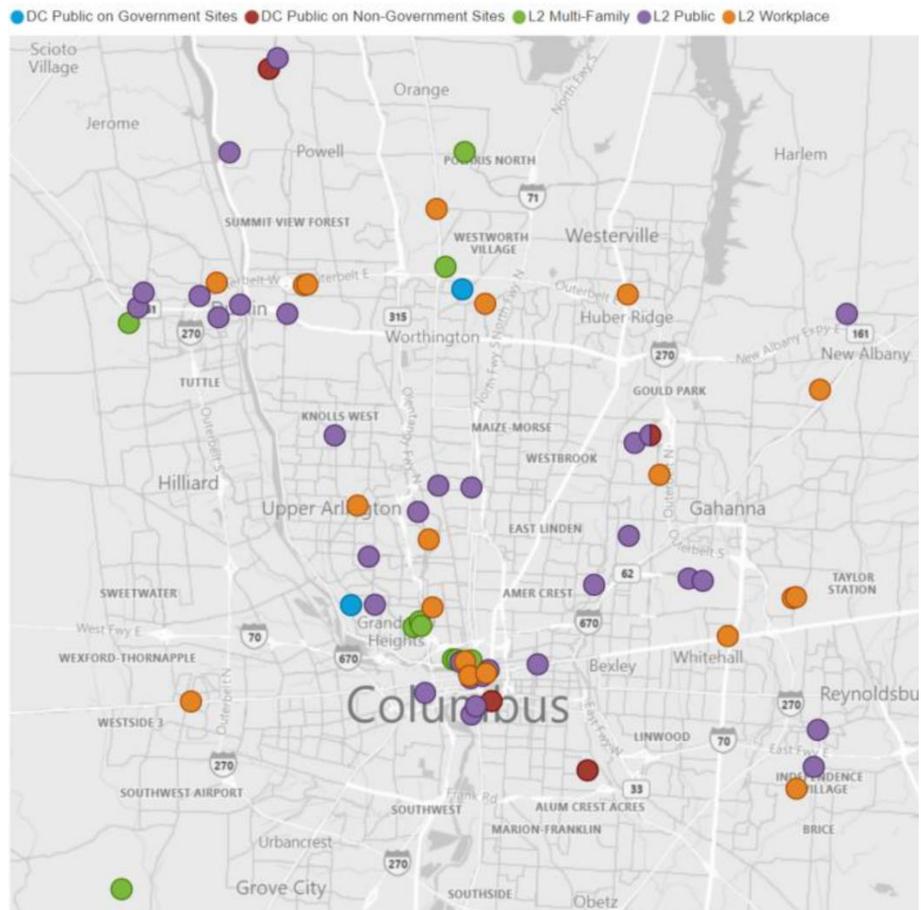
AEP OHIO EV CHARGING STATION INCENTIVE PROGRAM

Type of Charging	Number of Projects Approved	Number of Ports/Stations Under Review or In Design	Number of Ports/Stations Activated	Total Number of Ports/Stations
MUD	27 Level 2	12 Level 2 ports; 6 stations	72 Level 2 ports; 36 stations	84 Level 2 ports; 42 stations
Public	77 Level 2 54 DCFC	94 Level 2 ports; 46 stations 56 DCFC ports; 56 stations	122 Level 2 ports; 67 stations 32 DCFC ports; 32 stations	216 Level 2 ports; 113 stations 88 DCFC ports; 88 stations
Workplace	59 Level 2	100 Level 2 ports; 52 stations	127 Level 2 ports; 64 stations	227 Level 2 ports; 116 stations
TOTAL	163 Level 2 54 DCFC	206 Level 2 ports; 104 stations 56 DCFC ports; 56 stations	321 Level 2 ports; 167 stations 32 DCFC ports; 32 stations	527 Level 2 ports; 271 stations 88 DCFC ports; 88 stations

Map 1 – Installations across AEP Ohio Service Territory

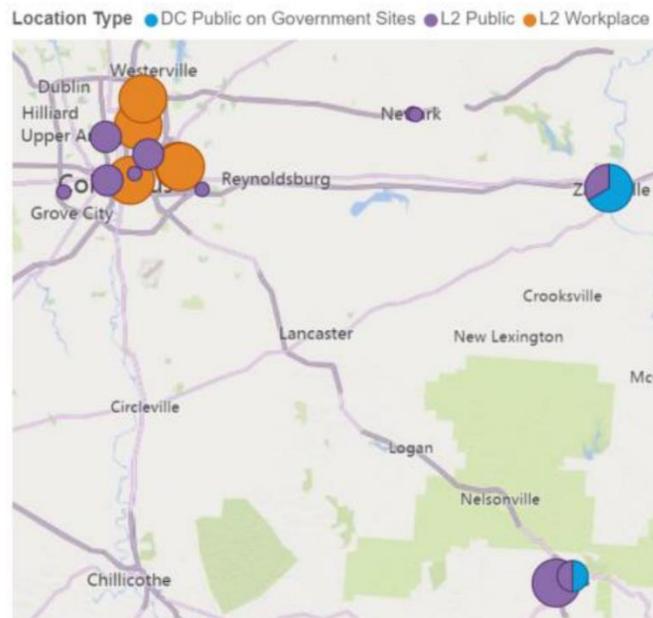


Map 2 – Installations within Columbus Metro Area



- AEP Ohio is maintaining a wait list of customers with preapproval applications pending, and those customers could become eligible for consideration should dollars become available as actual costs for projects underway fall below projected costs, or if reserved projects are not completed.
- AEP Ohio prepared its first annual report on the program for the PUCO, through May 2020. See Appendix M for the report.
- A map of the low income geographic areas can be accessed on the AEP EV website: <https://aepohio.com/save/business/ElectricVehicles/>. Eighteen percent of the applications are for charging stations in low income geographic areas.

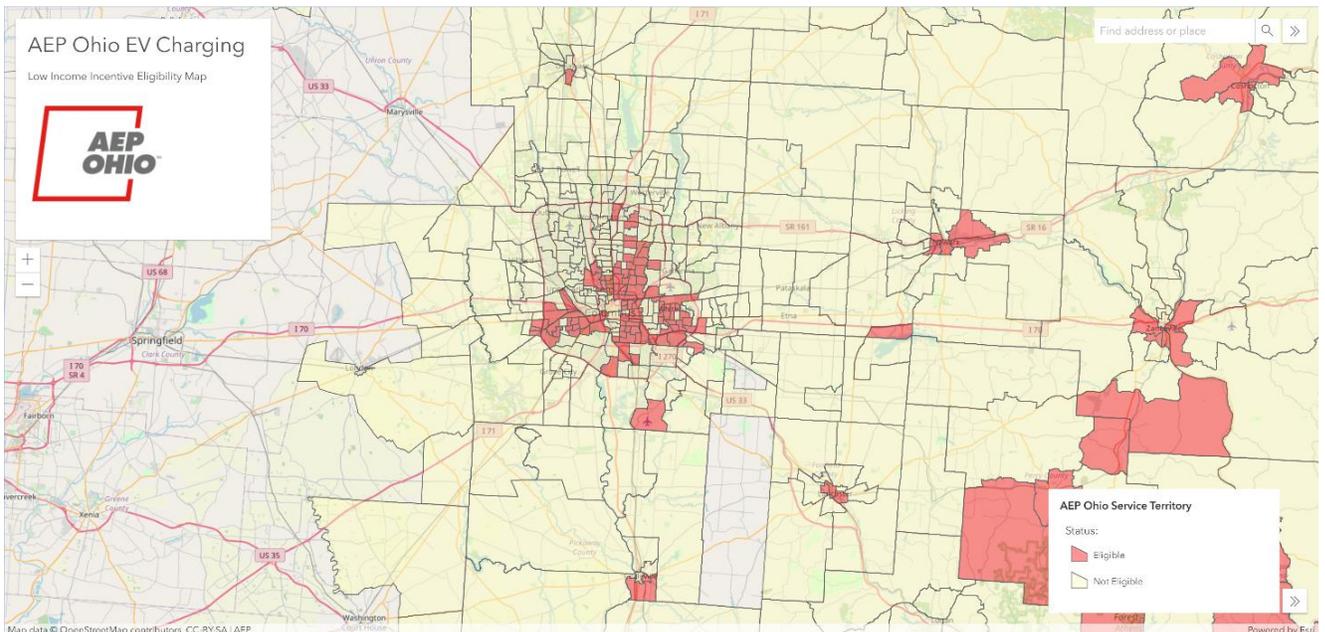
Map 3 – Installations within Low Income Geographic Areas
 (Map Bubble Size by Number of stations, 3 stations being the largest)



18% of total stations are located in Low-Income Geographic Areas

11% of DCFC stations are located in Low-Income Geographic Areas

19% of L2 stations are located in Low-Income Geographic Areas



Impacts and Lessons Learned:

- Utility regulatory practices are unique for every circumstance investigated. Complexities around asset ownership and maintenance require thoughtful deliberation and consideration when designing a Utility program supporting EVSE infrastructure. AEP worked concurrently with regulatory schedules and plans to have the program design-ready if the regulatory approvals occurred.
- Greater program flexibility to respond to market interest should be considered - public, workplace, MUD - as opposed to targeted allocations.
- Research around reconciling data flows between meters and charging stations
- A consistent approach to check meter configurations for charging station installation is needed. Changed program design to install one check meter per power source, rather than one meter per station.
- Incomplete applications required more review time because the requirements were not clear. Revised the online application to identify that drawings were needed with the initial application and further clarified the branding requirement.
- When the PUCO authorized the Smart City Rider (Cases 16-1852-EL-SSO and 16-1853-EL-AAM) to recover costs associated with technology demonstration projects for EV charging stations and microgrids, it provided for a midstream review of the program.
 - Level 2 Charging: Reopened all categories and removed target allocations for rebates to allow the highest interest of public charging need to be met and providing more customer access to EV charging.
 - DC Fast Charging: Increased the incentive limit per customer from 5% (\$475,000) to 10% (\$950,000).
 - DC Fast Charging: Clarified the definition of public charging to include customers who provide transportation to the public such as mass transit, shuttle buses for communities/airports/taxis or other public serving transportation.



OPERS



YELLOW CAB OF COLUMBUS



TOLLES CAREER CENTER

Westerville Commercial PowerUp EV Supply Equipment Rebate Program

Program Highlights:

- In 2018, the City of Westerville Electric Division developed and launched their [Commercial PowerUp EVSE](#) Rebate Program in alignment with the City Council-approved sustainability-focused initiative to encourage and expand EV charging throughout Westerville business locations, as Westerville has experienced some of the highest EV adoption rates in the seven-county region. The program offers a \$4,000 rebate for installing a dual-port Level 2 or DC Fast Charging ChargePoint station. Customers must share their charging data as a requirement for the program to provide Westerville Electric with critical data for future load growth.



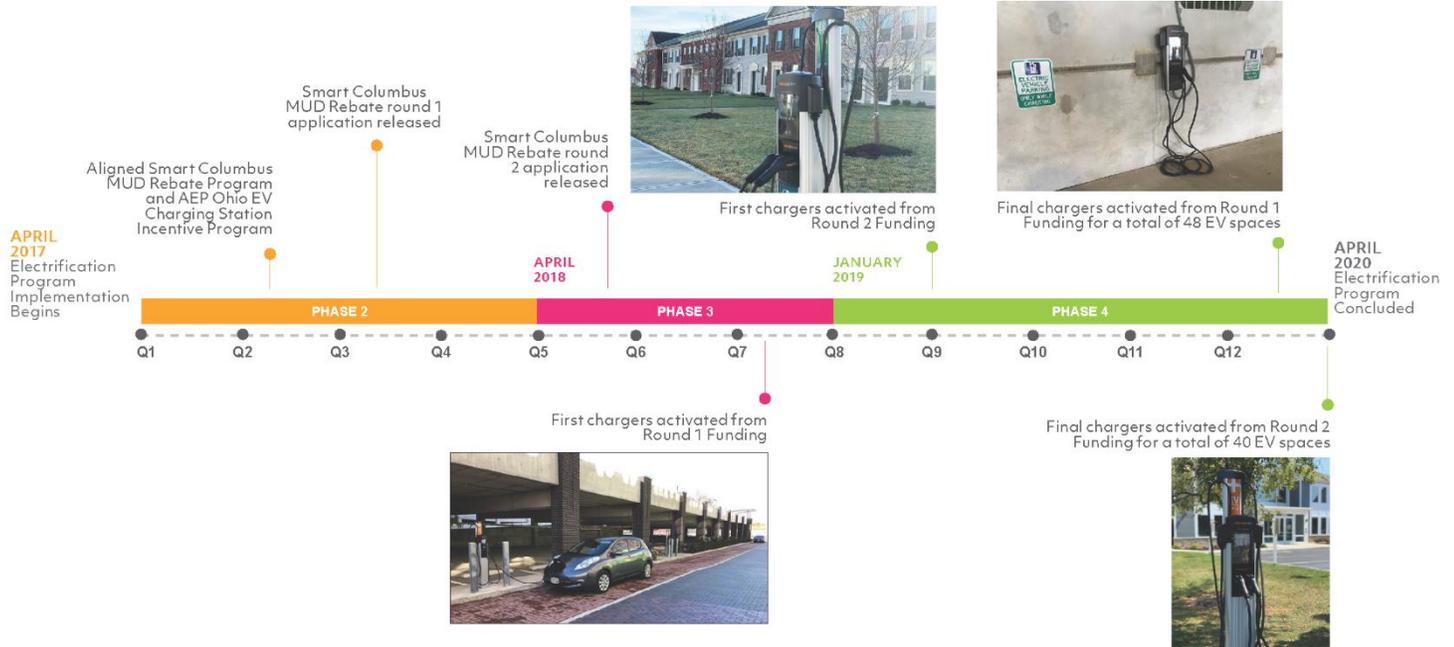
- As of June 2020, there were 14 active ports participating in the program located across commercial business and MUD locations. The program offers flexibility to station owners regarding the ability to charge for use and to make stations public or private. The City of Westerville has several stations available for public use located next to a public park. Most stations are offered free of charge as a benefit to employees or residents. Stations with fees are focused on reducing charging idle time and encouraging turnover. The charging stations adjacent to Hoff Woods Park at LakeShore Cryotronics (575 McCorkle Blvd.) are available for public use. Users at LakeShore pay a price-per-kWh.
- ChargePoint's comprehensive information dashboard provides key data metrics such as station statuses, real-time power draw, energy consumption, and daily demand load profiles among several others. The City continues to monitor key data points from the dashboard to better understand particular customer charging behaviors and how this may affect their distribution system. The City plans to continue to market the program in an effort to expand charging availability throughout Westerville and the resulting charging data flow. They also have plans to install several more City-owned charging stations strategically throughout the town.
- If you have any questions related to the EVSE Rebate Program, please call the Westerville Electric Division at (614) 901-6700, email at EVSErebates@westerville.org or visit the program website at www.westerville.org/powerup.



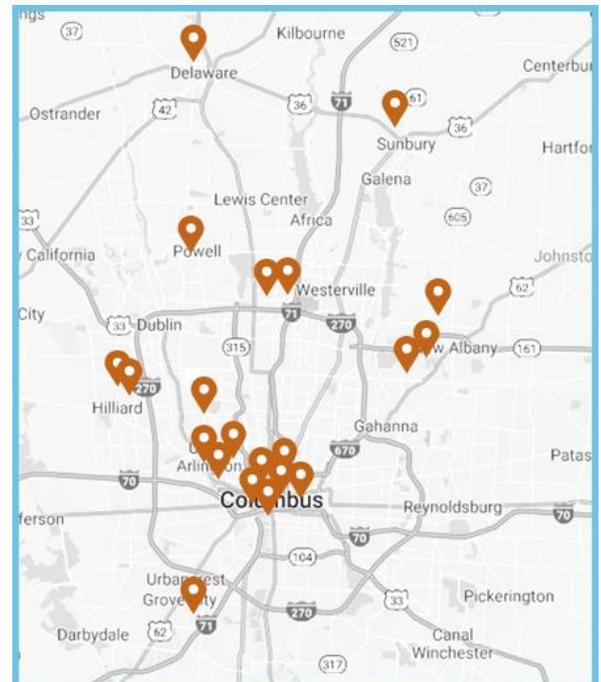
Initiative 5.1 – Residential Charging

Strategy 5.1.1 – Develop Multi-Unit Dwelling (MUD) Infrastructure Plan

Program Highlights:



- Smart Columbus launched the MUD Rebate program to provide home charging access for those who live in apartments or condos. The program awarded funding to apartment and condominium developers and owners in the seven-county region. Rebates could be redeemed for a value of up to \$3,500 per plug or parking space. A rebate application along with EVSE guidance documents were available on the Smart Columbus website. Emails were sent to various stakeholders and outreach was continually performed to build awareness of the program.
- In total, two funding rounds gave way to the installation and activation of 88 ports at 21 MUD locations in the greater Columbus region. Entities securing and utilizing funding included forward-thinking developers and community owners. Entities securing funding included: Nationwide Energy Partners, The Champion Companies, Casto, Nationwide Realty Investors, [Kaufman](#), The Pizzuti Company, T&R Properties, LC and Arlington Crossing. Smart Columbus received applications for funding that exceeded the total funding secured for the MUD program proving the demand for charging in apartment and condominium living is high.



PROJECTS AWARDED IN ROUND 1

Developer	Entity Name	Site Address	# of EV Spaces	Activation Date
SP+*	Neil Avenue Garage (NWD Investments)	300 Neil Avenue Columbus, OH 43215	4	12/28/2018
SP+*	John McConnell Garage (NWD Investments)	355 John McConnell Blvd. Columbus, OH 43215	4	12/28/2018
SP+*	Grandview Yard North (NWD Investments)	1125 Rail Street Grandview Heights, OH 43212	4	12/28/2018
SP+*	Chestnut Street Garage (NWD Investments)	44 E. Chestnut Street Columbus, OH 43215	4	12/28/2018
SP+*	Arena Crossing Garage (NWD Investments)	425 N. Front Street Columbus, OH 43215	4	12/28/2018
Champion*	Sunbury Pointe Endeavors, LLC	2183 Rushmore Lane Sunbury, OH 43074	6	11/4/2019
Champion*	Oak Creek Apartments LLC	9000 Oak Village Blvd. Lewis Center, OH 43035	6	7/12/2019
Casto	Riverside Sunshine LLC	260 McDowell Street Columbus, OH 43215	4	11/20/2018
NEP*	Villages at Britton LTD	4115 Britton Parkway Hilliard, OH 43026	4	12/26/2019
Kaufman**	Gravity Project, LLC	500 W. Broad Street Columbus, OH 43215	4	12/19/2018
Kaufman	Polaris	801 Polaris Parkway Columbus, OH 43230	4	5/20/2019
TOTAL			48	

*Also receiving a rebate from the AEP Ohio EV Charging Incentive Program

**Also receiving a rebate from the Columbus DOP's Residential EV Charger Rebate Program

PROJECTS AWARDED IN ROUND 2

Developer	Entity Name	Site Address	# of EV Spaces	Activation Date
NEP*	Preserve Crossing	6400 Preserve Crossing Blvd. Columbus, OH 43230	4	12/26/2019
NEP*	Market Street	7079 Market Street New Albany, OH 43054	4	12/26/2019
NEP*	Villages at New Albany	770 Bayton Place New Albany, OH 43054	4	12/26/2019
Pizzuti*	Smith Tandy	3443 Park Street Grove City, OH 43123	4	3/22/2019
T&R Properties*	Flats on Houk LLC	1000 Solomon Square Delaware, OH 43015	4	9/12/2019
SP+*	Grandview Yard South	975 Rail Street Grandview, OH 43212	2	4/25/2019
SP+*	Grandview Yard West	960 Bobcat Avenue Grandview, OH 43212	4	4/25/2019
NEP*	Arlington Crossing	3175 Tremont Road Columbus, OH 43221	4	11/18/2019
Champion*	Greyson at Hickory Chase	4460 Mountain Laurel Drive Hilliard, OH 43026	6	3/21/2020
Champion*	Powell Crossing	147 West Olentangy Street Powell, OH 43065	4	Installed, not yet activated
TOTAL			40	

*Also receiving a rebate from the AEP Ohio EV Charging Incentive Program

- Program funding helped to not only purchase and install EVSE for MUDs, but also support the education of developers, property owners and residents alike. Literature developed by equipment distributors and communities will continue to support future adoption of chargers at MUDs in the future. See *Appendix G – EV Residential Charging Flyer* for an example of what was given to developers, and *Appendix H – Gravity – New Charging Stations Flyer* for example flyers made by the developers for residents.



CHAMPION – SUNBURY POINTE
ENDEAVORS, LLC



NEP – MARKET STREET



NEP – VILLAGES AT
NEW ALBANY

- In 2019, stations reporting usage reported 45,255 kWh used to charge resident vehicles. As of July 2020, slightly over half-way through the calendar year, stations reporting usage have provided residents with 28,823 kWh. This includes a significant drop-off in charging energy and events in mid-March correlated to work from home policies enacted as part of the response to COVID-19. For the duration of the Smart Columbus Program through July 1, 2020, the Smart Columbus MUD chargers have provided 64.8 MWh of energy during a total of 5,049 charging sessions.
 - Smart Columbus has developed a charging data dashboard for the Smart Columbus MUD program chargers and City of Columbus Fleet Chargers. See the link below to explore the dashboard. The location type filter at the top of the page can isolate the MUD charging data from the fleet charging data. Visit the [Smart Columbus MUD and City of Columbus Fleet Charging Data Dashboard](#) for more details.
- AEP Ohio installed 72 Level 2 MUD ports through their EV Charging Station Incentive Program. An additional 12 Level 2 MUD ports are under review, in design or being installed. Many developers took advantage of both the city and AEP Ohio's programs, as shown in the charts on the previous page.

Impacts and Lessons Learned:

- Developers learned that ensuring parking garages and parking spots where EVSE would be installed were “EV ready” proved to allow for significant savings during the installation process. Ensuring sufficient wiring and electric panels made the installation process quicker and allowed for cost-savings.
- EVSE vendors that provided educational sessions for community owners and residents aided in a greater acceptance and understanding of the equipment, EVs, and the future trends of increased EV adoption.
- Developers and community owners faced challenges with permitting from the State of Ohio. Communities installing EVSE emphasized that selecting an installer that had experience in EVSE installations was key to ensuring a smooth installation process. Electricians with previous EVSE experience were key to an easier process.
- Demand for MUD EV Charging exceeded the Smart Columbus incentives available during the grant period. In a growing city, creating EV ready policies and incentives make properties more attractive and can be a cost saver for developers. Many developers didn't have a defined EV charging strategy early on as part of their business, or a strong internal knowledge about the EVSE landscape - market need, technology, suppliers, revenue models, etc. When they applied for funding, they were making assumptions for community needs and interest, equipment providers, demand for stations, usage, etc. The application process required them to discuss key questions (who should own stations, how much revenue could be generated, what is the payback, which technology provider is best, how many stations are needed, how often will they be used, etc.) which helped them develop a business model.
- Work with rebate recipient and EVSE vendor/installer to ensure proper electrical capabilities are available at the MUD site. Smart Columbus provided rebate recipients with tools and resources to ensure their MUD facility has proper electrical capabilities.
- Urban locations are challenging due to parking limitations: 1) In some locations where space is tight, revenue is gained from the parking spots and they do not want to lose that revenue by assigning it an EV spot. 2) In condo communities, parking is typically assigned/owned by a specific tenant. This forces them to locate a station outside or further away, which increases the installation cost or limits the number of stations/plugs they can typically install.
- In early conversation, developer and vendor need to make sure the developers are willing to provide access for data portal for charging data. Get agreement upfront for developer to provide access to the data.

Strategy 5.1.2 – Residential Charging Research and Assessment

Program Highlights:

- The DOP’s EV Charger Rebate Program was for residential customers, including multi-unit dwellings, only. This program has ended, but funds have been reserved for the final eligible project which has plans to install six chargers in the parking garage.

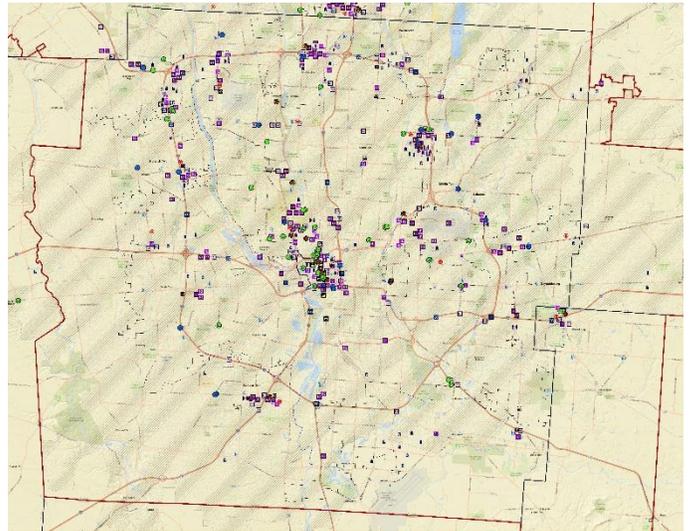
Impacts and Lessons Learned:

- There are homeowner permits needed to install a residential charging station. Columbus DOP included this information within their applications for the Residential EV Charger rebate.

Initiative 5.2 – Public Access Charging

Program Highlights:

- 136 Level 2 and 36 DC Fast Chargers were installed for public access charging through the program in the seven-county region.
- At the onset of the program, NREL provided the City of Columbus with information that enabled a charging station siting study. This study was an important tool to help determine charging station goals for this priority. Detailed information about this is found in the case study at the following link:
<https://smart.columbus.gov/playbook-assets/electric-vehicle-charging/finding-the-right-locations-for-public-access-electric-vehicle-charging-in-columbus>
- In program Q1 (Q2 2017), as part of the ODOT 2G roadway improvement project (FRA-70-14.56), the City of Columbus requested four locations in downtown Columbus be made EV-ready for future EV chargers. The locations were on both sides of Mound Street just west of S. 4th Street and on E. Fulton Street just east of S. 4th Street and just west of S. Grant Avenue. EV-readiness in this case included designing all underground conduit, wiring, and the electrical distribution equipment.
- Engineering design for the EV ready sites was completed in November 2017 and updated in October 2018.
- In November 2017, development began on an RFP for a Public Access Charging Pilot Project for DC Fast Charging at Mound and Fulton Streets. The RFP looked for charging companies to install and operate chargers at up to four EV ready sites provided on Mound and Fulton streets. *See Appendix I for the RFP and Addendums.*
- The RFP was released on November 14th, 2018, with submissions due on December 17th, 2018. There were three viable responses to the RFP, with [Greenspot EV](#) being the awardee.
- Greenspot EV received an NTP in July 2019 for the Public Access Charging project on Fulton Street in downtown Columbus. Greenspot EV selected Über.Energy as the EVSE installation contractor for two [BTCPower 50 kW DCFC units](#).
- On January 14, 2020, Smart Columbus, together with CCAD, the Columbus Foundation and Greenspot EV, dedicated Columbus' first DC fast chargers available in a public right-of-way and open to public use. Visit <https://smart.columbus.gov/news/dc-fast-chargers-for-electric-vehicles-now-available-to-public-in-columbus> for the news release.



- As a part of a branding class, CCAD students designed a public art sculpture that was built around one of the DC fast chargers.
- Installed and activated 122 public Level 2 charging ports to date through the AEP Ohio EV Charging Station Incentive Program. In addition, 32 DC Fast Charging ports have been activated. Additional public charging projects are under review, in design or being installed for 94 Level 2 ports and 56 DC Fast Charging ports.
- In December 2019, Nationwide Children's Hospital installed four public DC Fast Chargers in a parking lot along Livingston Avenue, south of Downtown Columbus. These are 50kW ChargePoint chargers with both [CHAdeMO](#) and CCS combo plugs with cord management.
- In February 2019, Tesla installed 10 Superchargers and 10 publicly accessible Level 2 ports at the Columbus Convention Center parking garage.



- In June 2020, COTA activated 12 EV charging ports, including six at their Northern Lights Park & Ride location and six at Northland Transit Center.



- At this time, the City of Columbus is working to finalize agreements with Greenspot EV and Yellow Cab of Columbus to place DC Fast and Level 2 chargers to be used for public charging and electric ride share vehicles.

Impacts and Lessons Learned:

- Pursuing public EV charging-only type projects will take time in order to allow for needed legislation. The city began adding charging infrastructure to projects already programmed for construction in order to reduce the need for additional legislation, mobilization and construction time. However, even with these projects, the charging installation was still subject to the main project's construction schedule and delays. Consider the size and scale of the ongoing infrastructure projects. Matching projects of similar scale may be the best way to prevent either project from significantly delaying the other.
- When using a public siting study to determine ideal public access charging locations, the Smart Columbus team had to further analyze an EV concentration located in Hilliard, Ohio, caused by a local business' national vehicle lease program. Keep unique local characteristics in mind when utilizing EV adoption data.
- Relying heavily on external funding sources for public charging means KPIs and project schedules are often controlled by the funding source. With the [VW settlement funds for Ohio](#), the first charging program was released on June 30, 2020, approximately three months beyond the end of the grant program.
- Commercial interest in public corridor DC Fast Charging has started to grow, but companies are hesitant to take this on without some form of outside funding due to the riskier business case to date (high capital and energy costs with uncertain demand).
- Prior to contract negotiation, determine what form the contract should take (city template, vendor template, etc.) and then set a schedule for development and review by project teams and attorneys. Also, formalize the scope set in the RFP in order to prevent add-ons that should be included as separate contracts.
- Attempt to coordinate potential DCFC projects with both public and private stakeholders in order to prevent redundancy, especially during the early adoption market phase.
- When placing charging stations at a facility, sub-metering is an important consideration to help understand true building energy efficiencies and allow for multiple agencies at a site, such as a garage, to manage their own chargers.



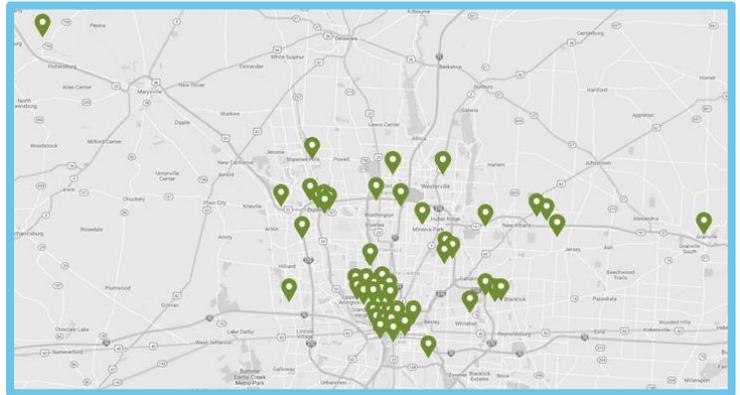
Initiative 5.3 – Workplace Charging

Program Highlights:

- 419 workplace charging ports deployed across 63 organizations throughout the program’s implementation period; one of the largest portions of EV charger deployment through Smart Columbus.
- Developed a [Workplace Charging Plan of Action](#) to provide step-by-step charger siting, procurement, and deployment guidance for partner organizations.
- Installed and activated 127 Level 2 workplace charging ports through the AEP Ohio EV Charging Station Incentive Program. Additional workplace charging projects are under review, in design or are being installed for 100 Level 2 ports.

Impacts and Lessons Learned:

- **Tackling Barriers Early Leads to Deployment.** While many partner organizations relatively bought in to purchasing EV chargers, some lingering questions on how to site chargers, pricing policies, or other considerations remained a barrier for deployment. By focusing Smart Columbus staff on educating and addressing barriers, such as education through webinars, in-person events, and charging site walk throughs, many organizations were able to garner relatively quick buy-in for charger deployment.
- **Have a Plan of Action for Guidance:** The aforementioned Workplace Charging Plan of Action provided an in detail, week-by-week guidance for how an organization can go from start to finish for deploying an EV charger, including: siting of prospective EV charger locations, surveying employees for estimated utilization, consider available incentives, create usage policy, branding/signage guidance, PR opportunities around announcement/opening of EV chargers. This guidance proved instrumental to helping organizations address their own needs in the process, and custom-cater resources to lead to deployment.



- **Identifying EV Chargers in the Wild Can be Difficult:** Online mapping tools (AFDC, PlugShare, etc.) do not capture all workplace charging locations. Smart Columbus conducted a workplace charging baseline field survey to identify all workplace charging in the grant project area and the date it was installed. Work with vendors and utilities to capture information about newly installed workplace charging stations.
- **Workplace Charging as Employee Benefit:** Workplaces are seeing chargers as an added employee benefit/amenity and promotes their sustainability mission. For organizations with multiple campuses, installing charging at subsequent locations was found to be quicker/cheaper after facility staff gained experience of the process, able to more efficiently repeat EV charger projects at new locations.
- **Build Scale to Meet Demand:** Ensure a good use policy is in place once the chargers are online, and that charger supply will meet employee demand. By notifying and including employees in the charger installation process, they can be informed of charger location, pricing (if needed), and usage policy. Organizations who conducted advance surveying of employees to identify number of expected EV purchases in the near future were also able to match EV charger deployment to needed employee charging, making charging more convenient without the need for queuing for a charging time slot. Furthermore, by installing additional conduit for further expandability during installation makes future expandability easier and cheaper, relative to the cost of hiring additional installation and construction crews down the road. Overall, having an internal champion for charging, such as staff within facilities, HR, or sustainability departments can ensure proper information sharing between groups, keeping building staff informed of project needs throughout the process.

HOW TO PREPARE FOR ELECTRIC VEHICLE CHARGING AT YOUR WORKPLACE

Thank you for your partnering with us to accelerate electric vehicle (EV) adoption in our city! Installing workplace charging at our region's workplaces is a critical step toward achieving our goals—the presence of workplace charging has been proven to increase an employee's likelihood of driving electric by 6X.

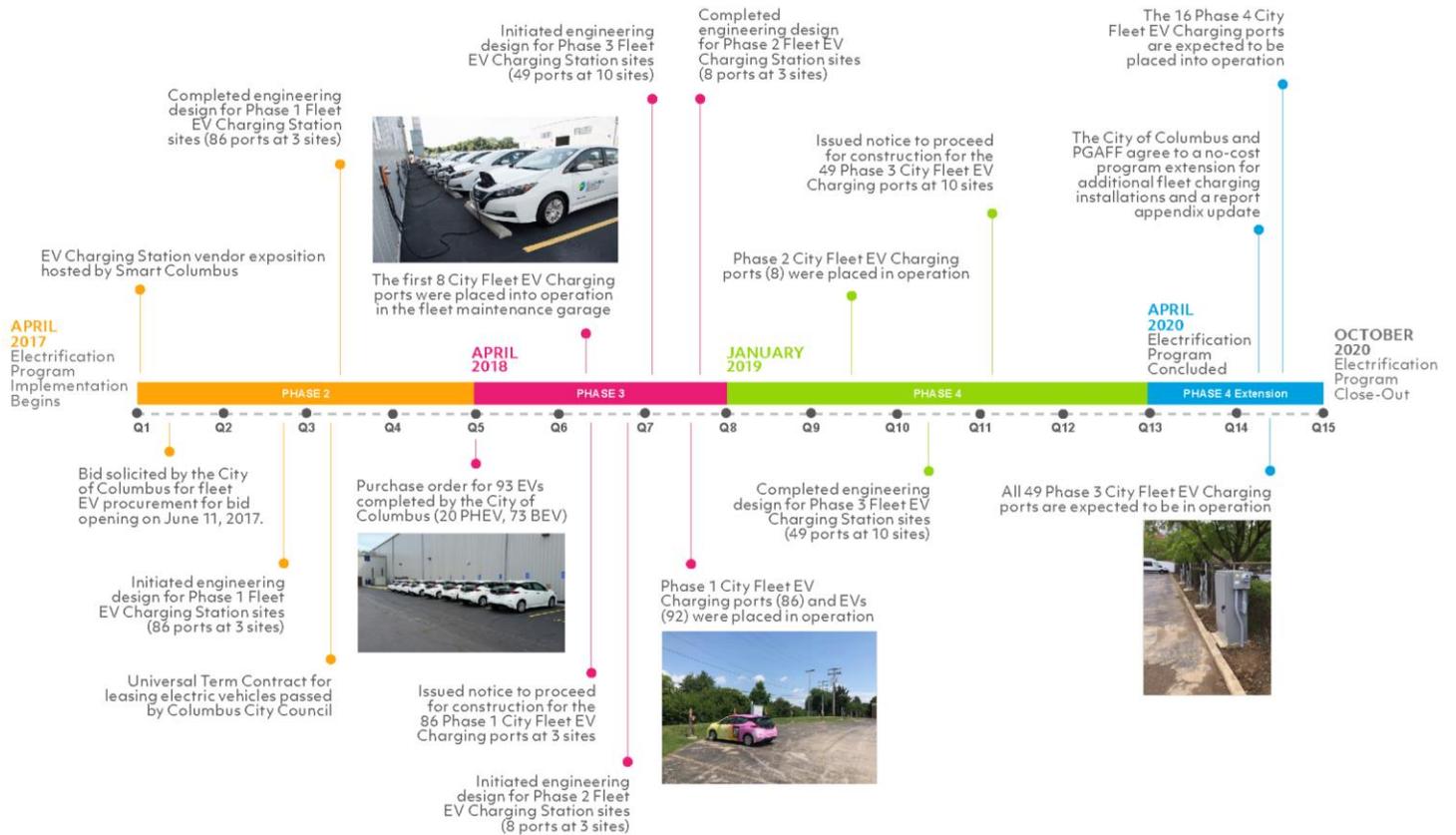
Following is a step-by-step guide to the actions your organization can take to establish a workplace charging program. These steps will ensure your employees are educated and excited about EV charging, and a smooth equipment launch is ensured.

Survey → Site Plan → Fund → Policy → Announce → Launch → Drive



Initiative 5.4 – Fleet Charging

Program Highlights:



- The City of Columbus has 151 Level 2 fleet charging ports operational, eight ports under construction and at least another eight planned for design for a total of 167 Level 2 fleet ports at 18 sites. In addition, eight Level 1 outlets that are currently under construction will allow for future upgrades to Level 2 charging.
- For a complete list of City of Columbus Fleet Charging sites and port counts, see *Appendix J*.
- Smart Columbus has developed a charging data dashboard for the Smart Columbus MUD program chargers and City of Columbus Fleet Chargers. See the link below to explore the dashboard. The location type filter at the top of the page can isolate the fleet charging data from the MUD charging data. Visit the [Smart Columbus MUD and City of Columbus Fleet Charging Data Dashboard](#) for more details.



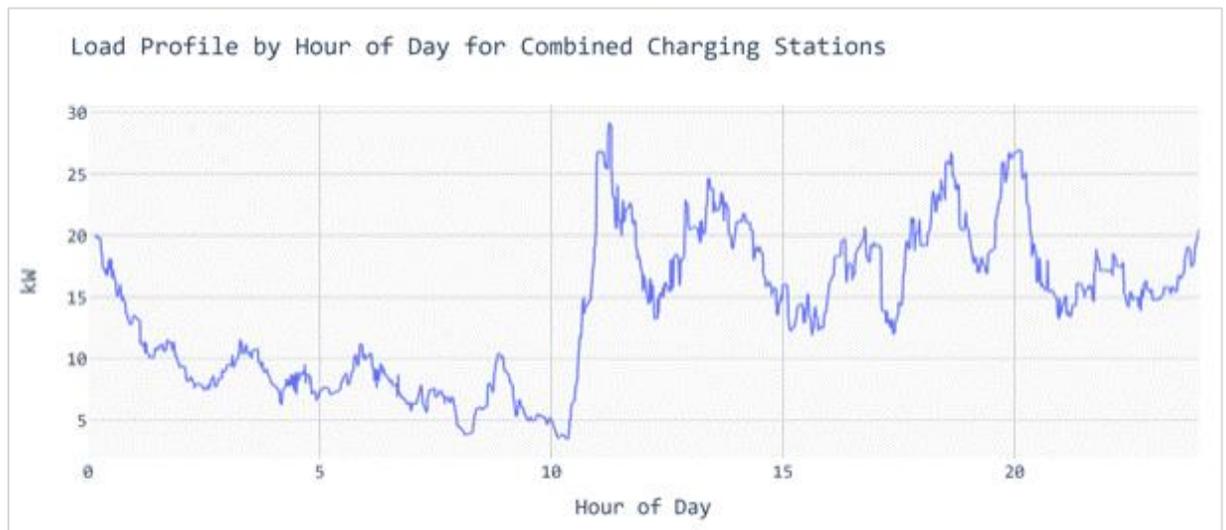
- The Ohio Department of Administrative Services (DAS) accepted bids submitted in response to Invitation to Bid No. RS900320 that opened on September 18, 2019, for EVSE charging station equipment. The result was a multi-award contract for various charging station options available for purchase from the state term contract schedule. More information is available at:
https://procure.ohio.gov/OrigContract/RS900320_OC.pdf.
<https://procure.ohio.gov/proc/viewContractsAwards>



- Yellow Cab of Columbus installed two dual-port 50kW DC Fast Chargers at their headquarters in July 2019 to support their fleet. The data and methodology for charging are included below.



- **Load profile:** take the sum of kW dispersed to vehicles being charged at the Yellow Cab of Columbus headquarters at each minute. This number is averaged across every day's worth of data collected.



- **Utility consumption:** Calculate the difference in battery level for each distinct charging session across vehicles, multiply by 0.75 to get kWh gained (assuming 75 kWh battery) and sum / split by month.
 - Feb 2020: 6,902 kWh
 - Mar 2020: 7,291 kWh
 - Apr 2020: 5,243 kWh
 - May 2020: 5,184 kWh
- An additional 75 Level 2 fleet chargers were installed during the program, including 19 at OSU, 32 at Franklin County, and two at MORPC. Although categorized under fleet charging, many of these chargers were setup as multi-purpose chargers used by fleets, workplaces and the public.

Impacts and Lessons Learned:

- Allowing additional time for review and inter-agency coordination early in a fleet charging program development is recommended. The City of Columbus plan review and development process for the Part 1 fleet charging plans took more time than a standard project review due to this project being the first of its kind for the city. In addition, coordination between MORPC, ODOT, the City of Columbus, and the engineering design consultant took more time than a standard public infrastructure project. Smart Columbus used the final Part 1 fleet charging plans to develop EVSE installation plan templates viable for use in future fleet charging projects to reduce plan review times.
- Have a clear understanding of legislation schedules as it relates to project approvals. Smart Columbus overestimated the amount of time able to be cut from City of Columbus legislation processes on short notice. The team ultimately worked through a typical schedule line by line in order to determine where time could be saved in the process.
- The preliminary construction specifications included information not needed specifically for City of Columbus fleet charging. Additional clarity was needed in the process for choosing a charger and understanding the implications for load management, networking, and maintenance agreements.
- Recommend adding a general note to all charging plans confirming the contractor will contact the equipment manufacturer for written approval before modifying any existing or proposed electrical equipment. At one project site, equipment modification without prior approval lead to a much longer inspection process with a global safety certification company, UL, as their approval was needed for the modified equipment.
- Lining up fleet procurement schedules with EV infrastructure installations requires vehicle procurement plans to be developed well ahead of charging projects due to charging project lengths. From the charging infrastructure side, aim to streamline the design and legislative processes. Consider alternative contract types so additional chargers can be added to an existing construction contract as needed.
- Consider the pros and cons of outside funding sources for EV charging projects. Sources may include various levels and types of government funds (infrastructure, energy, state, federal, etc), utility programs and private grants. Additional funds can provide for larger, more robust installations, but may limit equipment choices, lengthen project schedules, complicate data analysis and data sharing, and may include higher administrative costs to manage additional funding documentation.
- For planning considerations for public fleet EV charging, more information is available at <https://smart.columbus.gov/playbook-asset/electric-vehicle-charging/considerations-for-planning-public-fleet-charging>.



Initiative 5.5 – Building and Zoning Changes to Support EV Charging

Program Highlights:

- In Program Q2 (Q3 2017), the City of Columbus Fire Department provided draft fire code policy regarding EV charging station installations. The policy included requirements for an emergency power disconnect and vehicle impact protection. The policy was first implemented at three sites as a part of the City of Columbus Part 1 Fleet EV Charging Station project. It has since been implemented in all City of Columbus Fleet EV charging projects and at the Public Access Charging Pilot Project for DC Fast Charging at Fulton Street. *For the fire code language, see Appendix K.*
- In April 2018, the City of Columbus Building and Zoning Services standard permitting process for EV charging stations was reduced from 20 days to 10 days. Smart Columbus also developed a city permit process flow chart to outline each permitting step and provide an estimated cost and timeline for each item. *For the permit flow chart, see Appendix L.*
- In June 2019, in an effort to remove disincentives to EV adoption, Columbus City Council passed an ordinance to amend City of Columbus Zoning Code, so that off-street parking spaces dedicated to EV charging and located outside of special parking areas will count as a required parking space and not count toward the maximum number of parking spaces. Now businesses and developments can install EV charging stations without negatively impacting minimum parking space calculations and requirements. More detailed information and legislation text can be found at <https://smart.columbus.gov/playbook-assets/electric-vehicle-charging/columbus-crafts-ev-parking-ordinance>.
- In August 2019, a draft EV readiness policy for the City of Columbus was developed by using other cities policy templates and the lessons learned from the Smart Columbus MUD, public and fleet EV charging projects. Current considerations include how to set the requirements based on future EV adoption goals for the region, how to format the policy to allow for future change given the expected growth coming to EV adoption, where to locate the policy within City Code and how technical and/or detailed to make the policy requirements.



Impacts and Lessons Learned:

- The initial navigation of the city's permitting process for charging infrastructure was relatively unknown to users. The Smart Columbus team mapped the process and coordinated with the appropriate staff to streamline the permitting process for electric charging infrastructure.
- Safety can play a major role in EVSE code and policy development. The draft City of Columbus Fire Code includes a section for EVSE installations. Fires involving EV batteries can take up to 2-4 times as much water to put out, so in the event of a vehicle fire, the Division of Fire needs to be able to quickly and safely de-energize the adjacent charging stations without having to search for a power disconnect. In the event that there were difficulties due to construction timing or unique site circumstances, site hosts were directed to reach out to the City of Columbus Division of Fire directly to work together on a feasible solution.
- There was a lack of awareness of policy activity to date across our stakeholder and partner network. The team produced a Playbook article on changes to the parking code to support EV infrastructure and a new electrification policy brief for partner municipalities.
- The city remains involved in the process of ensuring city code supports EV adoption. Due to the early adopter status of the EV market in the seven-county region, there are inherent concerns regarding equitable access to electrified transportation, including where EVs are sold, the small size of the used EV market, potential gentrification, rural availability, and policy development skewing benefits to affluent neighborhoods. Outreach and community engagement will take place as the policies are developed.

PLAYBOOK

Content Generation

Content Development and Management

Program Highlights:

- Published 99 articles and 260 assets to the Smart Columbus Playbook during the grant period, exceeding the content generation goals of 97 and 167, respectively.

Impacts and Lessons Learned:

- Steady communication with internal and external partners assists with timely and relevant content creation.
- It is important to uplift electrification progress but also regional and partner progress on smart city initiatives on an owned platform, such as the Playbook, to demonstrate the overall impact of the program's effectiveness.

Playbook Delivery Platform – Website

Program Highlights:

- Received more than 60,000 unique visitors outside the region (before the Smart Columbus Playbook microsite was distributed) and 14,245 asset downloads on the Smart Columbus website.
- Visitors spent an average time of 2:53 minutes on the website, exceeding the goal of 2:00 minutes.

Impacts and Lessons Learned:

- Without significant paid marketing strategy on web and social media for niche audiences, it is a challenge to reach website visitors outside of the region.
- Electrification audience is very interested in downloading assets that accompany articles.
- Long form articles on programs are a good way to increase the amount of time spent on website.
- When launching a website, security issues are important to consider when marketing to a large consumer audience.

Playbook Content: Best Practice Documents and Multimedia Storytelling

Program Highlights:

- Published 99 documents via the [Smart Columbus Playbook](#) so that other programs may leverage content directly from the program.
- Developed a series of six videos on key programs of the Electrification Program.

Impacts and Lessons Learned:

- It was cost prohibitive for Smart Columbus to produce a significant number of videos using outside production agencies. If video creation is a top priority for similar organizations, suggest hiring a staff member with video capture and production experience to produce content in-house rather than out-of-house.

Smart Webinars

Program Highlights:

- Held 23 smart webinars, 19 of them were promoted and hosted by USDOT-programming.

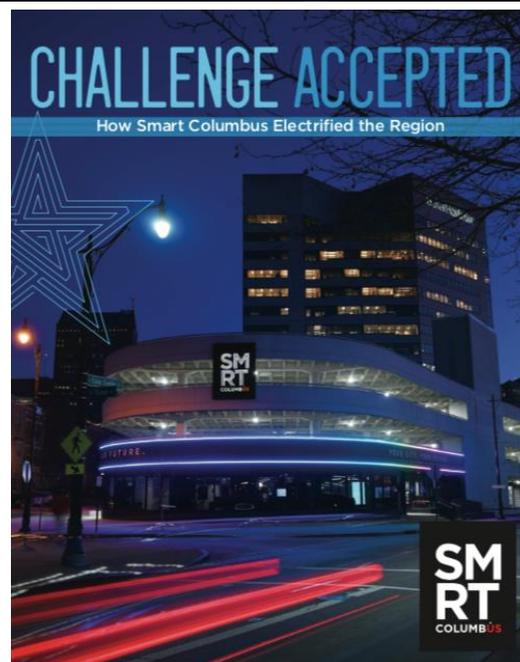
Impacts and Lessons Learned:

- Media or partner sponsored webinars make the biggest impact. It is more challenging to promote webinars without media, web or social media advertising.

Smart Columbus E-Book

Program Highlights:

- Created a multi-platform strategy to disseminate final learnings and best practices for Smart Columbus Electrification programs, including:
 - An interactive microsite displaying Playbook content that specifically highlights lessons learned and best practices for the PGAFF electrification program. The microsite is displayed on two vanity URLs: AccelerateYourCity.com to market to audiences outside of the region and SmartColumbusPlaybook.com to market to regional audiences.
 - A 16-page special section in Columbus CEO magazine, a local publication geared toward regional leaders and the business community. The section highlights successes from the public and private sectors on meeting and exceeding electrification goals. The insert will be distributed to 82,000 subscribers. Smart Columbus received 1,000 additional copies to distribute to stakeholders. <https://smart.columbus.gov/playbook-assets/our-journey/smart-columbus-celebrates-employer-partners>



Impacts and Lessons Learned:

- Due to the COVID-19 pandemic, the events strategy to attend large electrification-themed conferences and share final best practices was discontinued. The team is continuing to evaluate virtual opportunities throughout the year for Smart Columbus to share final best practices and promote the microsite.
- Creating a multimedia, interactive way to disseminate learnings is valuable because it is easier to read and share than a traditional e-book. Looking for opportunities to make content more accessible and easier to understand is a priority as electrification practices are quickly evolving.

Content Dissemination

Newsletter

Program Highlights:

- Created organic strategy to gather 1,276 newsletter contacts from outside of the region to distribute Playbook articles on a monthly cadence.
- Since the Playbook newsletter began distribution in December 2018, open rates were consistently over 20% (many times topping 30%) and click rates were over 8%, exceeding industry standards.

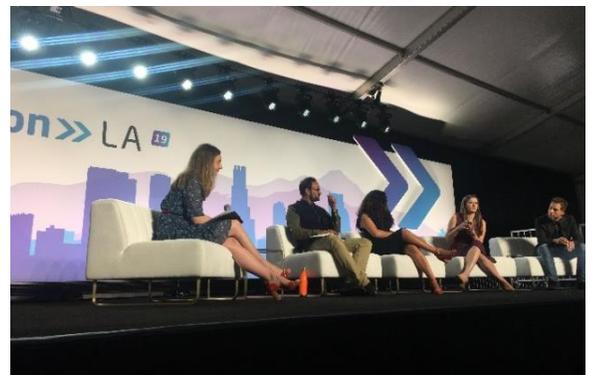
Impacts and Lessons Learned:

- Using owned media strategies, such as newsletters, is an important way to promote regional electrification work and build relationships with audiences outside of the region. Newsletters are also an important way to distribute more complex content to a niche audience that would find it most useful.
- Paid strategies to grow contacts can also benefit the newsletter reach. However, the Smart Columbus team was successful in growing its list organically with contacts that had a touch point with a member or program from Smart Columbus. This resulted in increased open and click rates from contacts who were familiar with the program.

Attending and Presenting at EV-related and OEM Dominated Conferences

Program Highlights:

- Smart Columbus presented at 35 major national and international conferences, reaching over 35,000 individuals. Highlights included:
 - EVS31 in Kobe, Japan;
 - EVS32 in Lyon, France;
 - EV Roadmap; and
 - LACommotion.

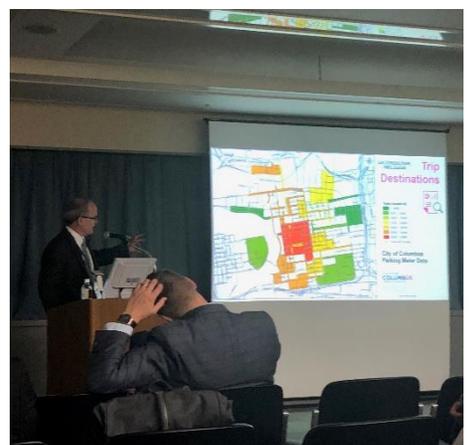


Impacts and Lessons Learned:

- Building relationships with the planning organizations and leveraging your team's network can position you to have speakers on key conference agendas.
- In-person contact and engagement at conferences, speaking engagements and events creates opportunity for partnership.



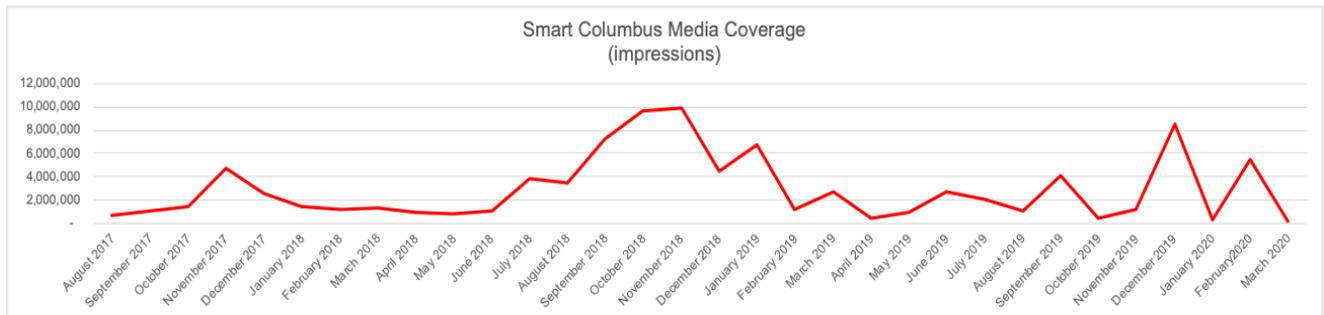
- Networks or membership organizations, such as NewCities or Cities Today, are a valuable tool for learning exchange with diverse peers.
- [Monday.com](https://www.monday.com) was the most helpful tool in managing speaking, event, exhibit, and all other external engagement requests. The communications team researched and tested a diverse array of project management software, but found [Monday.com](https://www.monday.com) to have the most user-friendly interface and fluidity amongst the Smart Columbus team.
- The Smart Columbus team received ample speaking requests, especially for spring events. While our team could not provide presentation support for many of them, the communications team maintained contact with conference organizers throughout the year. The team sent polite regrets, expressed interest in hearing about future opportunities, and added conference organizers to the Smart Columbus Weekly Newsletter for sustained communication.
- A basic presentation deck with continually updated metrics and projects, accessible to the core speaking team, helped to ease deck compilation for conferences and other external engagements.
- Unfortunately, event cancellations and travel restrictions related to COVID-19 limited the team's reach at conferences as the program concluded. The team had planned to speak at EVS 33 and host a special convening in Portland timed with the event, and had several additional national conferences on its docket. Smart Columbus will make efforts to attend these events as they are rescheduled or transitioned to digital events.



Media Relations and PR

Program Highlights:

- From July 2017 to March 2020, Smart Columbus generated more than 97 million media impressions, 63 million of them national, international and trade media impressions.



- The Smart Columbus team leveraged program milestones, program lessons learned and leadership perspectives to spread the message of Smart Columbus' successes outside the city limits. Media coverage highlights included:
 - [Smart Cities Dive: Checking in on Columbus, OH a year after Smart City Challenge](#)
 - [TechCrunch: Chariot expands to Columbus, Ohio with JPMorgan Chase commuter shuttle](#)
 - [Government Technology: Smart Columbus to Open an EV Showroom](#)
 - [Associated Press: Ohio capital launches unique 'Smart City' operating system](#)
 - [Associated Press: Columbus opens learning center with 'Smart City' message](#)
 - [American City & County: Driving change: Columbus, Ohio, shows how non-coastal cities can accelerate electric vehicle adoption](#)
 - [Delta Sky: Smart City, Big Dreams](#)
 - [Washington Post: Self-driving shuttles arrive in Columbus this week](#)
 - [Inc.: Columbus Isn't the Next Business Destination, It's Already Happening](#)
 - [Forbes: Making Smaller Cities Smarter](#)
 - [Cheddar: City of Columbus Still Wants to be a National Destination, Even Without HQ2](#)
 - [Bloomberg TV: How Columbus, Ohio Became America's Smart City](#)
 - [Smart Cities Dive: City of the Year: Columbus, OH](#)
 - [Cheddar: Cheddar Crystal Ball: The Smart Cities of the Future Are Already Here](#)
 - [New York Times: 52 Places to Go in 2019](#)
 - [Automotive World: What's the first Smart City Challenge winner doing today?](#)
 - Midwest Living: In Columbus, OH We Swapped Our Road Rally Fleet for Maria (print)
 - [Forbes: From Cow Town To Smart City, Can Central Ohio Make The Grade?](#)
 - [Smart Cities World: Columbus: first US city to meet ozone compliance rules](#)

- [US News & World Report: The Role of Business in Smart Cities](#)
- [Government Technology: Inside Columbus' Mission to Spread Its Smart City Knowledge](#)
- [Smart Cities Dive: Electric revolution: How are cities overcoming EV range anxiety?](#)
- [Forbes: Columbus, Ohio Is Piloting A Mobile App That Helps People With Cognitive Disabilities Use Public Transit](#)
- [Bloomberg: Self-Driving Mass Transit Arrives on American Streets](#)
- [Forbes: Columbus Is First City In U.S. With Autonomous Shuttles In Residential Areas](#)
- [State Scoop: Columbus, Ohio, launches 'digital capstone' of smart city advice](#)
- Smart Cities Connect, [Smart Cities Connect: Columbus Exceeds Smart City Challenge Grant's Electric Vehicle Adoption Goal.](#)

Impacts and Lessons Learned:

- The national, competitive nature of the Smart City Challenge made Smart Columbus efforts newsworthy with local, national and trade publications, as we were unique among organizations of our kind. Columbus earned more than one billion media impressions for winning the Challenge, and media interest in the program continued well into implementation. The US government and national grantors may wish to consider a similar challenge format for future grant programs, as it gave Columbus as the winning organization an advantage in amplifying its message. That said, at the outset of the program, the organization was not prepared to process the volume of incoming media interest. The organization adapted through marketing hires and by partnering with a PR agency. If such a high-profile strategy is pursued by a grantor, they should provide marketing support to the recipient organization until they put resources in place to keep up with the volume of media interest independently.

Social Media

Program Highlights:

- Smart Columbus launched and maintains a presence on Facebook, Instagram, Twitter, LinkedIn and YouTube. As of the end of May 2020, the organization has 13,680 followers across channels and achieved more than six million social media impressions through social posts not associated with the education campaign (see 4.3.3.2).

Impacts and Lessons Learned:

- Smart Columbus had to use social media to uniquely engage two different audiences: residents inside the region (with the goal of inviting them to participate in projects and educational opportunities) and professional audiences outside the region (with the goal of teaching them best practices so the program could be replicated). This was achieved by using LinkedIn mainly for our B2B/outside Columbus audiences, and Facebook and Instagram mainly for local audiences. Twitter was used for both groups.

Learning Exchanges

Program Highlights:

- In formation of the Smart Columbus Electrification Program, the team participated in meetings with OEMs, workshops with industry experts and took a learning trip to leading e-mobility cities around the world. The European learning trip was organized by PGAFF and attended by leadership from the City of Columbus, Columbus Partnership, Franklin County, AEP, and the Electrification Coalition. Those on the trip met with government, private sector, academic and non-profit leadership who have been paving the way for EV adoption in the Netherlands, Norway and Sweden.
- The Smart Columbus Experience Center proved to be an exceptionally helpful tool for convening Learning Exchanges. Delegations from 80 cities and 20 countries visited Columbus to learn from our smart city portfolio.
- Our team presented at nearly 200 conferences or speaking engagements locally over the course of the program.



Impacts and Lessons Learned:

- Forum-style learning exchanges, especially when hosted at the Experience Center, maximize the impact of the exchange without requiring extensive travel or individual introductions.
- When hosting external groups in Columbus for learning exchange, planning meetings with organizers, as well as planning meetings with local mobility partners, were crucial to maximizing the impact of the visit. The most highly regarded visits included numerous Columbus mobility and research partners, which emphasized the importance of the collaborative spirit of the Smart Columbus initiative.

CHALLENGES AND CONSIDERATIONS OUTSIDE THE PROGRAM

Throughout the Smart Columbus program, there have been challenges to EV adoption outside of the program control, typically as part of broader policy initiatives or opportunities not yet available in Ohio. Consider the following external forces that may significantly impact EV adoption and develop a way to work with, change, or work around these potential impacts to EV adoption.

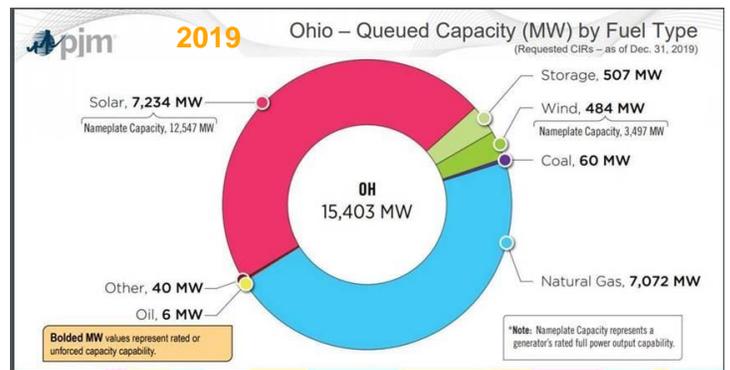
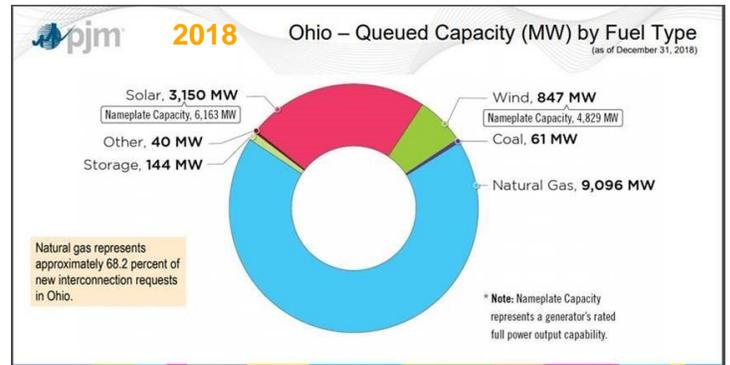
- State Government Policy
 - Because the State of Ohio does not utilize a ZEV program, the Smart Columbus team had to develop strategies to influence consumer behavior, as state incentives are minimal. Actions taken: 1) Strong and active advocacy taken to preserve the federal tax incentive. 2) Leveraged relationships and connections to top leadership at OEMs to make the case for why the supply of EVs should be increased for Columbus. 3) Regular and ongoing meetings with OEMs and dealers were held to monitor inventory levels and advocate for increased supply. <https://smart.columbus.gov/playbook-asset/electric-vehicle-consumer-adoption/oem-engagement-bringing-more-evs-to-a-non-zev-state>
 - In April 2019, the State of Ohio transportation budget was approved. This approval included:
 - Doubling the amount of public transit funding from \$33 million a year to \$70 million;
 - Increasing the gas tax by 10.5 cents a gallon, bringing nearly a 60% increase to the infrastructure budgets of local municipalities; and
 - Authorizing the introduction of a \$200 annual registration fee for plug-in EVs and \$100 for non-plug-in hybrid vehicles.

The gas tax increase brought the total tax to 38.5 cents per gallon. The state assumed that the average resident consumes 536 gallons per year costing them \$206 per year in tax. The state legislature used this same rationale to justify the \$200 annual registration cost for an EV, with the assumption that an EV driver would drive 13,400 miles a year at 25 miles per gallon. Smart Columbus believes that EVs will continue to gain popularity in the consumer market and appreciate the state's interest in making all vehicles on the road pay their fair share. We will continue to work with the leadership at the state to educate them about the benefits of EVs compared to combustion engines. In the short term, Smart Columbus worked with the state to clarify the language around what defines an electric vs. hybrid vehicle, to be sure that plug-in hybrid vehicles were more fairly considered in the fee structure. The gas tax increase and registration fees went into effect starting July 1, 2019, (i.e. EVs that registered after July 1 paid the new registration fee). Smart Columbus provided talking points to our front line EV dealers and Smart Columbus Ambassadors in order to help existing and future EV owners understand these new fees.

- Utility and Energy Policy

- **PUCO Action on AEP Application:** On November 21, 2019, the PUCO denied AEP Ohio’s application to charge their customers for the utility’s investments 900 MW of wind and solar (visit <http://dis.puc.state.oh.us/TiffToPdf/A1001001A19K21B61059J03417.pdf> for the full PUCO Opinion and Order for this case). This included two utility-scale solar farms (500 MW) located in Southwest Ohio, known as the Willowbrook and Highland solar farms, and 400 MW of wind generation. In Ohio, distribution utility companies like AEP Ohio are barred from charging all customers for development or operation of any electric generating facility unless they can show that “there is need for the facility based on resource planning projections.” The PUCO found AEP Ohio failed to provide adequate support to satisfy the narrow circumstance¹ in which a distribution utilities may request to charge all of its customers for generation outside of the normal competitive marketplace (Case Nos 18-501-EL-FOR; 18-1392-EL-RDR; 18-1393-EL-ATA).

- **Ohio’s Planned Renewables:** It still looks very positive for hitting renewable targets of 900 MW by 2030 as referenced in the original grant application. Recent legislation created a \$20 million annual fund to support solar facilities approved by the Ohio Power Siting Board (OPSB). This legislation is supporting three projects in Ohio for a total of 650 MW. The trend is towards investment in solar as evidenced by PJM’s reporting on queued capacity at end of 2018 vs. 2019. Solar projects outpaced natural gas, the recent leader, in 2019 for the first time <https://pjm.com/-/media/library/reports-notices/state-specific-reports/2019/2019-ohio-state-infrastructure-report.ashx?la=en>.



- **City of Columbus Aggregation:** The City of Columbus is currently considering this path through the use of government aggregation². This is expected to greatly increase the use of renewables in Columbus. As a state with a competitive market for electricity (often called a “deregulated state”), Ohio provides the customers of investor-owned distribution utilities with the ability to choose the source of their own electricity. In deregulated states, this mechanism provides the clearest avenue to support renewable resources.

¹ Ohio Revised Code Section 4928.143(B)(2)(c)

² An aggregator is a person or organization that brings a group of customers together. Ohio’s law allows for local government aggregation by cities, townships or counties, with "opt-in" or "opt-out" provisions for their consumers. Some cities have used this mechanism to encourage the use of a supplier sourcing electricity from renewable generating facilities.

- **Ohio Energy Laws:** The Ohio Legislature passed, and Governor DeWine signed, a significant rewrite of Ohio's energy laws in the summer of 2019. [House Bill 6 \(HB6\)](#) authorized a ratepayer increase to subsidize two coal plants run by Ohio utility companies, bailout two FirstEnergy nuclear power plants and support six solar power projects being built in rural areas around the state, two of which are in the AEP Ohio service area. The bill gets rid of energy-efficiency standards and programs. The bill ultimately went into effect on October 22, 2019; however, more consideration about the implementation of HB6 is expected.
- Local Policy
 - At the beginning of the Smart Columbus program, EV only parking spaces did not count towards minimum parking count zoning requirements. This proved to be a deterrent to EV adoption for developers considering installing EV charging. In June 2019, the City of Columbus Zoning Code was amended to remove this constraint. In addition, the City is currently working to implement an EV Ready policy through Building and Zoning Services.
 - In Q10 (July to September 2019), the City of Columbus Division of Support Services' Weights and Measures section began planning an inspection program for fee-based public chargers, as part of the growing availability of public EV charging, in order to protect consumers. The inspections will be based on the way the fee is charged. If the charger fee is based on energy, the charger will be tested for kWh output and if the fee is based on time, the charger will be tested for session time. It is currently expected that the inspections will occur annually and will cost approximately \$60 per port for the energy-based testing and \$20 per port for the time-based testing.
- Availability of External Funding Sources
 - **VW Settlement Funds:** During the planning phases of the program, it appeared the VW Settlement Funds for Ohio would be useable in meeting program KPIs for public charging. Although it appeared the funds for Ohio for EV charging would be made available as early as Fall 2019, the [EV Charging station program for Level 2 chargers](#) for \$3.25 million released on June 30th, 2020 for applications due on September 30, 2020. DCFC funds are expected in early 2021. Although this was ultimately delayed outside of the grant program, this should still help with the state layering charging within the Smart Columbus MUD/Public/Fleet and AEP Charging Incentive Programs.
 - **MORPC – Federal Project Funds:** The Federal Highway Administration's (FHWA) Congestion Mitigation and Air Quality (CMAQ) Improvement Program funding from Metropolitan Planning Organizations (MPOs) can be a good resource for charging projects, but they are limited and compete with other city infrastructure projects related to congestion mitigation and air quality improvement projects.
- External Market Forces
 - COVID-19 has impacted the reported vehicle sales. Due to the Ohio Bureau of Motor Vehicles (BMV) closing on March 18, 2020, and issuing extended temporary tags, data from mid-to-late March through late May likely does not reflect true sales data. Additionally, COVID-19 made it more difficult for customers to access dealerships and likely influenced their willingness to purchase during an uncertain economic time.

SUPPLEMENTAL RESEARCH AND FUNDING

- In October 2018, Bloomberg Philanthropies announced Columbus as a winning city in the Bloomberg American Cities Climate Challenge, a \$70 million dollar program to accelerate 20 ambitious cities' efforts to tackle climate change and promote a sustainable future for residents. Through the Climate Challenge, Columbus was accepted into a two-year acceleration program that has been providing powerful new resources and access to cutting-edge support to help meet or beat the city's near-term carbon reduction goals. Columbus is working with Bloomberg Philanthropies to achieve the following actions:
 - Deploy a workforce development program for energy efficiency auditors and increase the number of homes audited with a focus on the City neighborhoods with the highest rates of energy poverty;
 - Accelerate existing and add new financing programs for energy efficiency and renewables for commercial buildings;
 - Roll out a multi-modal trip planning app to drive behavioral insights and engagement strategies to encourage mode share; and
 - Launch a communications campaign to increase ridership on newly expanded high-frequency transit lines.
- Smart Columbus partnered with OSU where students majoring in EEDS and engineering presented capstone projects based on real Smart Columbus programs that would affect area businesses and residents and promote electrification and mobility. The capstone projects offer an in-depth analysis of several Smart Columbus projects, including EV adoption, shared mobility options entering the market and energy savings programs. Capstone projects completed include:
 - City of Columbus EV Fleet Adoption Analysis;
 - EV Adoption Among Lyft & Uber Drivers;
 - Impact of Docked Bikes in Columbus;
 - Identifying Best Practices for Management of Electric Scooters;
 - Identifying Barriers to Linden Energy Saving Programs;
 - Mobility Equity Analysis of Electric Scooters in Linden;
 - Potential for Municipal Procurement of Renewable Energy via Virtual Power Purchase Agreements; and
 - Fuel Source Impacts on Greenhouse Gas Emission Reduction by EVs.

