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Paul G. Allen Family Foundation Smart City Challenge Request for Proposals

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EXECUTIVE SUMMARY:

Vision: The City of Columbus, along with an extensive network of public and private partners, has aligned around a unified vision to lead the country in the deployment of Smart City technologies, as well as reduce the region's carbon and greenhouse gas (GhG) emissions through electrification of the electric supply and transportation sectors. We are pleased to submit the Smart Columbus Electrification Plan to the Vulcan Foundation (Vulcan) to support advancements in these areas. Smart Columbus offers a bold and practical Electrification Plan designed to: 1) produce one of the largest regional GhG reductions; 2) address the Midwest's lagging position in electric vehicle (EV) deployment, rapidly accelerating the region to a leading position; 3) advance a replicable model of transportation electrification for mid-sized cities across the nation; and 4) produce data-rich, trackable metrics to demonstrate project successes and share best practices via our Mid-Sized City Forum.

The Columbus Way: Columbus has a long tradition of partnerships and collaboration between business, nonprofits, and government. The Mid-Ohio Regional Planning Commission (MORPC), a voluntary association of more than 60 Columbus region governments and organizations, has served as the metropolitan planning organization for the region with origins back to 1943. The Columbus Partnership is a membership-based organization comprising more than 50 CEOs from the city's leading businesses and institutions. The Partnership also supports Columbus 2020, the leading economic development organization for the Columbus region. These partnerships are examples of the "Columbus Way" of organizing the private and nonprofit sectors for thought leadership, expertise, implementation, and funding essential for the success of projects like the Smart Columbus Electrification Plan.

Sustainment: To accelerate and sustain the Smart Columbus Electrification Plan, the City has established a Smart Columbus Program Office within the Department of Public Service, as well as created a nonprofit organization to handle private funds supporting the Plan. Managed by the Smart Columbus Board of Trustees, the nonprofit will provide the resources and guidance needed to implement Smart Columbus initiatives, including an Acceleration Fund, which will nearly triple USDOT and Vulcan funding, providing \$140 million in overall investments during the grant performance period, and leveraging continued public and private investments beyond this period. This match will take the form of investments in solar energy, electric vehicles (EVs), EV infrastructure, educational efforts, and more during the performance period, as well as set in place investments beyond the grant.

Innovation: By knocking down silos and building up partnerships, the Columbus region has quickly become one of the fastest growing in the country, leading the Midwest in job and wage growth. We are ranked as the #1 "opportunity city" and the #3 City for tech jobs by Forbes Magazine. In order to continue expanding this growth, as well as to attract and retain the nation's best and brightest, the Smart Columbus Electrification Plan is committed to environmental leadership through the implementation of innovative, scalable, and replicable projects focused on renewable energy and efficiency, transportation electrification, and regional decarbonization goals. The Smart Columbus Electrification Plan's project by each element is shown in Table 1:



Table 1. Smart Columbus Electrification Plan Summary by Element

| Elements | Electrification Plan Projects |
|---|--|
| Element 1: Electricity Supply Decarbonization | 1.1 Utility-scale Commercial Renewable Energy Programs: utility Power Purchase Agreement's (PPA's) scaled installations using venture capital: group renewable power purchase plans for businesses |
| | 1.2 Residential Renewable Energy Programs: incentivized residential solar cooperatives: group renewable power purchase plans for homeowners. |
| | 1.3 Grid Modernization & Efficiency Program: including gridSMART 2.0 upgrades, scaled battery storage installations, and modernization to expand capacity for renewables and EVs. |
| Element 2: Fleet Electrification | 2.1 Public Fleet Electrification: through City, County, University, & regional municipal EV adoption. |
| | 2.2 Private Fleet Electrification: through Utility, Columbus Partnership (over 50 top employers) EV adoption; creation and use of total cost of ownership fleet evaluation tool and FleetCarma analytics. |
| | 2.3 Car Sharing / Ride Sharing Fleet Electrification: Green Commuter, Car2Go, E-Rive, & EverCar. |
| Element 3: Transit, Autonomous and Multi-Modal Systems in the City | 3.1 Transit System Enhancement and Efficiencies: to lower carbon intensity and boost ridership. |
| | 3.2 Electrified Autonomous Vehicles: for proof of concept and long-term carbon reduction. |
| | 3.3 Electrified Car Sharing Programs: incentivizing ridership and reducing carbon. |
| Element 4: Driving Consumer EV Adoption | 4.1 Consumer EV Adoption & Sales Program: with group purchases & incentives. |
| | 4.2 Consumer EV Education & Demo Program: improving consumer EV knowledge. |
| | 4.3 Dealer EV Education & Sales Incentives: providing tools to make EV sales a dealer priority. |
| Element 5: Charging Infrastructure | 5.1 Residential Charging Program: offering purchase pools & driving to scale. |
| | 5.2 Workplace Charging Program: innovative financing commitments from Columbus Partnership |
| | 5.3 Public Access Charging Program: regional deployments of level II & DC fast chargers. |

Partnership: For this endeavor, Columbus has built from our many existing strengths to create a broad implementation partnership involving extensive public and private cooperation, including:

| Smart Columbus Electrification Plan: Key Partners |
|--|
| • The Columbus Partnership , featuring over 50 of the region's top corporate employers |
| • The Ohio State University (OSU) , the nation's 3 rd largest public university; with smart grid and EV research expertise |
| • Battelle Memorial Institute , the world's premier energy technology research nonprofit, with USDOE lab access |
| • Honda of America Manufacturing , manufacturing in Columbus region, offering EVs and access to dealers |
| • Mid-Ohio Regional Planning Commission (MORPC) , a top U.S regional planning organization supporting regional efforts |
| • American Electric Power (AEP) , one of the largest U.S. utilities, with 5.4 million customers in 11 states |
| • Clean Fuels Ohio (CFO) , the largest and most dynamic U.S. Dept. of Energy (USDOE) Clean Cities coalition |
| • Columbus 2020: the regional economic development organization, attracting new investment, and creating new business |

Proven: In Columbus, we've built an unprecedented culture of Collaboration. It's through collaboration that Columbus has delivered complex private/public projects like the \$35.5 million Scioto Greenways downtown riverfront restoration and the \$387 million OARS Deep Sewer Tunnel. Notably, our Public Private Partnership Program has managed 102 projects, representing \$284.5 million in public investment while leveraging \$2.58 billion in private investment. It is through collaboration and partnership that the Smart Columbus Electrification Plan will deliver scalable and replicable results.

Capability: The City of Columbus has more than 8,000 employees, an operating budget over \$820 million, and capital budget of more than \$1 billion. The City has a long history of managing large complex projects with multiple partners and federal, state, local, private, and grant funding. The City of Columbus has an experienced procurement office with defined procedures for managing large capital and technology projects as well as unique projects that may not fit the usual capital project definition. The City also has efficient contracting processes and performance measures.



Capacity: The Columbus Region has the workforce to sustain the Smart Columbus Electrification Plan well into the future. The City and partners will engage in joint efforts to lead and support the Smart Columbus Electrification Plan. The Columbus Region already has a good foundation for this project.

| <i>Smart Columbus Electrification Plan: Key Attributes</i> |
|--|
| • Leadership: <i>Electrification Plan led by Mayor Ginther and administered by Smart Columbus Program Office.</i> |
| • Reliability: <i>City of Columbus, Franklin & Delaware Co.: AAA bond rating, operating budget \$820M, capital \$1 billion.</i> |
| • Efficient: <i>City of Columbus eGov initiative, 24/7 Vendor Portal, selects consultants in 9 days of RFP, contracts in 55 days.</i> |
| • Capable: <i>OSU, nation's 3rd largest public research university; Battelle, world's premier energy technology research nonprofit with access to USDOE energy labs; CFO, nation's largest USDOE Clean Cities Coalition with EV expertise.</i> |
| • Connected: <i>MORPC coordination of 60 regional governments; Columbus Partnership coordination of 50+ top employers.</i> |
| • Committed: <i>Smart Columbus nonprofit and advisory board created.</i> |
| • Long-term: <i>\$140 million Acceleration Fund, innovative financing mechanisms for sustainment.</i> |

Impact: The Vulcan Smart Cities Challenge Grant, in collaboration with the USDOT Smart City Challenge grant, will provide critical support that the City of Columbus and our broad collection of partners will leverage to facilitate investments at scale in each of these five areas. The award also will enable us to develop and implement needed policies, mainly at the local level, while conducting education. This will place Columbus in a position to deliver significant near-term results and on a trajectory to substantially decarbonize transportation within the next 10-20 years.

| <i>Smart Columbus Electrification Plan: Outcomes & Responsiveness to Vulcan Goals</i> |
|--|
| • Decarbonize Electric Supply: <i>by installing 918 MW of Renewable Energy and improving grid efficiency by 1.3% annually</i> |
| • Electrify Regional Transportation: <i>by deploying 3,978 Electric Vehicles and 311 Public Charging Stations.</i> |
| • Leverage Resources: <i>Creating \$140 million Acceleration Fund over the grant period and for sustainment.</i> |
| • Climate Friendly Transportation Practices: <i>Investing in Transit Efficiencies, Autonomous Vehicles, & EV CarSharing</i> |
| • Data-Driven: <i>Metrics focused on baselining, tracking, documenting, and easily sharing solutions and successes.</i> |
| • Replicable: <i>Playbook of Best Practices, Lessons Learned, and Innovative Solutions to Share with Peers.</i> |
| • Scalable: <i>Hosting our Annual Mid-Sized City Forum to share information and spur continued innovation.</i> |

Replicable: Smart Columbus will become a successful, replicable model for medium-sized U.S. cities. For years Columbus has served as the test bed for new products and services because marketers have long understood that the region is typical of many cities in culture, political views, and growing diversity. Columbus' success in scaling transportation electrification and decarbonization will inspire confidence throughout other American cities. To further inspire this confidence, Smart Columbus will also host an annual Mid-Sized City Forum and share our results and best practices with other mid-sized cities.

1. INTRODUCTION: Following electric power generation, the transportation sector consumes the most energy and accounts for the largest amount of net greenhouse gas (GhG) emissions. Transportation also presents the greatest challenge because petroleum dominates this sector in a way that no other single energy source dominates others. Yet, we must decarbonize transportation.

Electrification presents the best opportunity to reduce GhG emissions at scale within the timeframe required to avoid catastrophic climate change this century. Accomplishing this result requires integrating transportation with an increasingly lower carbon electric power sector. In the coming few decades, electric vehicles (EV) increasingly will play dual roles: 1) an enabler for a cleaner grid for some of the storage resources needed to help facilitate use of growing renewable energy capacity; and 2) a reducer of net GhG emissions through inherently greater efficiency and use of those same renewables on the grid.

The City of Columbus and partners are committed to improving the region's environmental performance by



dramatically reducing carbon and greenhouse gas emissions by developing scalable strategies. Ohio’s capital city is the fastest-growing of any in the Midwest. Impressively, job growth has outpaced this rapid population growth, making Columbus one of the most economically vibrant cities in the Midwest. Our diversity, blend of youth and experience, intellectual capital, engaged corporate sector, world-class university, and purposeful local government have fueled this economic revitalization. Columbus has a culture of collaboration, with a resource base and spirit to take on tough challenges. We are turning our energies to the challenge of decarbonizing the transportation sector. Our strategy features five interconnected elements, shown below.

| <i>Smart Columbus Electrification Plan Strategies</i> |
|--|
| 1. Displace carbon-intensive electricity generation with zero-carbon renewable power; |
| 2. Decarbonize regional vehicle fleets, relying mainly on electricity with efficiency and alternative fuels assisting; |
| 3. Build out smart transportation systems that reduce GhGs while improving mobility for residents, visitors and freight; |
| 4. Drive significant electrification into personal mobility through policy, investments and education; and |
| 5. Build out infrastructure for smart charging with EV grid-connectivity to lower EV adoption barriers. |

For this endeavor, Columbus has built from our many existing strengths to create a broad implementation partnership involving extensive public and private cooperation, including the City of Columbus, Franklin County, the Columbus Partnership (top 50+ employers), the Ohio State University, Battelle, Honda, MORPC, American Electric Power (AEP), and Clean Fuels Ohio.

Collectively, all partners are committing to triple the USDOT and Vulcan grants to create a \$140 million Acceleration Funding. This match will take the form of investments in solar energy, EVs, EV infrastructure, educational efforts, and more during the grant, and will set in place investments beyond the grant. Our goal is to become a nationally replicable EV adoption and transportation decarbonization model for mid-sized cities.

Financing and policy will be critical to our success. The City and partners will test and utilize a variety of financing mechanisms and policies necessary to attain scale. Examples include vehicle leasing for fleets based on total lifetime cost of ownership, solar financing including Property Assessed Clean Energy (PACE), Environmental Impact Bonds (EIBs), electric vehicle infrastructure banks (EVIBs), and regulatory approvals for utility investments in “smart” EV charging infrastructure at scale. Smart Columbus team will pilot innovative rebate programs to spur consumer investments in EVs and charging infrastructure.

The City of Columbus will educate and lead by example. One of City government’s unique strengths is our Fleet Management Division. Columbus Fleet Management has received awards for management excellence. In 2014 it was recognized as the #1 green fleet in the U.S. by The 100 Best Fleets and Governing Magazine. The City is committed to aggressively deploying EVs in its own fleet, as well as facilitating training and providing leadership to other governments and private fleets in the region.

The Columbus Partnership’s 50+ corporate employers, including their CEOs personally, will also lead by example by acquiring EVs. AEP will seek public utilities commission approval for investments in EV charging, owned by site hosts, but funded in part by rate-payers. The Smart Columbus team will coordinate fleet education and analysis for EV deployments, help plan charging infrastructure deployments, and provide more technical capacity with the support of USDOE labs such as NREL. Implementation partners, including original equipment manufacturers (OEMs), local car dealers, and fleet analysis resources, will facilitate market adoption.



1.1 PROGRAM MANAGEMENT: The City of Columbus has a bold vision to become a world-class Smart City and a mission to share its experiences with other mid-sized cities. To achieve this vision and mission, the Smart Columbus team is proposing a unique approach to managing this large and diverse transportation technology deployment and data project, an approach designed to ensure a sustainable program following conclusion of the grant period. The Smart Columbus team will also host an annual Mid-Sized City Forum share our results and best practices with other mid-sized cities.

1.1.1 Smart Columbus Project Leadership: Sound and stable leadership is a hallmark of Columbus. Mayor Andrew J. Ginther assumed office on the first of January 2016 after serving nine years on the City Council and five years as its president. Mayor Ginther will provide continuous leadership over the entire Smart City Challenge grant, championing the efforts and placing a high priority on the Smart Columbus Electrification Plan as it creates the opportunity to meet both USDOT and Vulcan goals. Smart Columbus goals include improving safety, enhancing mobility, enhancing ladders of opportunity and addressing climate change, as well as advancing the City and region's priorities such as reducing infant mortality, lifting up disadvantaged neighborhoods, and addressing carbon footprint.

1.1.2 Team Members and Partners: The City of Columbus is proposing a team of Key Personnel from the City's Department of Public Service to manage the activities of the Smart Columbus Electrification Plan by creating a Smart Columbus Program Office. This Program Office will receive assistance from other City departments, regional implementation partners, communications professionals, and technical electrification consultants, all of whom will assist with funding, design, deployment, operation, data collection, and implementation of the Smart Columbus Electrification Plan.

The City has assembled a team of top local and national electrification professionals. Their depth and breadth of experience provides the Smart Columbus team with a well-grounded, yet ambitious approach to demonstrate the objectives and goals of the Smart City Challenge. This core leadership team includes:

- **The Ohio State University:** Smart Grid research and electrification deployment;
- **Battelle:** electrification deployment, access to USDOE energy lab resources and technical services;
- **Clean Fuels Ohio:** fleet analysis, consumer EV adoption, education, policy assistance;
- **MORPC:** Integrated Data Exchange, transportation planning, regional coordination and collaboration;
- **The Columbus Partnership:** sustainable funding, leadership from over 50 employers to implement the Plan's strategies.
- **AEP:** utility leadership in transition to renewable energy, grid modernization, and EV charging.

The City also has well-established procurement processes geared to handle the various professional services, construction services, and equipment purchases required by the Smart Columbus Electrification Plan. The City allows for various forms of procurement from closed bid to sole source. The City's Vendor Services is an eGov initiative that provides a one-stop, 24-hour portal for vendor services and contract information. The City will also procure consulting services of the best-qualified national professionals to ensure successful implementation of the Smart Columbus Electrification Plan to include:

- Public relations and marketing firm to assist with branding, design, outreach, and education;
- EV implementation experts, including OEMs, dealership, and technicians;
- Solar manufacturers, project assessment experts, installers, and technicians;
- Financing, venture transaction, and project management experts.

1.1.3 Key Stakeholders: Through the new Smart Columbus Program Office, key stakeholders will assist the City with achieving the Smart Columbus Electrification Plan. Key stakeholders include:



| Smart Columbus Electrification Plan Key Stakeholders | | |
|--|--|---|
| Type | Organizations | Roles |
| Public | City of Columbus, ODOT, COTA, Mid-Ohio Regional Planning Commission (MORPC), Franklin County | Implementation team partners focused on policy/regulatory, and program sustainment. |
| Business / Private | Columbus Partnership, Columbus2020, AEP | Implementation team partners focused on program sustainment, and economic development responsibilities. |
| Technical | Clean Fuels Ohio, OSU, IBM Analytics Data Center, and Battelle | Data gathering, analysis, technical services and assistance with metrics reporting. |
| International | City of Barcelona, IDIADA Lab, City of Montreal, Innocité | Best practices, information sharing, advice. |

1.1.4 Governance Process: The Smart Columbus Program Office will be responsible for directing and coordinating all activities (technical and non-technical) related to the planning, procurement, execution, monitoring, sharing, close-out and sustainment of the Smart Columbus Electrification Plan. To ensure the sustainment of the program beyond the grant, the Program Office will train, organize, and assist city departments in changing procedures, policies and standards to meet goals and objectives of the Smart Columbus Electrification Plan and to infuse the Smart City approach.

1.1.5 Partnership Management: The Smart Columbus Program Office will be supported by a Smart Columbus nonprofit, chaired by Mayor Andrew J. Ginther. The nonprofit will collect and manage the private sector funds (grants and matching funds) and create an Acceleration Fund for Smart Columbus. This organization will meet at regular intervals and provide the Smart Columbus Program Office the following support:

- Resources to implement the projects and sustain the Plan beyond the grant.
- Assistance in building and marketing Columbus as a global leader in electrification.
- Support to retain and attract innovative electrification companies to Columbus.
- Support in making sure that Smart Cities, as a high priority, is communicated to private sector leaders.
- Identify resources (capital, grants, research, & expertise) to fund the Plan through a privately financed Smart Columbus Acceleration Fund.

1.1.6 Smart Columbus: Roles, Responsibility, & Lines of Communication: An organization is only as functional and effective as its well-defined roles and lines of communication. Given the size and diversity of the Smart Columbus Electrification Plan, its roles and lines of communication are simple and straightforward, as summarized below. The Program Manager and Deputy Program Manager are critical to maintaining lines of communication with the Vulcan leadership in 6 month increments, if not more frequent.

| Program Office Roles & Responsibilities for Clear Communication & Effective Management | |
|--|---|
| Role | Responsibilities |
| Program Manager | <ul style="list-style-type: none"> • Responsible for the overall program delivery • Primary point of contact for the Vulcan regarding the program execution • Primary point of contact for Smart Columbus non-profit • Manages all stages of the project including the Vulcan-funded and Smart Columbus Plan activities • Manages and directs procurement, reporting, and auditing • Responsible for communication plan and its execution • Responsible for the stakeholder plan and its execution |
| Deputy Program Manager | <ul style="list-style-type: none"> • Manages the technical activities and deliverables, City department and Implementation Partner support • Leads component reviews by the Senior Technical Advisor (each 6 months), as well as the periodic reviews for safety and QA/QC |



1.1.7 Quality Assurance, Timeliness, Cost-Effectiveness, & Risk Management:

Successful risk management on advanced technology programs starts with having a detailed Program Management Plan (PMP) and skilled program leadership. The Smart Columbus Program Office will ensure successful execution of the PMP, including ongoing operations. In addition, the Program office will be informed by a team of internal Senior Technical Advisors and interaction with Vulcan. Furthermore, the Program Office will be supported by an audit and QA/QC team member to ensure fiscal accountability, document control, and quality assurance. Finally, the Program Office will utilize and maintain a Schedule Management Plan to review delivery of projects, risks, and schedule recovery.

1.1.8 Staffing Approach: Columbus is organizing the Smart Columbus Program Office within the City’s Department of Public Service. The Program Office will be staffed by two top technically qualified leaders serving as Program Manager and Deputy Program Manager. (See Appendix B for resumes.) The two leaders will direct, manage and coordinate the Smart Columbus Electrification Plan. The Program Office will leverage the existing and well-established Department of Public Service organizational structure to directly coordinate with City departments’ procurement of highly-qualified electrification consulting professionals, communications support, construction, installation services, and equipment providers.

Public Service has an organizational infrastructure that is geared toward implementing the Plan, with its staffing and established procedures designed to handle bidding and procurement of over \$150 million annually for professional services and construction contracts. The Department has a successful track record in managing complex projects and programs with a variety of funding schemes.

Following City regulations for procurement, the Program Office will oversee and direct the procurement of the best-qualified electrification, communications, and project design professionals to ensure successful management of the Electrification Plan.

1.1.9 Organizational Staffing Chart:

The Smart Columbus Program Office is organized to manage, direct and coordinate all aspects of the Smart Columbus Electrification Plan while leveraging existing and well-established city organizational structure (Figure 1).

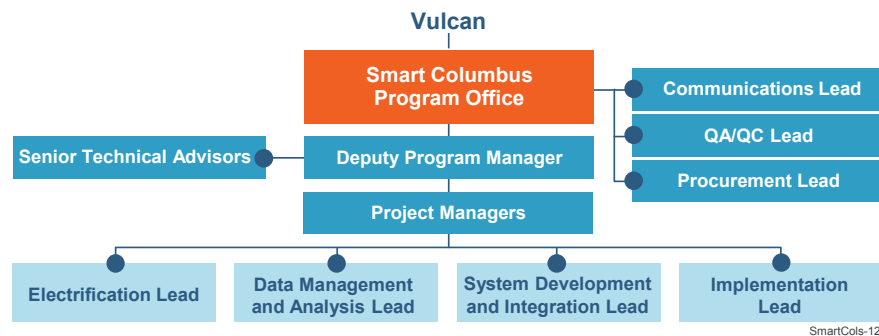


Figure 1. The Smart Columbus Program Office and project leadership centralized management team.

1.1.10 Staff Contingency Plan: Risks exist both of an organizational and technical nature. While that may be so, every effort will be made to minimize risk through the Risk Management Plan within the overall Program Management Plan (PMP). The key organizational risks are associated with turnover in staff and key personnel involved in the project. The Smart Columbus Program Office will address these risks by contracting with a team with a depth of staff and resources available. Our team has redundancy in capable staff which will allow us to replace key personnel over the life of the project. It is the intention of the City to engage the proposed key personnel and key staff from CFO, Battelle, OSU, and other skilled electrification consultants. All consulting professionals are subject to the City’s procurement and contract award procedures and legislative processes.



1.1.11 Technical Advisory Committee: The Smart Columbus Program Office will coordinate and direct all aspects of the Plan and report directly to Vulcan. The Smart Columbus Program Office will form an advisory committee to minimize risk. Members of the Senior Technical Advisory will include:

| | |
|------------------------------------|--|
| • Columbus Mayor’s Office | • Germain Family of Car Dealers |
| • Columbus Department of Utilities | • Transit alternative modes expert or advocate |
| • MORPC | • Transportation Network Company |
| • AEP | • Electrical Trades Center Financing expert |
| • The Ohio State University | • Columbus 2020 |
| • Honda of America Manufacturing | • Central Ohio Transit Authority (COTA) |

1.2 STATEMENT OF UNDERSTANDING: Vulcan Smart City Challenge is part of a collaboration with the USDOT. The Vulcan portion of the collaboration is focused on a reduction of GhG in the transportation system. The strategy is to provide a \$10 million grant to a single mid-sized city, then leverage and scale success through other cities across the U.S.

Decarbonization of transportation at scale within a timeframe needed requires mass deployment of electric vehicles (EVs), infrastructure needed to connect them to the grid, and mass decarbonization of the electric grid through renewable energy. The Smart Columbus Electrification Plan will achieve substantial decarbonization in the near-term with a trajectory to model reductions needed to avoid catastrophic climate change. Our strategy will achieve five interconnected primary goals: 1) Decarbonization of the region’s electrical supply; 2) Fleet electrification; 3) Public transportation and personal mobility decarbonization; 4) Mass consumer adoption of EVs; and 5) Charging infrastructure installation.

Smart Columbus Electrification Plan will achieve these goals at scale during the grant. We understand scale to mean deployments of technologies, vehicles and infrastructure, creation of policies to facilitate rapid trajectory over a 10-15 year period, and successful demonstration of financing mechanisms that enable sustainable deployments at scale, and successful demonstration of educational initiatives to accelerate the trajectory required for transportation decarbonization.

The Smart Columbus Electrification Plan defines a set of metrics with temporal benchmarks to make sure we remain on a pathway to achieve success. For example, we are setting trackable deployment goals for renewables and grid efficiency, fleet EVs acquired, use of no or low carbon modes of transportation, charging stations installed, registered consumer EVs, and others. In addition to these numerically quantifiable metrics, we are defining metrics to track the effectiveness of policies.

2. SCOPE OF WORK: The Smart Columbus Electrification Plan is focused on five primary goals to transform and decarbonize the electric grid and transportation sector in the Columbus region. Table 2 below lists five elements and respective sub-projects essential to achieving these goals, as well as lists a few of the key success metrics corresponding to each goal.

| Elements | Electrification Plan Projects | Key Success Metrics |
|--|--|-----------------------------|
| Element 1: Electricity Supply Decarbonization | 1.1 Commercial / Industrial Solar Program | 915 MW Solar/Wind Statewide |
| | 1.2 Residential Solar Program | 3.4 MW Installed |
| | 1.3 Grid & Building Efficiency Program | 1.33% annual improvement |
| Element 2: Fleet Electrification | 2.1 Public Fleet Electrification | 300 EVs |
| | 2.2 Private Fleet Electrification | 448 EVs |
| | 2.3 Car Sharing / Ride Sharing Fleet Electrification | 30 EVs |



Table 2. Smart Columbus Electrification Plan Projects and Metrics

| Elements | Electrification Plan Projects | Key Success Metrics |
|---|--|--|
| Element 3: Transit, Autonomous and Multi-Modal Systems in the City | 3.1 Transit System Enhancement and Efficiencies | Completed BRT and 3000 DSRC vehicles |
| | 3.2 Electrified Autonomous Vehicles | 6 deployed AVs |
| | 3.3 Bike Sharing & Alternate Modes Programs | 10 kiosks and common payment platform |
| Element 4: Driving Consumer Adoption | 4.1 Consumer EV Adoption & Sales Program | 3,200 Registered EVs by 2018 |
| | 4.2 Consumer EV Education & Demo Program | 100 Events with 7,500 consumers |
| | 4.3 Dealer EV Education & Sales Incentives | 15 Dealer trainings; 200 participants |
| Element 5: Charging Infrastructure | 5.1 Residential Charging Deployment Program | 1,600 New Level II Chargers 300 New Level II Chargers |
| | 5.2 Workplace Charging Deployment Program | |
| | 5.3 Public Access Charging Deployment Program | |

The Smart Columbus Electrification Plan elements and sub-projects are designed to be integrated with results to decarbonization over both the near and long terms. In addition, the Smart Columbus Electrification Plan is designed to be trackable, metrics-driven, scalable, and replicable. Figure 2 provides examples of performance metrics and evaluation during two phases. In general, the scope of work in this Plan is in Phase I, while Phase II is focused on the expansion and sustainment of the program beyond the grant.

2.1 ELEMENT 1: ELECTRICITY SUPPLY DECARBONIZATION

Ohio, including the Columbus region, remains reliant today on fossil fuels, with coal and natural gas currently used to generate 83 percent of electricity (58 percent and 25 percent respectively) as of June 2015. Coal fueled generating capacity has been reduced from 68% in 1999 to 50% in 2016, with an AEP investment of \$8.5 billion in environmental controls. The natural gas portion has increased recently. This, along with slow load growth and coal retirements, has cut CO2 emissions by 16.5 percent in one year (123 to 102 metric tons), part of a 39 percent reduction since 2000. Still, renewable energy today comprises only 3 percent of the overall Ohio mix of electricity sources.

2.1.1 Utility Scale & Commercial Renewable Energy & Power Purchase Programs:

Utility-Scale: Fortunately, AEP’s mass transition to renewable energy has begun to happen. The Federal Energy Regulatory Commission (FERC) recently vacated the Public Utilities Commission of Ohio’s (PUCO) ruling on AEP’s coal power purchase agreement (PPA) filing. Included in that filing was a negotiated investment of \$300 million for 400 MW of solar and 500 MW of wind over the next four years. Renewables advocates were concerned that AEP would terminate this negotiated commitment. However AEP recently recommitted to this despite FERC vacating the coal PPA’s.

AEP has developed a plan to fulfill this commitment and has shifted to implementation. Within the last month, they released a request for information (RFI) to develop a list of qualified large-scale solar and wind project developers. Responses are due July 13. Following their review of RFI responses, they plan to

| | PHASE I | PHASE II |
|-----------------------------|---|--|
| Activities | Plan, Test, Execute, Collect Data | Analyze Data, Refine Plan (Adapt), Execute |
| | <ul style="list-style-type: none"> • FLEET Conversion • Consumer Adoption • Solar Program | |
| Funding Sources | Vulcan Grant & City/Partnership | City/Partnership |
| Timeframes (Years) | 0 – 3 years | 4+ years |
| Performance Measures | <ul style="list-style-type: none"> • Regional GHG Improvement • Number of Fleets Converted • Number of EV Sales • Number of EV Stations | <ul style="list-style-type: none"> • Regional GHG Improvement • Number of EVs in Fleets • Number of EV Sales • Coverage of EV Stations |

Vulcan-03

Figure 2. Smart Columbus Electrification Plan Phases.



quickly issue RFPs. Based on developers' responses and negotiations, AEP will take a package of projects back to the PUCO, seeking approval for renewable power purchase investments for the full 900 MW of renewable energy. Subject to PUCO approval, AEP will move quickly. Under the right circumstances, they could begin work on projects in 2017. AEP is interested in completing projects so their ratepayers will benefit from federal tax credits. AEP also wants investments to qualify for the Clean Power Plan by being in place by 2021. This 900 MW investment in solar and wind will help increase AEP's renewable energy portion from 3 percent up to 15 percent, not factoring in other anticipated contributions from Smart Columbus activities, but factoring in AEP's additional investments in grid modernization, including investments for 10-20 MWhs in battery storage for reliability, load management and micro-grid resiliency.

Also, AEP is giving preference to partners that will help develop solar manufacturing supply chain jobs, especially in Appalachia, and give preference to Ohio's military veterans for these jobs. The White House has committed \$1 million this year and \$1 million next year to job training directly related to this project through their Power Plus Initiative. It is worth remarking that this investment in renewables is occurring despite the freeze on Ohio's RPS. While advocates remain hard at work to reverse the Ohio General Assembly's action, engaged parties are finding ways to mitigate the worst effects. AEP's commitment represents a significant aspect of that work. Details provided in this section on the Smart Columbus Electrification Plan for residential and commercial solar also will contribute positively.

Commercial and Industrial Solar: The Smart Columbus team and partners will launch a region-wide initiative to deploy commercial and industrial-scale solar. Our goal is to identify and develop a wide diversity of replicable projects in terms of hosts and site characteristics in order to achieve full-scale potential for commercial solar to contribute to grid decarbonization. We will utilize a solar mapping tool (for example, Mapdwell) to provide free assessments for building owners and to target high-value locations. Columbus Partnership members have already expressed their willingness to examine solar installation. Smart Columbus team will offer vetting and project development services. We have allocated budget to adapt and expand on the Solarize Cincinnati Model, funded by the City of Cincinnati, to further incentive these developments. Smart Columbus also will work with MORPC and the Columbus Partnership members to coordinate solar installations, to the degree possible, into areas of heavier EV charging – based on multi-unit residences, public, and workplaces, including at locations of Columbus Partnership members. This will enable much of this additional electricity load from EVs to be fulfilled by new solar capacity.

As part of this project, we will select a few larger scale projects – 3 to 5 MW – for development. For these projects we have received a commitment from Quantified Ventures, a firm that helps identify and shape projects for Environmental Impact Bonding. This project will prove out this concept as it applies to commercial solar financing, so the model can be replicated and scaled in the Columbus region and by others across the U.S. These smaller and larger commercial solar projects combined will provide combined new solar deployments of at least 15 MW in the Columbus region by 2018. The continuation plan will multiply that deployment several fold. This effort will help Columbus mitigate the challenge presented by the RPS freeze and continue rapid progress toward grid decarbonization.

2.1.2 Residential Renewable Energy & Power Purchase Programs: The Smart Columbus team's residential solar deployment program will leverage group purchasing power to incentivize and provide guidance for consumer solar adoption throughout the region. To facilitate site identification for Columbus area homeowners and businesses, Smart Columbus team and local partners will develop a remote assessment solar mapping tool that will assist in analyzing solar potential. The Smart Columbus team and our partners will market this service to be offered free of charge. By utilizing GIS mapping, residents, especially those engaged in a group purchasing co-op, will be able to determine approximate



power they could generate through rooftop solar. The solar mapping tool will be combined with a group purchasing program to educate residents and expedite action on installations.

Key to the Smart Columbus residential strategy will be a rooftop solar group purchasing program. With cooperation from local solar panel providers and installers, Smart Columbus partners such as OHSUN will facilitate and promote a discounted opportunity for businesses and homeowners to install rooftop solar throughout the region. Based on recent experience in nearby states, OHSUN estimates each participant will save 15-30 percent off the cost of their system not counting the Federal tax credit, and receive support from their peers as they go through the process. These savings result primarily from driving installers to compete while squeezing out costs such as customer acquisition. In 2015, data indicated 107 Columbus residences had installed rooftop solar. This plan will increase this adoption several fold by 2018. OHSUN, and other partners also will be able to market EV group purchasing programs together with solar co-op purchasing. This is based on a combined EV and solar group purchasing model developed in Boulder, Colorado. This will enable consumers to enjoy added financial benefits while reducing residential and transportation carbon footprint.

Based on projections from OHSUN and other partners, and with budget allocated, Smart Columbus team will accomplish a major acceleration of residential solar in the Columbus region. Specifically, beginning immediately, we will implement 4-6 year-one solar co-ops, educating 500 homeowners at informational sessions, recruiting 600 co-op participants, then facilitate 120 installed solar systems, for installed capacity of ~600 kW. In year two, we will implement 5-7 co-ops, educate 600 homeowners at informational sessions, recruiting 800 co-op participants, then facilitate 200 installed solar systems, for installed capacity of ~1 MW. In the first half of year three, we will establish 7 co-ops, educate and recruit 800 co-op participants and establish a clear pathway for installation of 360 installed solar systems (to be completed during the continuation phase) for installed capacity of ~1.8 MW.

Notably, Ohio is one of 26 states that currently lack “solar rights.” Because of this, homeowners associations may block residential solar installations. Our partners’ strategy will proactively engage these associations as part of the work with a wide range of other local partners to ensure local “solar rights” for residents.

Besides the direct results of nearly 3.4 combined MW of installed solar, Smart Columbus through our partners will recruit and educate active local partners, and also educate participants and local partners about resources to make homes more energy efficient to support our efficiency goals. In addition to direct residential solar installations, the Smart Columbus team will create a residential renewable energy purchase program to expand the impacts of electric supply decarbonization to those residents throughout the region that can’t or don’t wish to install residential solar. PUCO has just begun a program to create a database and track consumer RECs purchases. We will work with PUCO to establish a baseline, then set goals for specific MW of residential renewable power purchases in the Columbus region by 2018.

2.1.3 Energy Efficiency & Grid Modernization Programs: Energy efficiency is the most cost-effective strategy to reduce CO₂ emissions. Energy storage also is a critical step to facilitate utilization of renewable energy that is intermittent and can be generated in low demand areas, and respond to peak demand periods.

AEP offers energy efficiency programs to help business and residential customers reduce energy waste and save money. Overall, these programs have reduced CO₂ emissions by more than 2.3 million tons. Customers get audit services along with efficient lighting, heating and cooling, weatherization upgrades and others, and AEP offers special services for residential customers at or below 200 percent of the federal



poverty guidelines. In 2015, 21,165 premises participated, achieving over 69,182 MW savings in AEP’s territory.

AEP will increase energy efficiency targets from 1 percent to 1.33 percent annually as proposed in a PPA stipulation approved by PUCO. To meet these goals, AEP has piloted additional programs, such as Community Energy Savers, to increase participation. The City of Columbus and partners such as MORPC have developed plans to support this effort by creating an “incentives road map” to help commercial and industrial sectors navigate the benchmarking, rebates, tax incentives, financing available to help them reduce energy usage and costs. Smart Columbus team also will actively support the Community Energy Savers program. As a pilot, this program increased participation by three fold.

Grid Modernization / Efficiency Initiatives: AEP will build upon its successful gridSMART program with implementation of gridSMART 2.0, an initiative that will increase efficiency by providing consumers and AEP with information and greater control over energy consumption. AEP will continue its investment in the gridSMART program, subject to PUCO approval. It also proposes research to develop vehicle to grid (V2G) services such as peak shaving and eventually frequency regulation. This effort will position EVs to play an increasing role as grid-connected distributed resources to help meet peak demand, provide frequency regulations and other services. The City of Columbus will install more efficient technologies to reduce the impact of its infrastructure on the grid, lessening the total energy usage. Smart street lights will provide an efficient, safe solution that will reduce electricity consumption and operational costs by over 30 percent.

Subject to regulatory approval and rate recovery, AEP long-term plan would deploy storage for reliability, transmission and distribution deferral, and backup power at critical loads. Subject to PUCO agreement, 10-20 MWh are envisioned in the region over the next four years.

Element 1: Scope of Work Details

| | 1.1 Utility Scale and Commercial Solar Projects: | 1.2 Residential Solar Program: | 1.3 Efficiency and Grid Modernization: |
|------------|--|---|--|
| Objectives | 1) Implement AEP Renewable Power Purchase Plan; 2) Utilize and test financing mechanisms for solar installations. 3) Develop solar projects at targeted commercial and industrial facilities in and around Columbus. 4) Increase commercial renewable power purchases. | 1) Acquire rooftop solar assessment tool 2) Establish solar group purchasing program that provides education and reduced installation costs. 3) Connect solar to EV group purchasing. 4) Ensure “solar rights.” 5) Develop residential renewable power purchase program | 1) Expand AEP Community Energy Savers program. 2) Increase energy efficiency savings from 1% to 1.33% per year. 3) Install Smart street lights. 4) Increase battery storage capacity in Columbus area. |



Element 1: Scope of Work Details

| | 1.1 Utility Scale and Commercial Solar Projects: | 1.2 Residential Solar Program: | 1.3 Efficiency and Grid Modernization: |
|---|---|---|---|
| Tasks & Timeline Milestones (see budget for quarterly breakdown by project) | <p>(2016): 1) AEP issues RFP for solar and wind developers. 2) Acquire mapping tool and begin to conduct assessments. 3) Contract with EIB financing partner. 4) Develop commercial renewable power purchase program.</p> <p>(2017): 5) AEP files for PUCO approval of 900 MW PPA for Ohio. 6) PUCO approves filing. 7) Market program to businesses and consumers. 8) Identify small to medium-sized commercial solar projects. Arrange PACE or other financing, permitting. Increase commercial RECs purchasing.</p> <p>(2018): AEP develops 900 MW of solar and wind projects. Facilitate installer participation (at group discounted rates). Increase commercial RECs purchasing.</p> | <p>(2016): Identify locations for initial solar co-ops. Use solar assessment/ mapping tool. Conduct outreach and organization of first 4 co-ops. Develop residential renewable power purchase program.</p> <p>(2017 – Q1&2): Select installers for first solar groups. Complete installations for first groups. Identify second set of solar co-ops. Conduct outreach and hold meetings.</p> <p>(2017 – Q3&4): Identify 3rd set of solar co-ops. Select installer for second set. Complete installations for second set.</p> <p>Conduct outreach for 3rd set of co-ops and hold meetings</p> <p>(2018 – Q1&2): Contract with installers for 3rd set</p> | <p>(2016): 1) AEP expands Community Energy Savers (CES) program into entire City. 2) Columbus begins initial planning on smart street lights.</p> <p>(2017): 1) AEP expands CES to entire region. 2) Columbus begins to deploy smart street lights. 3) AEP begins deployment of battery storage.</p> <p>(2018): 1) Columbus continues smart street lights. 2) AEP continues battery storage.</p> |
| Partners | City of Columbus, AEP, Columbus Partnership, Solar Installers, Building Owners and Operators, MORPC, Quantified Ventures, Mapdwell | City of Columbus, AEP, OHSUN, Green Energy Ohio, MORPC, Solar Installers, residential building and home owners, Mapdwell, Community-based Organizations | City of Columbus, AEP, Columbus Partnership, MORPC, Community-based Organizations |
| Risks & Barriers | 1) Long term funding sustainability. 2) Lack of suitable space. 3) Cost of rooftop solar installations. 4) Lack of interest in rooftop solar installations. 5) Lack of experience applying EIBs to commercial solar projects. 6) PUCO approval required for AEP PPA. | 1) Long term funding sustainability. 2) Lack of suitable space. 3) Cost of rooftop solar installations. 4) Lack of interest in rooftop solar installations. | 1) PUCO approvals on Smart Meter installations; 2) Consumer resistance to efficiency measures; 3) Delays and costs in street light program; 4) Cost of battery storage and/or smart grid technology |
| Mitigation & Financing Strategies | 1) Wide range / multiple financing tools, including EIBs, Special Energy Improvement Districts, and PACE. 2) Simple solar mapping tool for site identification, 3) Interest in Columbus Partnership to explore solar, 4) Strong alignment among utility and advocates to support renewable PPAs, federal tax credits, forward-thinking new PUCO leadership. | 1) Utilize a variety of solar financing strategies and ownership models, including traditional bank or credit union financing, leasing and others. | 1) Support of AEP by Columbus Smart City Partners for PUCO case. 2) Strong financial savings potential of efficiency; 3) Financing tools to support efficiency; 4) AEP commitment to invest in battery storage technology. |



Element 1 Deliverables: Program Metrics & Overall Outcomes

| | 1.1 Commercial Solar Projects: | 1.2 Residential Solar Program: | 1.3 Grid Modernization and Efficiency: |
|-------------------------|--|---|--|
| Program Metrics | PV Capacity Installed (util, comm, ind); % of Utility & Com/Ind Load met by PV Capacity/generation; % of Identified new EV load met by Solar | PV Capacity Installed; Spatial Correlation of PV (Metropolitan Population Space); % of Residential Load met by PV Capacity/generation | *kWh per sq ft. (Res and Comm) |
| Overall Outcomes | Total MW Installed (900 MW utility; 15 MW new comm/ind; Total Carbon Displaced ¹) | 3.4 MW total new residential Total Carbon Displaced ¹ | 23 MW of Additional Efficiency Savings Over Baseline Total Carbon Displaced ¹ |

¹ Metrics for total CO2 reduced will depend on several factors including percentage of electricity provided to Columbus region compared with total AEP territory. It also will be based on the per MW CO2 intensity of current Columbus (as opposed to Ohio) grid, factoring in how the grid will become less CO2 intense over the next several years. Smart Columbus will develop methodologies to accurately track these grid-based CO2 reductions as part of project implementation.

Continuation Plan: Beyond 2018, grid-integrated EVs and larger-scale battery storage help maintain this momentum, facilitating utilization of growing utility and distributed renewable energy resources. Anticipated cost reductions in renewables and batteries will be vital. Another key factor will be refinement and scaled use of innovative financing tools such as EIBs, PACE financing, and co-operative purchasing. AEP will include battery storage and micro-grid projects in future PUCO filings.

2.2 ELEMENT 2: FLEET ELECTRIFICATION: Fleet electrification is an essential component of the Smart Columbus Electrification Plan, accelerating large-scale EV deployments and enabling EVs to become a primary driver of regional transportation decarbonization. Fleet Electrification is a key strategy because: 1) Fleets have incentives to make vehicle purchase decisions based on total cost of ownership (TCO) data to maximize operational cost savings; 2) Fleets have consistent drive and duty cycles, generally rely on centralized refueling (recharging), and make annual bulk replacement purchases; and 3) Large fleets are visible leaders, driving adoption of best practices among peers through associations such as the Municipal Equipment Managers Association (MEMA), National Association of Fleet Administrators (NAFA), and others.

The Smart Columbus Electrification Plan will drive large-scale fleet EV deployments by targeting specific adoption strategies and key implementation leaders in the two main market segments: Government Fleets (with City of Columbus leading implementation) and Private Fleets, including car sharing and taxi fleets (with the Columbus Partnership top 54 employers leading implementation).

2.2.1 Cross-Cutting Fleet Deployment Strategies: The Smart Columbus team will also utilize several key tools, policies and processes to ensure fleet electrification is done effectively among government and private fleets alike. These include:

Vehicle Data Logging and TCO Analysis: The Smart Columbus team will acquire one-year licenses from FleetCarma for 400 data loggers. During the first year of active implementation, these data loggers will be installed on vehicles in 15-20 government and private fleets to analyze drive cycles and provide guidance on EV total cost of ownership (TCO) and savings tailored to specific fleet vehicles and routes. Smart Columbus team will then work with these fleets to purchase EVs, largely through performance-based contracts and leases directly tied to these real-world analyses and cost savings.

Fleet EV Demo Program: Conducted by CFO and partially funded by the USDOE (thru July 2017), Midwest DRIVES offers free demo vehicles, including EVs, to interested fleets ranging from one week to one month. These vehicles are equipped with FleetCarma data loggers to assess EV performance during



fleet specific trials. CFO will conduct EV demos for at least twenty Columbus region fleets between fall of 2016 and July 2017. As part of this program, CFO will develop a case study following each fleet demo. This case study will be reviewed by experts at the National Renewable Energy Laboratory's (NREL's) Fleet DNA program. This program will help accelerate fleet adoption of EVs by offering real-world data and fleet-specific EV experience. CFO will also retain ownership of all program content, data loggers, and technical tools allowing demos to continue through the Vulcan grant.

Used EVs: As EV and battery technologies continue to advance, used EVs are increasingly coming to market. Because of this, used EVs present an opportunity for fleets to acquire vehicles at a favorable price to accelerate larger scale electrification. Working with OEM partners such as Honda, Smart Columbus team will facilitate used EV purchase pools for participating regional fleets, including an initial pooled purchase of used Honda Fit EVs from the City of Los Angeles. We will also track used EV sales metrics.

EV Charging Infrastructure: The City of Columbus and Columbus Partnership have committed to lead an effort to develop specifications, engineering and then issue a solicitation for installation of needed charging for EVs in government and private fleets.

Vehicle Technicians Training: While EVs do not require the same level of maintenance compared with conventional vehicles, it is still important to have key personnel highly trained to perform diagnostics, maintenance and repairs. As part of its commitment to incorporate EVs into the fleet, Columbus will arrange training for technicians to be assigned to work on EVs. Along with OEM training, others, such as the National Alternative Fuels Training Consortium (NAFTC), offer in-depth courses. Columbus Fleet Services, according to its custom, will invite technicians from other fleets to participate in these trainings. As the City's technicians receive training and gain experience with EVs, we will be positioned to train and mentor others, enabling fleets throughout the Columbus region to scale up in capabilities to provide needed service.

Emergency Responders Training: Emergency responder (fire, police) training also remains critical to ensure proper handling of vehicles during first responder scenarios.

Increasing VMT of EVs: One of the main challenges with incorporating EVs into fleets is to ensure they are utilized enough to achieve a return on investment over the vehicle lifetime. The City of Columbus and other fleet electrification partners will develop and share best practices for EV utilization.

EV First-in-Line Policy & Software: The City of Columbus will create and model an "EV first" policy for EVs integrated into departmental pools. This will be backed up with "key valet" software optimized to ensure drivers use only EVs when they are available, maximizing vehicle utilization and return on investment potential. The budget includes an allocation to cover about 25 percent of this software.

EV Ambassadors, Contests & Education: The City of Columbus will adopt a program modeled on the City of Loveland, Colorado that selects individuals within departments to become champions of EVs, then educate others. The City will offer small rewards and recognition for the drivers logging top mileage and best driving practices while in EVs.

Ongoing Vehicle Usage Tracking and Fleet Right-Sizing: The City of Columbus and other EV fleet partners will track mileage quarterly to quantify success, and identify any EVs that are underutilized. This will allow vehicle redeployments and facilitate ongoing right-sizing.

Utilizing these strategies, we project the deployment of 778 electric vehicles and a total displacement of 1,323 tons of carbon (CO₂) annually from the region's fleets by 2018 as a result of Vulcan fund investment.

2.2.2 Government Fleet Acquisitions: The City of Columbus Division of Fleet Management will lead the overall government fleet electrification efforts. The City's Fleet Division is a national leader among its peers and the City's Green Fleet Action Plan has become a national model. Based on this plan, the City



is successfully transitioning its heavy-duty fleet from diesel to compressed natural gas (and B20 biodiesel for diesel vehicles awaiting transition). The City is also preparing to take the next step by incorporating net zero GhG renewable natural gas, generated from anaerobic digestion of waste streams, such as sewage treatment sludge and other organics available in every community.

The City has chosen fleet electrification as its primary Green Fleet strategy for light-duty vehicles. An initial high-level analysis performed by Electrification Coalition identified targets of opportunity for EV replacements. Based on this analysis and with assistance through the Smart Columbus Electrification Plan, the City will successfully transition to EVs, committing to acquire 200 EVs by 2018. In addition, the City is excited to lead other fleets in the region through this transition to electric vehicles, as noted above. As part of the Smart Columbus Electrification Plan, other public fleets have made commitments to purchase and deploy EVs, including the Ohio State University (50 EVs), Franklin County (10 EVs), and the City of Dublin (10 EVs). Others will add at least 30 EVs.

2.2.3 Private Fleet Acquisitions: The Columbus Partnership (top 50+ regional private employers) will lead overall private fleet electrification efforts with the support of Smart Columbus team. Columbus Partnership members have made commitments to acquire EVs in their fleets. CEO's of Partnership members also are acquiring EVs for their personal use to lead by example. This effort will influence others and individual consumers. The total number of private fleet EV commitments among all partners is 400. In addition to this, AEP is committed to incorporating 48 EVs in its utility fleet, primarily in the form of plug-in hybrid bucket trucks.

2.2.4 Taxi, Car-Sharing, and Ride-Share Electrification: The Columbus region features various transportation network companies (TNCs), carshare, and rideshare services. Many of these innovative services can respond flexibly to meet the transportation needs of the rapidly growing Columbus region at all hours, while reducing needs for some to own personal vehicles.

Many services align with EV charging facilities that have already been installed. Plans for significantly more installations (outlined in Element 5) provide additional opportunities for providers to offer expanded services by deploying EVs. The Smart Columbus team will collaborate with these providers to deploy EVs to reduce single occupancy vehicle traffic and contribute to decarbonization of a growing alternative transportation service sector. Smart Columbus team will work with service providers that feature EVs, such as EverCar, Green Commuter and others. We also will connect TNC company drivers with incentives and education through the consumer EV programs (detailed in Element 4) to spur EVs in this growing service market.



Element 2: Scope of Work Details

| | 2.1 Government Fleet EV Deployments | 2.2 Private Fleet EV Deployments | 2.3 Taxi, Car, & Ride Sharing Electrification |
|---|--|--|--|
| Objectives | 1) Conduct TCO analyses to identify best fit fleet EV deployments; 2) Spur sizable adoption of EVs in three core fleet segments; 3) Create processes and programs to ensure high fleet EV utilization; and 4) Provide technical and safety trainings to facilitate smooth regional fleet transitions to EVs. | | |
| Tasks & Timeline Milestones (see budget for quarterly breakdown by project) | <p>(2016): 1) Work with City and other government fleets to identify EV placements and plan for 300 EV purchases; 2) Acquire data loggers, run analyses on public fleet vehicles to target EV best EV replacements within fleet;</p> <p>(2017): 3) Conduct Midwest DRIVES EV demos & case studies; 4) Develop EV procurement specifications for public fleets; 5) Set up EV Ambassador program; 6) Conduct EV Technical & Safety trainings and continue in 2018;</p> <p>(2018): 7) Setup EV “first in line” utilization software and program; 8) Scale and complete additional public fleet EV deployments.</p> | <p>(2016): 1) Work with Columbus Partnership fleets to identify EV placements and plan for 400 EV purchases; 2) Acquire data loggers, run analyses on private fleet vehicles to target best EV replacements within each fleet;</p> <p>(2017): 3) Conduct Midwest DRIVES EV demos & case studies; 4) Develop EV procurement specifications for private fleets; 5) Replicate City EV Ambassador program; 6) Private fleets attend City hosted EV Technical & Safety trainings and continue in 2018;</p> <p>(2018): 6) Adopt EV “first in line” utilization software and program; 7) Scale and complete additional Private fleet EV deployments.</p> | <p>(2016): 1) Work with TNC fleets to identify EV placements and plan for 30 EV purchases; 2) Acquire data loggers, run analyses on TNC fleet vehicles to target best EV replacements within fleets;</p> <p>(2017): 3) Conduct Midwest DRIVES EV demos & case studies; 4) Market consumer EV incentives to TNC contract drivers; 5) TNCs attend EV Technical & Safety trainings & continue in 2018;</p> <p>(2018): 6) Scale and complete additional TNC EV deployments.</p> |
| Partners | <p>Lead: City of Columbus, CFO, FleetCarma;</p> <p>Supporting Partners: MORPC, OSU, City of Dublin, Franklin Co., Honda, other OEMs, Dealers</p> <p>Future Partners: MEMA, APWA</p> | <p>Lead: Columbus Partnership, CFO, FleetCarma;</p> <p>Supporting Partners: AEP, Columbus Chamber, Columbus 2020, Honda, OEMs, dealers</p> <p>Future Partners: NAFA, NTEA</p> | <p>Implementation Lead: City, CFO, FleetCarma, EverCar</p> <p>Supporting Partners: MORPC, Car2Go, Lyft, Uber, Taxi fleets</p> <p>Future Partners: Additional TNC fleets</p> |
| Risks & Barriers | 1) Lack of fleet interest in EV adoption; 2) Fleet uncertainty concerning EV savings; 3) Under-utilization of fleet EV assets; 4) Lack of EV technicians; 5) Lack of capital / fleet financing for purchases. | | |
| Mitigation & Financing Strategies | 1) Strong Public and Private fleet commitments; 2) TCO analysis & EV demos to address fleet uncertainty concerning EV savings; 3) “First-in-Line” software and program to ensure high utilization of fleet EV assets; 4) Wide availability of EV technician trainings; 5) EV purchase pools, and use of performed based fleet lease and financing solutions. | | |

Element 2 Deliverables: Program Metrics & Overall Outcomes

| | 2.1 Government Fleet EV Acquisitions: | 2.2 Private Fleet Acquisitions: | 2.3 Taxi, Car, & Ride Sharing Electrification |
|-------------------------|--|---------------------------------|---|
| Program Metrics | 1) 400 data loggers deployed on 20 largest fleets’ vehicles; 2) Detailed TCO analysis for 20 regional fleets; 3) EV demos and case studies for at least 20 regional fleets; 4) Two (2) Regional EV Charging Equipment Safety 5) 40-50 Technicians Trained on Charging Equipment Safety; 6) Four (4) Regional EV Technician Trainings; 7) 80-100 EV Technicians Trained; 8) Four (4) Regional EV Emergency Responder Trainings; 9) 80-100 EV Emergency Responders trained on EV safety. | | |
| Overall Outcomes | <ul style="list-style-type: none"> • 778 EVs deployed by Fleets in Columbus region by 2018 • 1,323 tons CO2 reduced annually* from the region’s fleets by 2018 <p><i>*Based on USDOE AFLEET tool assuming gasoline vs. EV at default MPG for 8000 mi/year</i></p> | | |



Continuation Plan: Beyond 2018, the Smart Columbus Plan is designed to create self-sustaining momentum to drive long-term fleet adoption by building technical capacities involving acquisition of data logging equipment, utilizing TCO analysis models based on growing sets of real-world fleet data, and conducting “train-the-trainer” technical and safety trainings to build local expertise. The Smart Columbus Electrification Plan will also be sustaining based on innovative purchase and financing strategies, including piloting and scaling fleet used EV purchase pools, and use of performance based fleet lease and financing solutions based on real-world vehicle data logging and demos.

2.3 ELEMENT 3: TRANSIT, AUTONOMOUS AND MULTIMODAL

SYSTEMS IN THE CITY: The third element of the strategy is targeted at reducing harmful emissions by moving people from making single occupancy vehicle trips, and instead, to select alternative transportation options to meet their needs. This element will be executed in the USDOT application. The types and environmental benefits offered by these options vary, but they all do serve in some capacity to benefit the overall system. As suggested by the element description, moving to transit is one option, an option proven to have numerous benefits versus single occupancy vehicles. A second option includes the use of first/last mile autonomous vehicles that serve as a valuable link to encourage overall transit use. And finally, the use of bike and car sharing, the first of which has obvious benefits, but even the latter, the car share, has shown to reduce the number of single occupancy trips, and in turn, GhG emissions. By deploying these strategies, Smart Columbus will produce: 1) complete BRT corridor; 2) 3000 DSRC vehicles; 3) 6 EAVs; 4) 10 kiosks for bike sharing; and 5) common payment platform.

2.3.1 Transit System Enhancement and Efficiencies: As part of their overall system evaluation and toward their fundamental goal of providing necessary transit services, COTA is deploying the first Bus Rapid Transit (BRT) system in the region. This system is highlighted in the USDOT application, and includes strategies that not only serve the access to jobs and reliable transportation goals, but also serves to provide the desired environmental benefits. CNG buses will be utilized, eco-friendly transit signal prioritization (TSP) will be employed, and expanded park and rides will be established to promote and support utilization of the BRT.

2.3.2 Electrified Autonomous Vehicles: A second option to support Element 3 is focused on the use of EVs, particularly autonomous EVs, as elements of multi-model “transit” environment, including first mile / last mile services. As part of the USDOT application, the Smart Columbus team intends to deploy exactly that, a fully autonomous, electrified vehicle to provide first mile / last mile service in conjunction with the region’s existing fix-route transit service provider.

2.3.3 Bike and Car Sharing Programs: Bike Sharing offers a tremendous opportunity to not only reduce GhG, but to also benefit the traveler by increasing their physical activity. Similarly, Car Sharing is another strategy. The Smart Columbus team will deploy, promote and potentially expand citywide, the program for car and bike sharing.

| Element 3: Scope of Work Details | | | |
|----------------------------------|--|---|--|
| | 3.1 Transit System Enhancement and Efficiencies | 3.2 Electrified Autonomous Vehicles | 3.3 Bike and Car Sharing Programs |
| Objectives | 1) Promote use of Transit System versus personal automobile. 2) Operate a ‘greener’ transit system. | 1) Provide first/last mile as well as park once strategy using a fully autonomous EV (EAV). 2) Evaluate use of Inductive charging as convenient, safe, and reliable means to recharge vehicles | 1) Provide affordable transportation options as alternative to single occupancy vehicle trips, both alone and as part of multi-modal system. |



Element 3: Scope of Work Details

| | 3.1 Transit System Enhancement and Efficiencies | 3.2 Electrified Autonomous Vehicles | 3.3 Bike and Car Sharing Programs |
|---|---|--|--|
| Tasks & Timeline Milestones (see budget for quarterly breakdown by project) | (2016): 1) Deploy BRT System using CNG Fleet vs. Diesel. 2) Employ eco-friendly Transit Signal Prioritization. (2017-2018): 3) Expand and improve existing facilities, to include added capacity at park and rides. 4) Promote use of the system. | (2016): 1) Identify and procure EAVs. (2017-2018): 2) Install Inductive charging. 3) Continued systems testing. 4) Operate system. | (2016): 1) Identify potential providers. 2) Determine best locations for deployment. (2017-2018): 3) Conduct any necessary infrastructure upgrades, shared use lanes, utilities. 4) Integrate offering into citywide planning applications. 5) Market program to businesses and consumers. |
| Partners | Lead: COTA (BRT Operator, vehicle owner), City of Columbus (signal owner) Supporting Partners: Econolite | Lead: Steiner and Associates (Easton property mgmt.), COTA, Supporting Partners: EAV vendors, Building owners and operators | Lead: City of Columbus, COTA, MORPC, Supporting Partners: Yay! Bikes, Car2Go, Lyft |
| Risks & Barriers | 1) Eco-friendly TSP affects operations, requiring monitoring to find correct balance. | 1) EAV operational and technical challenges. 2) Regulatory barriers to on-road use of EAVs | 1) Obtaining sufficient ridership to warrant 3 rd party investment in an area. |
| Mitigation & Financing Strategies | 1) Expanded outreach, including incentivized rides with low or no fares. 2) BRT service presently part of COTA plan for region, includes funding. | 1) EAV operations will be ensured by conducting rigorous testing and safety evaluations. 2) Regulatory barriers need to be negotiated to support on-road use of EAVs. 3) Funding from Easton Property Mgmt. group (Steiner and Assoc.) and the Columbus Partnership. | 1) Market as part of citywide integrated travel planning tool, as well as via other traditional and non-traditional means. 2) Vendor operated, but supported by City strategies to cross-promote service. 3) Vendor Funded. |

Element 3 Deliverables: Program Metrics & Overall Outcomes

| | 3.1 Transit System Enhancement and Efficiencies | 3.2 Electrified Autonomous Vehicles | 3.3 Bike and Car Sharing Programs |
|-------------------------|---|--|---|
| Program Metrics | 1) Expanded marketing effort around utilization of transit with BRT corridor. | 1) EAVs procured, 2) 6 inductive charging station installations. | 1) Expanded marketing effort, 2) Citywide travel planning tool, 3) infrastructure upgrades. |
| Overall Outcomes | 1) Complete BRT corridor. 2) 3000 DSRC vehicles. | 1) 6 EAVs. 2) 6 EAV chargers. | 1) 10 install to kiosks. 2) Common payment platform. |

Continuation Plan: Beyond 2018, the Element 3 strategy will be scaled to other Columbus neighborhoods.

2.4 ELEMENT 4: DRIVING CONSUMER ADOPTION: The Columbus area is home to nearly 2 million residents, and population is expected to increase by almost 50 percent in the next thirty years. Many of these residents will rely on personal automobiles. A reliance on vehicles with internal combustion engines leaves the region vulnerable to volatile fuel prices and produces increasing greenhouse gas emissions. In order to reduce the environmental and economic impact of personal vehicles, the Smart Columbus team will work to significantly increase the number of EVs deployed in the region through replicable models that feature financial incentives, consumer education, and dealership training initiatives.



Significant barriers still exist around consumer adoption of EVs, including higher capital costs and lack of understanding of EV technology. The Smart Columbus team is dedicated to eliminating these potential barriers and dramatically increasing EV sales in the Columbus region. Between 2009 and 2013, 211 new EVs were sold and registered in Columbus. This program will significantly increase annual EV sales, with a goal of 3,200 EVs purchased by consumers from late 2016-2018, resulting in approximately 6,440 tons of carbon (CO₂) reduced annually from the consumer EVs by 2018.

2.4.1 Consumer EV Adoption and Sales Program: The top barrier to EV adoption for many consumers is higher initial for purchasing a vehicle. However, EVs often result in a lower total cost of ownership due to reduced refueling cost. The Smart Columbus team will reduce initial upstart cost by offering a limited number of rebates for EV purchases, creating a group purchasing program, and incentivizing purchases of used EVs.

Consumer Rebates: To reduce initial cost, the Smart Columbus Electrification Plan will include direct \$1,000 rebates to consumers who purchase a new EV within the project time period. Facilitated through the Smart Columbus team, these rebates will be offered at certain intervals to 750 new EV purchases, and will be combined with savings from the consumer group purchasing program. This incentive will rapidly increase the annual EV purchases and create significant demand to sustained long term grow.

Group Purchasing Program: Smart Columbus team will create and manage a group purchasing program, modeled on successes in Colorado. This program will reduce the higher initial cost of EVs while reducing costs of customer acquisition for dealers. The Smart Columbus team will work to implement this program into a replicable model by: 1) Soliciting discount pricing proposals from OEMs and local dealers, 2) Negotiating discount pricing, program timeframe and eligibility, 3) Marketing the program to consumers and local groups. Nissan has agreed to partner on a group purchasing program, and Smart Columbus team will directly approach additional EV OEMs and dealers to secure their participation.

Used EV Market: Smart Columbus team will work with OEMs and selected local dealers to create a used EV deployment program that connects consumers and fleets with various used EV options based on need. As EV leases expire and new, higher-range, affordable hit the market, used EVs are an increasingly available and affordable option for consumers. With little battery degradation, consumers are often able to purchase a used EV at a much lower price compared to new vehicles.

This program will help consumers that prefer a used or can't afford a new EV. Smart Columbus team will: 1) establish a formal communications and marketing strategy to inform consumers of the value used EVs provide, 2) facilitate outreach to local consumers through community events, social media, and partner channels, and 3) Directly connect consumers with participating local dealerships to facilitate sales.

2.4.2 Consumer Educational Events and Demonstrations: Many consumers still know little about EVs. They question the drivability, cost, and range of EVs, and are unfamiliar with their superior driving experience. To dispel concerns and myths, Smart Columbus team will facilitate opportunities for consumers to drive EVs. Through extended test drives and large scale ride and drive events, consumers will receive hands on experience with EVs, promoting the technology and increasing adoption. This program will also build upon the enthusiasm and experience of current EV owners through their volunteer participation at EV events.

Long-Term EV Test Drives: Many consumers lack knowledge on the basic components of EV ownership, such as the feasibility of home charging and the basic driving experience. This program, in partnership with OEMs and dealers, will allow potential customers to take an EV home with them overnight or for 2-3 days, giving them the opportunity to charge the vehicle, take it around their normal commute, and generally establish a level of comfort with the somewhat unfamiliar concept of driving an EV. This program will



include a survey of participants, gathering data on effectiveness.

Ride and Drive Events: By hosting and promoting public Ride and Drive events, the Smart Columbus team will provide numerous, convenient, heavily promoted hands-on driving experiences for consumers. With participation from OEMs, local dealers, and private owners, the public will have the opportunity to view and test drive a variety of EV. Partners who have or plan install workplace charging stations will promote and host Ride and Drive events on location for their employees. These also will include smaller, community-scale events at retail locations, churches, recreation areas and others plus much larger-scale events tied to the Ohio State Fair, the large ComFest event, Ohio State Football games, the Greater Columbus Auto Show, and others. In total, the Smart Columbus team will host 100 events with the goal of reaching 7,500 consumers.

This program will capitalize upon and expand the existing “EV Owners Circle”, a grassroots network of passionate EV owners cultivated by CFO. These owners will provide testimonials on their EV experiences, volunteer at events, and provide their vehicles for test drives. These events will strengthen and grow the network, ensuring connectivity to the EV movement, as well as program sustainability.

2.4.3 Dealer EV Education & Sales Incentives: Dealerships often do not prioritize the sale of EVs, due to limited supply, longer consumer education process, lower residual revenue stream from vehicle service, and/or lack of understanding of the technology. The Smart Columbus team, working with EV OEMs, will create programs that educate dealers on best practices and financially incentivizes increased focus on selling EVs.

Dealership Training: With participation from OEMs and partners, dealerships will have the opportunity for dedicated training around EV sales from subject matter experts. This will supplement required OEM training. The Smart Columbus team, with in-kind technical support from USDOE Clean Cities and building on prior CFO dealer training experience, will coordinate this training. This EV training will allow dealership staff to improve their EV knowledge and more easily convert interested consumers into EV owners. Two of the largest Columbus region dealers have committed to participating.

Financial Incentives: A recognized best practice for overcoming disengaged auto dealers is to provide direct financial incentives per vehicle sold to dealer sales personnel. Smart Columbus team, through Vulcan and matching OEM funding, will administer a dealer sales personnel incentive, offering a \$200 per-vehicle bonus for each EV sold. Local manufacturing OEM, Honda, has agreed to launch their new Clarity Plug-In-Hybrid model, due out in 2018, to the Columbus region for sale. This incentive and Honda’s strong local presence will further increase EV adoption.



Element 4: Scope of Work Details

| | 4.1 Consumer EV Adoption and Sales Program | 4.2 Consumer Educational Events and Demonstrations | 4.3 Dealer Education & Sales Incentives |
|---|--|---|---|
| Objectives | 1) Establish EV group purchasing and rebate program that provides discounted prices to consumers. 2) Connect EV group purchasing program with solar group purchasing program. 3) Create accessible marketplace with dealers to connect consumers with available vehicles. 4) Educate consumers around reliability and economic savings available from used EVs. | 1) Educate consumers and address common questions and concerns around EV ownership. 2) Establish a long term EV test drive program with participation from OEMs and local dealers. 3) Promote long term test drives to interested consumers, partners, and community groups. 4) Hold Ride & Drive events across the region. | 1) Educate dealers about EVs, including best methods for increasing sales. 2) Establish financial incentive for dealers to focus on selling EVs. |
| Tasks & Timeline Milestones (see budget for quarterly breakdown by project) | (2016): 1) Solicit participating OEMs and dealers. 2) Establish discounted price structure and procedure for EV rebate program. 3) Develop Marketing materials. (2017-2018): 4) Market program to consumers. 5) Enroll interested consumers in group program. 6) Establish protocol for connecting consumers to dealerships offering used EVs. 7) Work with partners to implement program, administer rebates. | (2016): 1) Engage OEMs, dealers around extended test drive periods and Ride and Drive events. 2) Develop materials for promoting test drives and events to consumers. (2017-18): 3) Work with local partners to implement long term EV test drives. 4) Plan Ride and Drive events with local partners, hosting events at various locations, including partner facilities. | (2016): 1) Engage local dealers around training and incentives. 2) Work with OEMs to create financial incentive for dealer EV sales. (2016-2017): 3) Conduct trainings providing basic knowledge of EV technology and education around best practices for EV sales. 4) Implement dealer financial incentives. |
| Partners | Leads: Columbus Partnership, Clean Fuels Ohio. Supporting Partners: Honda, Nissan, area auto dealers. | Lead: City of Columbus, Clean Fuels Ohio. Supporting Partners: The Ohio State University, MORPC, Honda, Nissan, area auto dealers, Columbus Partnership | Leads: City of Columbus, Clean Fuels Ohio. Supporting Partners: Honda, Nissan, other OEMS, area auto dealers. |
| Risks & Barriers | 1) Securing OEMs and Dealerships for group purchasing programs. 2) Lack of consumer interest in used EVs. 3) Concern over battery depletion. | 1) Scope and reach of Ride and Drives. 2) Effectiveness of EV Education. | 1) Lack of OEM interest/participation. 2) Lack of dealer interest/participation. 3) Effectiveness of EV Education. |
| Mitigation & Financing Strategies | 1) Meet with key decision makers, leveraging Columbus Partnership. 2) Utilizing partners such as Clean Fuels Ohio, provide education to consumers illustrating the value and practicality of EVs. | 1) Partner with effective organizations in EV outreach and education. 2) Instill best practices for Ride and Drives. | 1) Foster strong OEM support and executive level dealership staff for “top-down” implementation around program commitments. 2) Utilize USDOE resources and industry best practices for EV sales education. |



Element 4: Deliverables, Metrics & Outcomes

| | 4.1 Consumer EV Adoption and Sales Program | 4.2 Consumer Educational Events and Demonstrations | 4.3 Dealer Education & Sales Incentives |
|-------------------------|---|---|--|
| Program Metrics | Marketing campaign developed, total EVs sold (new and used). | 100 educational events held, 7,500 consumers educated, 5,000 test drives given. | 15 Dealership training events with 10-15 attendees, development of a “best practices” model for incentivizing dealers. |
| Overall Outcomes | 1) 2,300 registered consumer owned EVs by the end of 2018. 2) 8,000 consumers engaged through events and marketing. 3) 6,440 tons of carbon (CO2) reduced annually from the consumer EVs by 2018 <i>*Based on USDOE AFLEET tool assuming gasoline vs. EV at default MPG for 14,000 mi/year</i> | | |

Continuation Plan: Beyond 2018, this program will be sustained beyond the performance period through private sector support of the group purchase program and used EV market, as well as utilization of Columbus’ strong, collaborative community, including the growing EV Owner’s club.

2.5 ELEMENT 5: CHARGING INFRASTRUCTURE: Lack of access to charging infrastructure is the most significant barrier today to consumer adoption of electric vehicles. It’s also essential as part of fleet EV acquisitions. Smart Columbus team will overcome this through a strategy to identify key locations and leverage funding to install infrastructure that consumers need to acquire EVs with full confidence.

The primary barrier to charging infrastructure development is financing. Closely related to this is pro-active policy. While markets everywhere are challenged to install charging, there are positive signs today in the Columbus region. Today, our region boasts 12 DC fast chargers (not including Tesla super chargers), including investments funded by Nissan, EVGo and a few others, public level 2 charging, and additional workplace charging. As the market develops, Smart Columbus team will be able to utilize Vulcan funding to leverage substantially greater investments from private sources, local government, AEP, and Columbus Partnership members. Smart Columbus team and partners will coordinate placements of charging based on plans described in each section below.

With the level and speed of investment in residential, workplace and public charging, ensuring well-trained installers and EVSE maintenance will be critical. Fortunately, Smart Columbus team has a tremendous asset in the form of the Electrical Trades Center (ETC). ETC already has trained dozens of electricians on installations and has the capacity to ramp up training to meet this need.

2.5.1 Funding and Financing Commitments and Models: Initial leveraged funding for EV charging will come from three primary sources: 1) The Congestion Mitigation and Air Quality Program (CMAQ), administered locally by the MORPC – \$600,000 (some in the form of an Electric Vehicle Infrastructure Bank, EVIB, modeled on a new State of Washington program); 2) AEP (subject to PUCO approval) – \$100,000 initially, additional funding in 2017 and 2018; 3) Columbus Partnership members (primarily workplace and multi-unit residences) – over \$3.1 million. Continued leveraged funding will be based on a plan to be developed in 2017. Sources will include substantially increased utility funding, continued CMAQ (including EVIB leveraging of private capital), and additional private partner (mainly for multi-unit and workplace).

2.5.2 Residential Charging: Home charging is and for most will remain the place where most EV charging occurs. In Columbus, 60 percent of households are single family. In the suburbs it is 72 percent. Most, not all, of these households have access to at least a 120 V plug, if not 220 V, in a garage. This means that for a significant percentage, about one-third overall, an EV is highly impractical due to lack of



home charging access. Columbus is rapidly growing with much of this growth occurring in denser “in-fill” urban areas. That’s good news for overall transportation efficiency, but providing access at multi-unit residences, plus single family homes that lack a garage, is a high priority challenge.

Also during 2017, Smart Columbus team will develop a comprehensive plan and financing strategy for buildout of multi-unit residential charging in the Columbus region. By 2018, implementation of this plan will begin. Likely funding sources will include match from building owners, AEP (subject to PUCO approval), additional CMAQ funding, and use of Property Assessed Clean Energy (PACE). Notably, Smart Columbus also will stretch Partnership and government funding by developing an EVSE group purchasing model to drive down the cost of this equipment and its installation. This program will be modeled on successful group purchasing programs for solar and EVs that have been described in Element 1 and Element 4 sections. The goal is to develop 1000 residential chargers by the fifth year.

The City will work with its partners and examine modifications in zoning and parking codes to incentivize developments to be made “EV charging ready” by incorporating wiring into initial designs and construction. This would save the considerably greater expense of needing to retrofit existing structures and lots.

2.5.3 Workplace Charging: The centerpiece of Smart Columbus Electrification Plan workplace charging investments during the coming 2.5 years will be to leverage the \$3.1 million commitment by over 50 large corporate members of the Columbus Partnership. This commitment is budgeted at \$11,500 per charger times five chargers for \$57,500. It’s likely that this commitment will fund more chargers in some locations. This remarkable commitment by the Columbus region’s corporate leadership will jump start a transformation of EV charging and connectivity. A key complement to this investment is a further commitment of all Columbus Partnership members that each CEO will acquire an EV personally and charge at work. With this budgetary commitment, Smart Columbus will be able to make investments in chargers that are equipped with “smart” features allowing communications and eventually bi-directional charging for V2G services – or can be upgraded to include those features when needed.

This investment will leverage tremendous benefits, especially accelerated adoption of vehicles by consumers. Element 4 includes discussion of numerous workplace charging events hosted by Columbus Partnership members as part of their installations. The investments also will leverage additional private investment by companies such as EverCar, Green Commuter and E-Rive that provide TNC services through Uber featuring EVs and/or EV ride sharing. These are described in Element 2. Specifically, Smart Columbus team will work with these EV transportation providers and Columbus Partner members to install additional charging, leveraged from electrical infrastructure provided to parking lots to develop additional charging that will be shared between the TNC and ride sharing services and employees with EVs at Columbus Partnership workplace locations.

Since these workplace charging investments are from private partners, no Vulcan, local government, or AEP funds will be used.

2.5.4 Public Fast Charging: The Columbus Region has made a strong beginning on public fast charging. However, more investments are needed. Smart Columbus team will work with MORPC and others to develop a program modeled on the Electric Vehicle Infrastructure Bank (EVIB) in the State of Washington. CMAQ funding will be used to leverage additional private investment through a competitive bidding process. Smart Columbus team is confident that such an approach will be successful because the private sector, as evidenced by investments to date, is already installing charging at strong hosts. This CMAQ funding will simply leverage this process more quickly in locations that are more fully vetted to fill



clear market needs in the region. MORPC’s stated CMAQ investment is budgeted at \$450,000 for public charging.

Overall the Smart Columbus Electrification Plan will deploy a mix of 5-10 public Level 2 chargers and 10-15 DC fast chargers. The project will scope and develop at least one of these DC fast chargers to incorporate solar and battery backup capabilities. This is part of a longer-term continuation strategy to develop chargers that can utilize solar for GhG reductions while also avoiding utility demand charges, which is a significant issue and can be a barrier to the economics of DC fast charging station development.

| <i>Element 5: Scope of Work Details</i> | | | |
|---|---|--|---|
| | 5.1 Residential Charging | 5.2 Workplace Charging | 5.3 Public Access Charging |
| Objectives | 1) Create Group EVSE Purchase Program. 2) Select 3-5 initial high-value multi-unit residential locations and install charging. 3) Develop comprehensive residential charging plan with multiple funding sources, and begin implementation. | 1) Install workplace charging at over 50 workplaces of Columbus Partnership members; 2) leverage partnership location investments by providing infrastructure for TNC partners. 3) Hold successful events (noted in Element 4). | 1) Develop 10-15 additional fast charging locations; 2) Develop 5-10 additional level 2 public; 3) At least one fast charging will be equipped with solar and battery storage. |
| Tasks & Timeline Milestones | (2016): 1) Solicit EVSE Group Purchasing Partners. 2) Select initial high-value multi-unit residential sites. 3) Develop site plans for EVSE. (2017, Q1&2): 1) Secure EVSE group purchase partners; 2) install EVSE in initial sites; 3) Develop comprehensive plan for residential EVSE; 4) Secure multiple funding sources for residential EVSE plan; (2017, Q3&4): 1) Evaluate initial residential EVSE deployments; 2) Begin site selection for first phase of comprehensive EVSE plan; (2018): Continue implementing EVSE residential – rebid group purchase, design/install sites, ID additional sites, financing, eval. | (2016): 1) Develop clear and specific implementation plan involving Columbus Partnership sites based on meetings, site vetting and budget estimating; 2) Leverage group EVSE purchasing noted under residential (2017-2018): 1) Controlled, deliberate implementation that begins more slowly and picks up speed with site development as experience builds; 2) Project evaluation as projects are completed; 3) CEOs acquire vehicles timed with installation of EVSE at their locations; 4) Monitor utilization EVSE. 5) Leverage employee adoption EVs through events and other education. | (2016): 1) Develop plan; 2) Develop EVIB program; 3) Promote program and solicit site hosts, EVSE developers; (2017 Q1&2): 1) Select sites and developer teams for fast charging; 2) Consider and select level 2 locations based on planning followed by solicitation.3) Develop initial five fast charging project. 4) Promote projects. (2017, Q3&4): 1) Continue to select and install public fast charging based on same process and EVIB program funded by CMAQ (2018): 1) Evaluate, continue to promote. |
| Partners | Leads: City of Columbus Supporting Partners: EVSE Suppliers, Clean Fuels Ohio, MORPC, developers, building owner members, financial partners | Leads: City of Columbus, Columbus Partnership Supporting Partners: EVSE Suppliers and installers, trainers, Clean Fuels Ohio, TNCs | Leads: City of Columbus Supporting Partner: EVSE Suppliers, Installers, Clean Fuels Ohio, MORPC |
| Risks & Barriers | 1) Securing EVSE Suppliers. 2) Site selection and development complications; 3) Making multiple financing instruments and sources work together. | 1) Workplace siting issues; 2) Volume and speed of installations; 3) installation efforts outpacing education of employees on EV adoption. | 1) Difficulty finding suitable sites. 2) Sufficient funding for fast charging with battery storage and solar additions. 3) Management of EVIB as new program model. |



Element 5: Scope of Work Details

| | 5.1 Residential Charging | 5.2 Workplace Charging | 5.3 Public Access Charging |
|--|--|--|--|
| Mitigation & Financing Strategies | 1) Clear process to communicate with and select EVSE winners; 2) Careful site selection process, especially the first 3 to 5 sites; 3) strong partnership communication; 4) Front-end communication with all code and license city personnel; 5) Financing strategies and sources noted – build strong relationships by taking time to ensure success in early projects, then evaluating. | 1) Work with Partnership and others on a realistic plan; 2) Begin slowly, deliberately with good site selection, planning, budgeting and financial mgt systems, 3) Plan out educational efforts in coordination. 4) Select strong, reputable, well trained EVSE supplier and installer. | 1) Work with expert stakeholders and partners to identify locations that meet all needed criteria. 2) Proceed deliberately with planning and rolling out EVIB. 3) Identify and work with vendors to contain costs. |

Element 5 Deliverables: Program Metrics & Overall Outcomes

| | 5.1 Residential Charging | 5.2 Workplace Charging | 5.3 Public Access Charging |
|----------------------------------|--|--|---|
| Element 5 Program Metrics | Plans for initial 5 sites Plan for 1,000 sites, including funding model | Plans and budgets for over 50 workplace installations At least two sites incorporate charging for TNC fleet CEO EVs acquired EVSE Utilization reports | EVIB program development Sites, plans, specifications, and vendor selection for public charging installations. |
| Overall Outcomes | 15 Level II residential chargers; plan to implement 1,000 additional | <ul style="list-style-type: none"> • 290 Level II Chargers deployed throughout the region • 10-15 DC Fast -Chargers deployed at strategic locations, 5-10 public Level 2 | |

Continuation Plan: Beyond 2018, Element 5 investments will prove critical to the longer term play for integrating EVs into the grid to provide additional value to utilities, EV owners and workplace hosts. Finally, the Plan also will develop a multi-faced funding strategy to rapidly accelerate residential EVSE.

2.6 CONCLUSION: The Smart Columbus Electrification Plan is designed to unify the Columbus region in order to lead the country in the deployment of Smart City technologies, as well as reduce the region’s carbon and greenhouse gas (GhG) emissions through electrification of the electric supply and transportation sectors.

Smart Columbus Electrification Plan: Key Attributes

| |
|---|
| <ul style="list-style-type: none"> • Leadership: Electrification plan led by Mayor Ginther and administered by Smart Columbus Program Office. |
| <ul style="list-style-type: none"> • Reliability: City of Columbus, Franklin & Delaware Co.: AAA bond rating, operating budget \$820M, capital \$1 billion. |
| <ul style="list-style-type: none"> • Efficient: City of Columbus eGov initiative, 24/7 Vendor Portal, selects consultants in 9 days of RFP, contracts in 55 days |
| <ul style="list-style-type: none"> • Capable: OSU, nation’s 3rd largest public research university; Battelle, world’s premier energy technology research nonprofit with access to USDOE energy labs; CFO, nation’s largest USDOE Clean Cities Coalition with EV expertise. |
| <ul style="list-style-type: none"> • Connected: MORPC coordination of 60 regional governments; Columbus Partnership coordination of 54 top employers. |
| <ul style="list-style-type: none"> • Committed: Smart Columbus nonprofit and advisory board created to spur implementation and continuing innovation. |
| <ul style="list-style-type: none"> • Long-term: \$100 million Public-Private Partnership Acceleration Fund, innovative financing mechanisms for future. |

2.6.1 Capacity and Capability: Columbus is the state’s capital, the largest Ohio city, and the fifteenth largest city in the U.S. We are the fastest growing metro in the Midwest, the top metro for job growth in the Midwest, and the top metro for wage growth in the U.S. In 2015, we were designated the



Most Intelligent Community in the World by Intelligent Communities Forum. We are an international economic powerhouse with a gross metropolitan product (GMP) of \$118 billion—an economy larger than 142 countries and 17 states. The Columbus Region is home to 15 Fortune 1000 companies and 4 Fortune 500 companies.

2.6.2 Efficiency & Readiness: The City of Columbus has an experienced procurement office with defined procedures for managing large capital and technology projects as well as unique projects that may not fit the usual capital project definition. The City also has efficient contracting process to secure the proper electrification consultants to support this Plan.

2.6.3 Executive Commitment: Sound and stable leadership is a hallmark of the City of Columbus. Mayor Andrew J. Ginther assumed office in January 2016 after serving nine years on the City Council and five years as its president. Mayor Ginther will provide continuous leadership over the entire USDOT and Vulcan grants. He continues the steady leadership the city has enjoyed over the past 16 years under former Mayor Michael Coleman, the longest serving mayor in city history. Mayor Ginther has made Smart Columbus one of his highest priorities and has engaged our leading business, political, and community leaders in the effort. He assembled broad bi-partisan support of the community with letters of support from local, state, and federal elected officials, regional governments, business leaders, and non-profits.

2.6.4 Partnership: The “Columbus Way:” Columbus has a long tradition of partnerships and collaboration between business, non-profits, and government. MORPC, a voluntary association of more than 60 Columbus Region governments, has served as the metropolitan planning organization for the region with origins back to 1943. The Columbus Chamber of Commerce has been helping Columbus Region businesses succeed since 1884. The Chamber also helps to administer the Columbus Region Logistics Council, to promote Columbus as global logistics hub. The Columbus Partnership is a membership-based organization comprised of over 50 CEOs from the city’s leading businesses and institutions and also supports Columbus 2020, the leading economic development organization for the Columbus Region. These organizations are the public and private partners supporting this Plan.

2.6.5 Regional Expertise & Workforce: The Columbus Region has the workforce to sustain Smart Columbus Electrification Plan well into the future. The Smart Columbus team comprises some of the world’s most talented individuals, companies, and organizations. The Ohio State University is in the top 20 of all universities in higher education research and development expenditures and a national leader in electrification and smart grid research and development. Headquartered and founded in Columbus, Battelle is the world’s largest nonprofit research and development organization with 22,000 employees at more than 60 locations globally. Battelle and each of the six national laboratories it manages bring excellent facilities and expertise into the electrification of vehicles, and smart grid.

IBM’s Client Center for Advanced Analytics, based in Columbus, is advancing research, development, client services, and skills training in the areas of analytics, big data, and cognitive computing. The Columbus Region is home to Honda of America Mfg., Inc., Honda R&D Americas, Inc., and the Honda North America corporate headquarters. All partners are providing significant resources and expertise to the Smart Columbus team. The Smart Columbus Electrification Plan was written by AEP, CDM Smith, Battelle, Clean Fuels Ohio, and the City. These organizations have leading work in electrification.

2.6.6 Sustainment Plan: The Smart Columbus team, led by the City of Columbus and the Columbus Partnership are committed to fund the Smart Columbus Electrification Plan well beyond the grants. The Smart Columbus nonprofit is designed to catalyze expanded implementation as well as spur investment and innovation, and sustain the City’s Smart City vision over the long term:



- To be the nation’s epicenter for electrification and smart grid research, planning, and implementation.
- To show the world a practical path to implementing electrification strategies and reduce GhG emissions.

2.6.7 \$140M Acceleration Fund: The City and Columbus Partnership created an Acceleration Fund that will nearly triple the USDOT and Vulcan grant funding. We will use this funding to accelerate specific projects as well as sustain the Program Office and its smart city technology deployment, scale-up activities within the Columbus region, and transfer of our project results to other mid-sized cities via our Mid-Sized City Forum. Table 3 summarizes the make-up of the Acceleration Fund. The Acceleration Fund has three components: program (in-kind) funds, cash, and research (in-kind) funds. We will use program (in-kind) funds to implement specific projects in this Plan. The program (in-kind) budget is \$37.1 million (Table 3). The cash budget is \$10.6 million (Table 3).

The City and Columbus Partnership have reserved \$10 million that will be used for sustainment of the Plan. Research funds will be used to support specific projects in the Smart Columbus Electrification Plan or future areas of innovation research. Throughout the grant and in the years ahead, the City and Columbus Partnership will invest additional capital funds, identify grants, and raise additional private funding to support the Smart Columbus Program Office.

Table 3. Smart Columbus Acceleration Fund.

| Organization | Grants | Acceleration Fund | | |
|--|---------------------|--|---------------------|-----------------------|
| | | Program ¹ | Cash | Research ¹ |
| US Department of Transportation | \$40,000,000 | | | |
| Vulcan Foundation | \$10,000,000 | | | |
| City of Columbus | | \$2,500,000 | \$8,000,000 | |
| Franklin County, Ohio | | \$3,000,000 | \$1,000,000 | |
| American Electric Power | | \$22,100,000 ³ | | \$700,000 |
| The Ohio State University | | \$5,000,000 | \$2,000,000 | \$8,000,000 |
| Columbus Partnership | | \$7,500,000 | \$10,000,000 | \$5,000,000 |
| Ohio Department of Transportation | | \$7,000,000 | | |
| Battelle | | \$1,000,000 | | |
| Greater Columbus Arts Council | | | \$1,000,000 | |
| Experience Columbus | | | \$100,000 | |
| Mid-Ohio Regional Planning Commission | | | \$600,000 | |
| Honda of America | | \$2,600,000 | | |
| Vendors | | \$3,644,000 ² | | |
| Total | \$50,000,000 | \$54,344,000 | \$22,700,000 | \$13,700,000 |
| | | Total Acceleration Fund: \$90,744,000 | | |
| Notes | | Total Program Fund \$140,744,000 | | |
| | USDOT | Vulcan | Sustainment | |
| ¹ In-kind cost estimate supporting specific projects in USDOT and Vulcan plans. | | | | |
| ² In-kind vendor support for USDOT-specific projects: HERE \$1,000,000, Peloton \$165,000, SPARC \$400,000, Mass Factory \$40,000, INRIX \$1,424,000, and Econolite \$280,000. In-kind vendor support for Vulcan-specific projects: FleetCarma \$300,000. | | | | |
| ³ AEP has additional \$103.7M for energy efficiency and GridSMART 2.0 projects in June 2016 filing with the State of Ohio PUCO. Additionally, AEP has a statewide Solar and Wind Deployment Project valued at \$300M for 2017. These projects are part of our plan, but are not included in Acceleration Fund amount. | | | | |



2.6.8 Replicate & Scale Success: The Smart Columbus team will invest resources for marketing, advertising, building relationships, and travel for key conferences/events for Smart Columbus team members to present the Smart Columbus Electrification Plan. Through our Mid-City Sized Forum, Smart Columbus team will be sharing its successes and challenges. The Smart Columbus team also will leverage its existing relationships with Barcelona, Montreal, and the existing Sister Cities Relationships the City has with Curitiba, Brazil; Accra, Ghana; Seville, Spain; Genoa, Italy; Odense, Denmark; Ahmedabad, India; Tainan City, Republic of China; and Hefei, People’s Republic of China, develop to spread its vision around the globe.

2.6.9 Impact: The Vulcan Smart Cities Challenge Grant, in collaboration with the USDOT Smart City Challenge grant, will provide critical support that the City of Columbus and our partners will leverage to facilitate investments at scale to lead the country in the deployment of Smart City technologies, as well as reduce the region’s carbon and greenhouse gas (GhG) emissions through electrification of the electric supply and transportation sectors.

| <i>Smart Columbus Electrification Plan: Outcomes & Responsiveness to Vulcan Goals</i> |
|--|
| • Decarbonize Electric Supply: by installing 918 MW of Renewable Energy and improving grid efficiency by 1.3% annually |
| • Electrify Regional Transportation: by deploying 3,978 Electric Vehicles and 311 Public Charging Stations. |
| • Leverage Resources: Creating \$100 million Acceleration Fund over the grant period and additional investments beyond. |
| • Climate Friendly Transportation Practices: Investing in Transit Efficiencies, Autonomous Vehicles, & EV CarSharing |
| • Data-Driven: Metrics focused on baselining, tracking, documenting, and easily sharing solutions and successes. |
| • Replicable: Playbook of Best Practices, Lessons Learned, and Innovative Solutions to Share with Peers. |
| • Scalable: Hosting Annual Mid-Sized City Forum to share information and spur continued innovation. |

The award also will enable us to develop and implement needed policies, mainly at the local and state levels, while conducting education. This will place Columbus in a position to deliver significant near-term results and on a trajectory to substantially decarbonize transportation within the next 10-20 years.