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# Smart City Collaborative: Exchange and EV Transition

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**Summary**

With the support of the Electrification Coalition (EC), the winner and six finalists of the 2016 Smart City Challenge (SCC), have formed a collaborative called the Smart City Coalition of Seven (SCC7). The SCC7's current project, The Smart City Collaborative-Exchange & EV Transition (SCCEET) will leverage the early momentum created during the SCC and the subsequent formation of the SCC7 to formalize an innovative city-to-city exchange that will create shared projects in the seven participating cities to accelerate the adoption of plug-in electric vehicles (PEVs).

*Keywords: EV (electric vehicle), PHEV (plug in hybrid electric vehicle), BEV (battery electric vehicle), city traffic, consortium, consumers, deployment, demonstration, education, market, policy, strategy, sustainability, user behavior.*

## 1 Introduction

The 2016 U.S. Smart City Challenge (SCC) paired the U.S. Department of Transportation (USDOT) with Vulcan, Inc. to facilitate a national competition among medium-sized U.S. cities. The Challenge garnered 78 applicants from cities across the country, all with their own innovative solutions for reducing U.S. oil dependence and ushering in a new era of mobility. From the original applicants, seven finalists were chosen: Austin, Texas; San Francisco, California; Denver, Colorado; Pittsburgh, Pennsylvania; Kansas City, Missouri; Portland, Oregon; and Columbus, Ohio, the ultimate winner. The finalist cities, with the support of the EC, then formed an early collaborative: the SCC7. The EC has leveraged and supported the roles of the individual cities in order to increase the collective impact of the cities and looking for opportunities create connected projects to scale.

This paper will leave conference attendees with an understanding of the unique role of the SCC7 in city-centered EV adoption through fleet transition and nationwide collaboration. The presentation will review the successes of the creation of the SCC7 as an innovative outcome of the SCC, the potential the group has for increasing EV adoption in the U.S., and the ability of the EC or a similar organization, to support these types of initiatives.

## 1.1 Smart City Collaborative-Exchange and EV Transition

The creation of the SCC7 is just one of the lasting impacts that the SCC had, though it was not one of the initial goals of the Challenge. The SCC demonstrated the broad impact that a challenge can have on influencing and accelerating city plans and activity. Additionally, it created the chance to share the selection criteria of the Challenge and therefore lead cities in an innovative direction more quickly.

The SCC7 was created to determine how to create a city-to-city information exchange and demonstrate the impact city-to-city collaboration will have on creating and implementing best practices, solving shared EV adoption barriers, and using the collective influence of the group to create pro-EV policies and programs. To do this, the SCC7 continues to develop paths for ongoing engagement of the participating cities including the current project discussed below, Smart City Collaborative-Exchange & EV Transition (SCCEET). Cities have a unique potential to drive consumer EV adoption through their own electrification efforts including public education, fleet transition, and the implementation of charging infrastructure in the built environment and right of way.

As part of the initial engagement efforts, the EC has worked with the seven cities to develop and execute key elements of the plans they initially proposed during the Smart City Challenge. SCC7 has provided valuable solutions and dialogue to foster important city-to-city collaboration that allows for shared strategies, challenges, and solutions, creating new models for transportation innovation. The SCC7 will leverage the early momentum created during the SCC to continue to support and formalize innovative city-to-city exchange and create shared projects that the seven participating cities will launch to create new smart mobility strategies.

As the cities develop new innovations to influence widespread adoption of PEVs, the cities have created early collaboration on two key areas – EV Fleet Transition and EV infrastructure in the built environment. While significant action is already taking place in cities around the United States, the SCC7 cities are hoping to create the nation's best replicable play book that not only shares proven strategies for success but also develops new program innovations that accelerate the timelines and outcomes.

# 2 Smart City Collaborative – Exchange and EV Transition

The Smart City Collaborative - Exchange & EV Transition (SCCEET) will leverage the early momentum created during the SSC and the formation of the SCC7 to support an innovative city-to-city exchange. This will influence and create shared projects in the seven participating cities that will accelerate the adoption of PEVs and accelerate development of smart mobility strategies. SCCEET will focus on four primary areas:

- Solving the key barriers to EV transition for city and private fleets.
- Fostering an active peer-to peer, city-to-city collaborative that will create innovative pilot programs, share challenges and solutions, and demonstrate successful programs that can be replicated across the country.
- Demonstrating economies of scale by creating a centralized, consistent and shared data system to track performance metrics across the seven cities.
- Creating a playbook and case studies that will highlight the impact of the city-to-city collaboration that accelerates EV fleet and consumer adoption.

The cities, through the early work of the SCC, already possess some of the best available plans and leadership engagement to support program success, and with the support of the Electrification Coalition, SCCEET can leverage projects and partnerships developed to create a sustainable collaborative that can demonstrate the prolonged impact of the SCC.

Additionally, SCCEET also represents broad geographic, economic, and political dynamics, allowing for greater program exposure, expanded and unique private sector engagement, and demonstrations that will be reflective of every community around the United States, successfully introducing EVs to the diverse cities, regions, and states across the country. The proposal team will document, measure, and record processes, best practices, and challenges involved with the project implementation for the purpose of widespread distribution.

SCCEET will incorporate the following four components. Each of these components will leverage strong partnerships and match commitments developed by the Smart City/Vulcan finalists.

## 2.1 Fleet Transition and Infrastructure Deployment

Drawing from existing program experience and prior fleet analysis provided through the Smart City Challenge, SCCEET will utilize a combination of analytic tools and city planning to develop fleet readiness plans for the transition to electric vehicles. Lessons learned through these projects demonstrate the necessity of unbiased third party technical assistance through planning and implementation phases of an EV deployment in fleets. These efforts will include infrastructure readiness plans that will help to solve for the challenges of incorporating infrastructure into the built environment. These initiatives are detailed in the following sections.

Using analytic assessment tools, SCCEET will establish baseline performance data for fleet vehicles and analyse vehicle-specific duty cycles to help fleets deploy EVs into the most economically and operationally successful applications.

Baseline analyses will inform the selection of vehicles for more detailed EV Suitability Analyses to evaluate individual vehicle drive cycles as well as vehicle and driver performance for the transition to EVs. The results will help each fleet determine which vehicles are most suitable for PEV conversion and the business case for EV transition.

EV Suitability Analyses will also be utilized to develop an infrastructure planning and procurement analysis that will support city and private sector fleets, with a specific focus on infrastructure in the "built environment". The granularity of the telematics data will inform infrastructure options (Level 1, Level 2, DC Fast Charge) needed, as well as the potential for demand response, peak shaving, payment, and site planning. Strategies will differ by city but examples include:

- Creating a centralized procurement or approved vendor for infrastructure purchasing
- Planning and best practices to incorporate infrastructure into the built environment
- Developing infrastructure financing options that solve city budget cycle challenges
- Utilizing fleets and infrastructure as demand response and to support renewables integration
- Maximizing public and private benefit through potential shared infrastructure

SCEET will develop a "boot camp" training and tool set that can be utilized by each city for staff-based outreach and education programs that will help increase interest and prepare the city for rapid transition. The "boot camp" will be designed to help engage all levels of a public or private deployment to include:

- **Innovative financing and procurement options:** Capital leasing/municipal leasing; guidance on non-appropriations clauses; financing battery or charging as an operational expense expenditure; fleets for public car share or TNCs; dealership direct financing or ESCO models; policy changes for sustainable transition.
- **Fleet Program Management:** Take home policies; managing to maximize TCO and "E-Miles" driven; managing "state-of-charge"; fleet EV ambassador program; pool car and EV first policies; preparing for longer range EVs and medium and heavy duty EV technologies.

## 2.2 City-to-City Collaborative

Through this initiative the EC will also develop a peer-to-peer collaborative where the seven participating cities will generate best practices for accelerating EV adoption. Through the sharing of lessons learned between cities, concepts and ideas will be tested in multiple environments, creating the ability to refine EV adoption strategies for further replication across the nation.

The cities will have monthly calls to check in on progress, and will meet in person two times per year. The goals of these meetings will also include to raise additional funding to create more direct support, sharing reporting metrics, case studies, and other resources that both support the cities and help share their impact.

The coordination of this collaborative will also involve:

- Ongoing coordination for regular peer sharing and ensuring shared strategies both for the priority fleet effort and for other shared EV programs that connect cities.
- Capturing lessons learned from each city.
- Developing new concepts for implementation that can be replicated in all seven cities.
- Creating a clearinghouse for private sector partnerships, new funding opportunities, webinar/extended learning, policy success, and new program pilots.

### 2.3 Data, Analytics, Playbook, and Case Studies

To ensure that lessons learned and best practices are captured and shared, the EC will work with the cities and the program partners to carefully track the impact of these programs on EV adoption by fleets, consumers, and the impact on e-VMT (vehicle miles traveled). The EC will develop case studies, develop a handbook, and conduct webinars to share lessons learned, which will be combined into a 'playbook' that can be easily shared with other cities around the country. The EC will work with the seven cities to develop tracking and data sharing protocols at the beginning of the project that are robust and uniform but not cumbersome to ensure continued participation. This would greatly expand data collection and increased understanding of how specific policies and programs can influence fleet transition and larger electric vehicle adoption uptake rates.

### 2.4 Project Partnerships and Deliverables

SCCEET will combine an extensive national network of public and private partners who will drive, scale, and sustain results. These include partnerships with the seven USDOT Smart Cities finalists, and numerous other public and private partners committed to each regional project, including metropolitan planning organizations, economic development entities, major corporations, research institutions and universities, utilities, dealerships, vehicle OEMS, EV infrastructure providers, and more. SCCEET will create a management and reporting structure with the EC serving as the historian of reference for the project.

SCCEET will achieve measurable outcomes and results to be gauged by successes in the following areas:

1. Number of fleets and infrastructure deployed;
2. Fleet infrastructure deployed and solutions in the built environment;
3. Number of case studies and best practices generated from the collaborative;
4. Number of EV trainings;
5. Number of public and fleet personnel trained;
6. Number and type of policies developed or improved;
7. Documented impact of the Collaborative
8. Developed metrics of performance
9. Total number of EVs deployed during the funding cycle.

## 3 Smart City Challenge Grant Competition – A Profile of Seven Cities

Each of the seven cities chosen as finalists in the Smart Cities Challenge grant brought a unique perspective to the Challenge and presented a variety of innovative project ideas. While Columbus ultimately won the Smart Cities grant, the process of developing these concepts propelled a number of projects forward even without the grant funding. The variety and ingenuity outlined in the city-specific summaries below highlights both the opportunities in bringing these cities together under this umbrella, but also the difficulty in implementing a single idea of a 'smart city' in cities with such diverse economies, workforces, politics, geographies, demographics, and politics.

### 3.1 Austin, Texas

Significantly reducing GHG emissions in the transportation sector is a critical component of Austin's Smart City transportation program, Climate Protection Plan, Austin Energy Generation Plan, and *the* focus of the Smart City Challenge application. It is important that transportation electrification does not just transfer GHG inventory to electricity. Austin Energy has a world-class 55% renewable (and approximately 80% carbon free generation) goal but in addition will continue to charge all public, multifamily, workplace, and

fleet charging stations with 100% renewable energy from Texas' growing wind and solar resources through its GreenChoice program. The core of Austin's Smart program revolves around three strategies:

1. **Target high-mileage, best ROI vehicles for electrification:** The core of Austin's strategy to greatly proliferate EVs and eVMT is to target high mileage, mobility service vehicles. These vehicles include taxis, municipal vehicles, transportation network companies (TNC) vehicles, certain corporate fleet vehicles, and public transit vehicles (including buses). This includes efforts to drive consumer adoption of EVs through outreach, smart infrastructure, direct engagement with auto dealers, and bulk purchases.
2. **Ensure eVMT are low-carbon:** Use EVs to increase renewable penetration on the entire grid and maximize "smart charging" to support renewable generation.
3. **Scaling solutions to maximize impact:** Development of a roadmap and playbook for other cities to follow based on lessons learned from the program, deployment and vetting of new financing and business models to allow the private sector to proliferate EVs rapidly, collaboration with other cities through a city liaison program, and engage local auto dealers and their sales staff.

## 3.2 Columbus, Ohio

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 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 metrics to demonstrate project successes and share best practices via our Mid-Sized City Forum. 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:

1. **Electricity Supply Decarbonization:** this includes commercial, industrial, and residential solar programs in addition to a grid and building efficiency program.
2. **Fleet Electrification:** deployment of EVs across public- and private-sector fleets as well as car/ride-sharing services.
3. **Transit, Autonomous, and Multi-Modal Systems in the City:** promote the use of transit, provide first/last mile services, deploy electrified autonomous vehicles, and incentivize ridership in electrified car-share program.
4. **Driving Consumer Adoption:** increase consumer adoption of EVs through group purchasing and incentives, improving consumer EV knowledge and providing tools and resources to make EV sales a priority for local dealerships.
5. **Charging Infrastructure:** this includes residential, workplace, and public access charging programs.

## 3.3 Denver, Colorado

Colorado has built one of the strongest policy and incentive structures for EVs in the nation. This framework was designed by an extensive group of stakeholders who worked collaboratively to address multiple EV adoption barriers all at once. Denver has multiple EV-friendly policies that create a healthy environment for market growth. For example, the city recently passed new residential building codes that include requirements for EV pre-wiring in new single-family houses and duplexes. Additionally, Colorado offers the most substantial tax credit in the country for EVs. HB16-1332 recently simplified the tax credit to a flat amount of $5,000 for all plug-in electric vehicles and made it assignable at point of purchase. This change streamlines the rebate process by allowing the buyer to receive the discount immediately instead of having to wait for their tax return. Denver's Smart City strategy prioritized EV adoption around the following priorities:

1. **Driving consumer demand:** educate the public about EV benefits and affordability; provide infrastructure at critical locations along transportation corridors, at workplaces and multi-family buildings; introduce consumers to the vehicles through experiential learning opportunities; and explore future technologies to enable zero emission transportation beyond the grant period.
2. **Electrified fleets:** Denver has engaged two public transportation mobility leaders who have committed to electrifying millions of miles in the both short-range and long-range EV taxis and

transportation network company (TNC) drivers. Additionally, Denver recently announced a plan to deploy 200 EVs in the city's municipal fleet by 2020 [3].

3. **Grid Decarbonization:** In 2016, Denver released an ambitious Climate Action Plan, which aims to reduce greenhouse gas (GHG) emissions 80% by 2050.
4. **Profound Scalability:** demonstrate an effective model for rapid growth in electrified vehicle miles traveled combined with grid decarbonization, which will be scalable to a vast portion of the country and have emissions reduction potential measured in gigatons.

## 3.4 Kansas City, Missouri

Kansas City will apply connected, autonomous and smart technology for managing transportation, energy production, and long term research to establish the foundations for a 22nd century city. Kansas City's Smart City plan includes three pillars that support vehicle electrification, connected technologies and data analysis to continue advancing the city's transportation sector. The first pillar is the Prospect MAX bus line that runs on Prospect Avenue in Eastern Kansas City. The Prospect Metro Area Express (MAX) bus line will employ electric busses, emplace charging stations at stops, construct and new bus stations along the route. Completion of this route will not only reduce GHG emissions, it will provide residents of the Prospect Corridor with greater access to jobs and technical training located along the BRT route.

The second pillar is electric, connected and autonomous vehicle operations (EV/CV/AV operations). It consists of a full application of electric vehicle, connected vehicle and autonomous vehicle infrastructure in three corridors to validate urban vehicle operations. This effort also includes a freight-specific application at an intermodal facility in Kansas City where the fleet will transition to EVs and will transform the rail and trucking industries.

The final pillar is the Connected and Empowered Communities initiative, which develops applications that enable the public to access transportation options in Kansas City and establishes research capabilities for long-term sustainment of the multiple programs initiated as a result of Kansas City's Smart City efforts. This pillar engages Kansas City's local entrepreneurs to develop applications that help the community to visualize the transportation options available to them, ranging from busses to B-cycle sharing, to Zip Car and other low GHG emitting options. GHG reduction is an important benefit of the current Kansas City DOT Smart City Challenge proposal, with 12 electric busses, 8 terminal yard trucks, Kansas City police department non-cruiser vehicles and eight AV shuttles. This is a key step towards the decarbonization, electrification and modernization of Kansas City and future partner cities that see the environmental benefit, cost savings and positive impact on our citizens.

## 3.5 Pittsburgh, Pennsylvania

The City of Pittsburgh, the *SmartPGH* Consortium partners, and the local Pittsburgh Region Clean Cities Chapter are committed to establishing the Pittsburgh Electrification Partnership (PEP) to advance their Smart City efforts and the electrification efforts of private fleet owners and operators. PEP will convene local fleet owners and operators to share resources, plan EV infrastructure, and give 'PEP Talks' - EV demos and presentations to encourage corporate fleet and public adoption of EVs. To further these efforts, the city is developing plans that will leverage its public EV charging infrastructure to help catalyse other public and private EV fleet conversions. Duquesne Light, the region's electric utility, has committed to developing a corporate strategy related to transportation electrification. This corporate strategy is intended to include not only a review of Duquesne Light's own vehicle fleet to assess its potential for conversion to EVs but also a review of the company's corporate policies and business practices to determine how it might make changes that would promote an increase in EV fleet conversions and personal usage within Pittsburgh.

1. **Reduced Demand:** educate SmartPGH Initiative is committed to a mode shift strategy, with a goal of reducing the number of commuters traveling alone over the next three years from greater than 46% today below 40%.
2. **District Energy:** In an effort to build a cleaner and more resilient electric grid and provide a local, renewable option to power EV charging infrastructure, the City of Pittsburgh, United States Department of Energy, and the National Energy Technology Lab signed a historic agreement to research, develop and deploy district energy and microgrid systems throughout our city and are

currently developing a 21st-century energy infrastructure plan for the region through the expansion and optimization of district-scale energy systems, such as microgrids, thermal loops, and combined heat and power systems.

3. **Local Renewable Energy:** A variety of local efforts to push renewable energy generation include the Pennsylvania's Alternative Energy Portfolio Standard (AEPS), Duquense Light's utility scale solar projects, and the Western Pennsylvania Energy Consortium.
4. **Transportation Electrification:** Pittsburgh aims to reduce reliance on personal vehicle ownership by weaving together a cohesive network of EV public transit, bike and pedestrian infrastructure, and EV car sharing and ride sharing that can service all personal trips. Planning for transit-oriented development and mixed use, walkable neighborhoods will reduce the miles people need to travel to meet their needs and dis-incentivize personal vehicle ownership.
5. **Renewable Resources Authority:** Pittsburgh will establish the Renewable Resources Authority (RRA) to facilitate the purchase of renewable energy and development of new sources in the Duquesne Light service territory.

## 3.6 Portland, Oregon

Portland has long been able to inspire broad community action to take on the challenge of global climate change. After achieving Portland's initial goal to reduce carbon emissions 10 percent below 1990 levels, the City of Portland and Multnomah County established 2009 Climate Action Plan a goal of reducing local carbon emissions 80 percent from 1990 levels by 2050, with an interim goal of 40 percent by 2030. The recently adopted 2015 Climate Action Plan reaffirms these goals, updates actions for the next five years, and notes that Portland is making progress. While total carbon emissions in the U.S. are up eight percent since 1990, Portland and Multnomah County have cut total emissions 21 percent. Portland's approach to personal mobility is grounded in a fundamental paradigm that views the private automobile (in its current form) as the least desirable mobility option. Just as "reduce, reuse, recycle" is expressed in order of preference, Portland is working to encourage complete communities that support walking, biking, transit use, and new mobility options before accommodating automobiles.

1. **Electricity Supply Decarbonization:** Portland residents are on a path to be served by some of the lowest-carbon power in the country; driving an electric vehicle (EV) in Portland today is equivalent to driving a gasoline vehicle that gets 94 miles per gallon.
2. **Fleet Electrification:** The city of Portland had transitioned 20% of their fleet to EVs in July 2016. Portland will work with regional partners to help public and private fleets deploy more electric vehicles by organizing a major annual fleet workshop; strengthening the West Coast Electric Fleets program; providing free access to sophisticated fleet telematics equipment to help fleets identify candidate vehicles for replacement; providing long term loaner vehicles for fleet "test drives," connecting fleet managers to existing state incentives and resources; and conducting aggregated group buying of vehicles.
3. **Transit, Autonomous, and Multi-Modal Systems in the City:** Multimodal transportation is central to Portland's transportation strategy, and electrification across modes is at the core of this proposal. Portland is the country's leader in cycling; and the transit system already includes electric streetcars, light rail, and aerial trams; TriMet will put the first electric buses and infrastructure into service, and work with Portland General Electric (PGE) and other stakeholders to develop innovative long term funding tools to implement this shift. Portland will creatively develop and demonstrate new tools to electrify carsharing that are sustainable and scalable.
4. **Driving Consumer Adoption:** Portland's Smart City's plan focused on a campaign to double electric vehicle sales within two years, putting the city on track to meet its ambitious targets and creating a national model for moving from engaging "early adopters" to the "early majority."
5. **Charging Infrastructure:** Portland already has more charging infrastructure per capita than any other city in the U.S. At this point, the challenge for Portland is to demonstrate how cities integrate charging into the urban streetscape in a thoughtful, well-planned way.

## 3.7 San Francisco, California

San Francisco has been globally influential in transportation, clean energy, and climate planning. It was an early and strong proponent of coordinated urban and regional climate action across jurisdictional and

national borders, including ambitious efforts to decarbonize both the transportation and energy sectors. California has been at the forefront of national efforts to reduce GHG emissions for decades; San Francisco's vision for our transportation future is a city of shared, electric, connected and automated (SECA) vehicles for all people, not just those with the means to own private vehicles. The SECA model is deliberate in its order. Autonomous technology offers unprecedented promise for the transportation sector and while highly publicized, the foundation for automated vehicles must be built upon a shared model that leverages electric vehicles that interact with one another to improve efficiency and safety.

San Francisco's Smart Cities approach calls on a 10% shift to improve quality of life, sustainability, safety and equity. In the transportation sector, the city focuses specifically on reducing emissions by targeting the PEV market: (1) shift up to 10% of single-occupancy vehicle trips to transit, shared and active modes, (2) reduce transportation emissions 10% through electrification and demand management, and (3) reduce the portion of low/moderate-income residents' income spent on transportation by 10%. San Francisco will work with utilities, the private sector, and community stakeholders on a series of interrelated projects that build on one another, emphasize collaboration, and share lessons learned across the nation and world.

# 4 Leveraging the EC's Fleet Readiness Plans and Programs

In leveraging other unique but interrelated programs, the EC is working with SCC7 cities to develop fleet readiness plans for the transition to electric vehicles. Lessons learned through these projects demonstrate the necessity of unbiased third party technical assistance through the planning and implementation phases of an EV deployment in fleets. These programs are detailed below.

## 4.1 Evaluation for the Potential Electrification of the Light-Duty Municipal Fleet

As part of its role in the Smart City Challenge application review process, the EC was tasked with completing an analysis of each finalist city's light-duty municipal fleet. These analyses were completed from March – May 2017 in collaboration with each city's fleet management and smart cities teams. The evaluations included four goals: (1) summarize fleet composition in aggregate and at an individual vehicle level; (2) help identify specific vehicles eligible for replacement with EVs; (3) establish baseline total cost of ownership (TCO) for existing fleet; and (4) help determine cost-effective options for EV deployment.

Each city provided the EC with aggregated fleet data that summarized both the lifetime and past 12-months operations in terms of vehicle miles traveled (VMT), fuel use, and costs. The core of the evaluation focused on sedans, minivans, and sport utility vehicles (SUV); extreme outliers and vehicles lacking sufficient data to produce a baseline TCO were excluded. TCO calculations include vehicle purchase price, maintenance, fuel, financing and the estimated residual value of each vehicle. TCO costs did not include accident repair costs and, to facilitate comparison, all TCO metrics are weighted and presented as $/mile metric.

The evaluation also provided greenhouse gas (GHG) emissions reductions estimates for EV replacement candidates based on well-to-wheels emissions estimates utilizing the 2014 *Alternative Fuel Life-Cycle Environmental and Economic Transportation (*AFLEET) [1] tool. The electricity grid mix is based on the regional averages within the North American Electric Reliability Corporation (NERC) regions. The estimated impacts are relative to the pool of vehicles being replaced, not the whole fleet. EV replacement candidates were chosen based on a combination of lifetime VMT, age, TCO, and potential GHG reduction. Older, less efficient, high mileage and more expensive (to operate) vehicles were targeted.

The nature of each fleet in terms of composition, operational characteristics, and TCO varied significantly. These results are summarized in Table 1.

#### 4.1.1 Table 1 Comparison of Fleet Evaluation Results for SCC7

Table 1: Comparison of Fleet Evaluation Results for SCC7

| City | Recommended # of Cars for EV Transition | Est. GHG Reduction ($MTCO^2e$) | Goal for Transition in SCC Application | City Est. GHG Reduction From Application Commitment ($MTCO^2e$) |
|---|---|---|---|---|
| Austin, TX | 302 | 618 | 400 | 819 |
| Columbus, OH | 90 | 137 | 200 | 304 |
| Denver, CO | 365 | 835 | 103 | 236 |
| Kansas City, MO | 252 | 760 | 12 | 36 |
| Pittsburgh, PA | 74 | 158 | 81 | 173 |
| Portland, OR | 73 | 113 | 129 | 200 |
| San Francisco, CA | 623 | 1,180 | 117 | 222 |

## 4.2 Electric Vehicle Suitability Analysis

Following their selection as the winning city, the EC worked with the City of Columbus, Ohio to complete a more detailed analysis of the vehicles they planned to transition to EVs. The analysis utilized data from the city's telematics vendor to utilize vehicle performance, routing and GPS, as well as fleet cost data provided by the city to (1) inform the suitability of each vehicle for transition to an EV; (2) validate that the city's plans for Electric Vehicle Supply Equipment (EVSE) (a.k.a. charging infrastructure) are sufficient to meet the driving needs of these vehicles, and (3) provide guidance on EV TCO, return on investment (ROI), and potential cost savings.

This analysis was requested by Columbus fleet management to confirm that the drive cycles of the 109 vehicles selected for transition to EVs in the first phase of the Smart Cities grant are well suited for the technology. This effort analyzed the drive cycles of 83 vehicles for which telematics data was available, and estimated that the 83 vehicles selected for transition to EVs could fulfill their daily driving needs on a single charge 99 percent of the time. There were only 12 vehicles that demonstrated a likely need for access to midday charging to fulfill their driving needs.

## 4.3 Leveraging the EC's Fleets for the Future Program

Through the SCC7 collaboration, the EC can also help connect the cities to new programs that can provide solutions to some of the goals established by the seven cities – for example Fleets for the Future. Funded by a U.S. Department of Energy (U.S. DOE) Clean Cities Program grant, Fleets for the Future (F4F) seeks to achieve nationwide economies of scale for alternative fuel vehicles (AFVs). F4F plans to accomplish these economies of scale through a coordinated strategy designed to increase knowledge, lower the transaction costs of procurement, achieve better pricing, and address potential challenges arising from large-scale procurement initiatives, thereby increasing the deployment of alternative fuel vehicles in both public and private sector fleets. F4F will enable fleets to obtain vehicles that will both reduce emissions and operate at a low total cost of ownership. In order to achieve these savings, fleet managers must justify the higher upfront cost of investing in AFVs. By harnessing the power of cooperative procurement to reduce transaction costs and to obtain bulk pricing, F4F aims to reduce the upfront cost premium and make an even stronger case for investing in AFVs.

As the technical advisor for Electric Vehicles on the F4F project, the EC has been instrumental in the development of the aggregated purchasing program that will be piloted in late 2017. At the beginning of the project, the EC was tasked with writing best practice documents focused on EV procurement, financing AFV procurement, and fleet transition planning [2]. Since that initial effort, the F4F team has partnered with the National Joint Power Alliance (NJPA) – a cooperative purchasing organization based out of Minnesota – to facilitate aggregated purchasing and/or leasing of EVs nationwide.

The SCC7 and their commitment to EV deployments in their municipal fleets represent a built-in opportunity to demonstrate the power, possibility, and sustainability of a coordinated aggregate purchasing program. While their commitments individually are laudable, they are not in and of themselves enough to trigger economies of scales and bulk purchase discounts. However, if the procurements were combined, this barrier can be eliminated. Recognizing the difficulty of coordinating procurement activities across multiple jurisdictions in multiple states, the EC will seek to include cites involved with out other EV deployment projects in this initiative.

### 4.4 Leveraging the EC's Energy Secure Cities Coalition

The goal of the Energy Secure Cities Coalition (ESCC) is to unite 25 cities in a pledge to transition their municipal fleets off petroleum by the year 2025. So far, the mayors of Sacramento, Atlanta, Houston, Charlotte, West Palm Beach, San Diego, Rochester and Indianapolis are committed to converting their petroleum-powered fleets to vehicles powered by alternative energy sources.

The EC facilitates a collaborative learning process, providing a network for cities to learn from each other before, during and after the transition process. The EC provides the essential tools that cities need to communicate their goals and participate effectively with the community, share lessons learned, and solve problems together with other ESCC cities. The EC also provides overall project management and coordinates on-going fleet evaluations, allowing cities to adapt quickly to new challenges and opportunities as they transition their vehicles from petroleum fuels to alternative fuels.

For example, the EC works closely with the City of Atlanta as an advisor for their Electric Vehicle program. Specifically, the EC has an Electric Vehicle "fellow" embedded within city staff to help manage their EV program and develop and modify best practices gained from their EV deployment. Working with the EV Fellow, the EC and city of Atlanta recently published a case study on the city's EVSE installation experience and hosted webinar on the same topic. The EC continues to work hand-in-hand with Atlanta to uncover ways to improve utilization of their existing EV fleet (approximately 60 vehicles) and to serve in an advisory role as the city works to expand their EV fleet to meet the mayor's goal of 600 EVs.

## 5 Concluding Remarks

SCCEET will combine an extensive national network of public and private partners who will drive, scale, and sustain results. These include partnerships with the seven USDOT Smart Cities finalists, and numerous other public and private partners committed to each regional project, including MPOs, economic development entities, major corporations, research institutions and universities, utilities, dealerships, vehicle OEMS, fuel and infrastructure providers, and more.

The EC is a nonpartisan, not-for-profit group committed to promoting policies and actions that facilitate the deployment of plug-in electric vehicles (PEVs) on a mass scale in order to combat the economic, environmental, and national security dangers caused by America's dependence on oil. Coalition member companies represent the entire electrified transportation supply chain, positioning the organization as a dedicated rallying point for an array of electrification allies.

The EC works to accelerate transportation electrification through a combination of public policy and market research, policy advocacy, and innovative partnerships. The EC's signature accomplishment has been the establishment of accelerator communities - cities and regions where all of the necessary public and private stakeholder partnerships are combined with appropriate policy, regulatory support, and consumer education in order to make owning and operating an electric vehicle a seamless and attractive experience. In the past five years, in support and beyond these unique projects, which have helped position the EC as a leader in the field, the EC has engaged leaders from across the political spectrum around the issue of vehicle electrification and advanced public policy with comprehensive roadmaps and models for vehicle and fleet electrification.

The EC has unique direct experience in working with cities across the country on multi-year engagements that will allow for the best and most likely program success. This includes the launch of multiple projects from square one (Drive Electric Northern Colorado, Drive Electric Orlando, Energy Secure Cities

Coalition) and work as the lead implementation partner for Vulcan during the Smart City Challenge. The EC's ability has been rewarded with government and private grants to support all three of these projects and the creation of a new accelerator community in Rochester, NY, which launched in summer 2017.

The EC has also successfully secured and administered outreach and training programs from several local and national sources to support capacity development, technical training, and other thought leadership. The EC has seasoned programmatic staff, along with our technical and administrative capabilities and strong relationships with the EV supply chain, fleets, technical contacts, and government.

## References


[1] AFLEET is part of the *Greenhouse Gases, Regulated Emissions, and Energy Use if Transportation* (GREET) model created by Argonne National Laboratory: https://greet.es.anl.gov/afleet

[2] http://www.fleetsforthefuture.org/best-practices/

[3] http://www.denverpost.com/2016/11/10/denver-electric-cars/


## Author


Ben Prochazka, Vice President, joined the Electrification Coalition (EC) in 2013 to lead the EC's Outside the Beltway Initiatives and has helped develop and implement innovative EV accelerator programs and engaged in advocacy and policy development at the local, state, and national level. His works includes Drive Electric Northern Colorado, Drive Electric Orlando, Rochester EV Accelerator, Fleets for the Future, Energy Secure Cities Coalition, and leading the EC's work as the lead implementation partner for the Vulcan's Smart City Challenge. Prior to joining the EC, Ben has spent more than a decade working on environmental, human rights, and voter engagements efforts. His experience includes leadership roles as the Campaign Director for the Save Darfur Coalition, the Legislative Director for the Colorado Environmental Coalition, the Colorado State Director for the New Voters Project, and numerous public interest campaign efforts as the Western States Field Organizer for U.S.PIRG.