SMART COLUMBUS CASE STUDY 2018

2018

Smart Columbus Develops Innovative Procurement Contract, Overcomes Barriers to Fleet Electrification

SMART COLUMBUS

Executive Summary

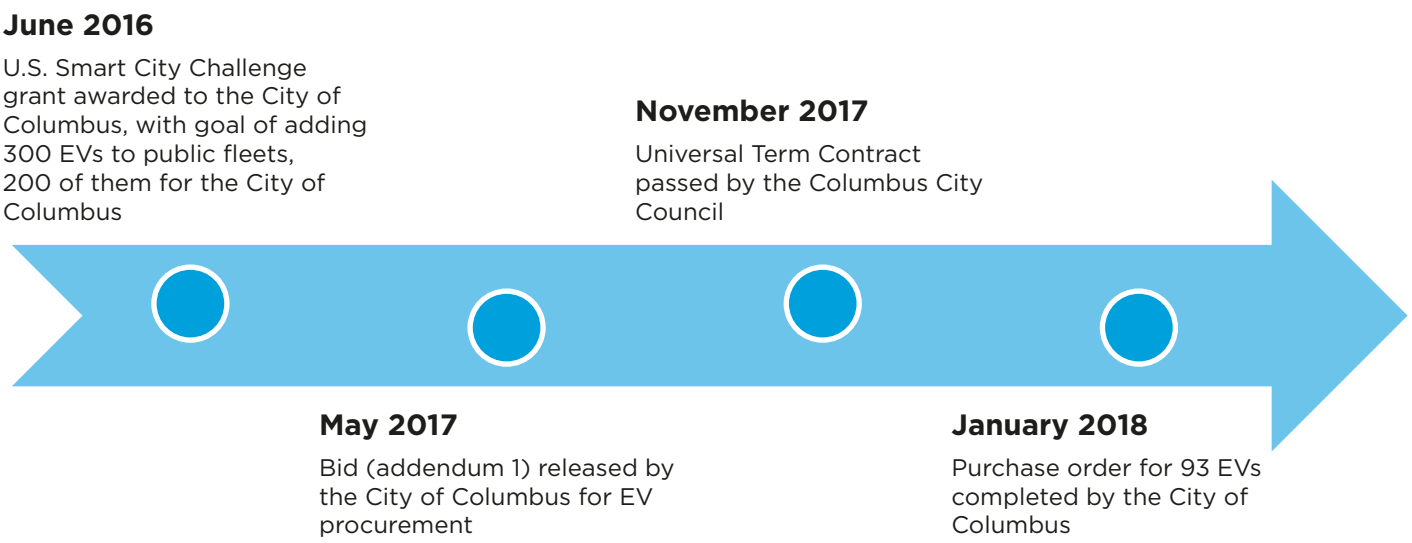
Smart Columbus has made significant progress against its objective of reducing greenhouse gas emissions by electrifying the transportation sector; a key goal of the Smart City Challenge. Among its five electrification priorities, Columbus is committed to introducing 300 electric vehicles (EVs) into public fleets, with the City of Columbus committed to procuring 200 of them by the end of the Smart City Challenge grant period. For its first procurement, the City of Columbus acquired 93 EVs: 72 Nissan LEAF EVs, one Chevrolet Bolt EV, and 20 Ford Fusion Energi plug-in hybrids. In addition to the vehicle procurement, the City intends to deploy Level 2 charging infrastructure in three locations for exclusive use of the EV fleet vehicles.

The procurement was a team effort, with the City's Fleet Management division working closely with City stakeholders to match vehicles to the needs of City divisions, the Electrification Coalition providing EV suitability analyses for the vehicles using existing city telematics data, and Clean Fuels Ohio providing education, outreach and training programs to support the process. The City developed a request for proposal (RFP) that allowed bidders to offer innovative financial arrangements in their proposals.

Following the RFP, the City developed an innovative vehicle acquisition program that allowed the City to lease vehicles for a short period followed by a title transfer to the city, attain vehicle pricing at triple-net dealer invoice, and capture a portion of the federal EV tax credit. The program is a Universal Term Contract (UTC) for vehicle procurement, which could be used by any local public entity in Ohio. The UTC is a 12-month lease with one payment at the outset and one at the end of the lease; the vehicle titles are then transferred to the City. The contract also allows City employees to purchase EVs at a reduced price to encourage the greater adoption of EVs in the region.

Smart Columbus credits the success of the first procurement to working closely with the City divisions, with City officials on the lease and purchase agreement terms, and with key project partners on analysis, education, and outreach. The UTC developed by the City of Columbus can be implemented by public agencies outside of Ohio and demonstrates a viable way to reduce the acquisition costs of EVs across jurisdictions.

FIGURE 1: FLEET ELECTRIFICATION PRIORITY TIMELINE



HIGHLIGHTS FROM THE INNOVATIVE CITY CONTRACT TO PROCURE EVS

The City of Columbus created an innovative UTC for EV procurement that allowed the City to significantly lower the acquisition cost of EVs and set an example for other cities to follow. The highlights include:

Unique Contract:

The contract is structured as a hybrid lease-purchase with a short lease period as opposed to typical City contracts that include only a purchase option.

Secured the Tax Credit:

City will receive half of the federal EV tax credit for each vehicle per the contract through a lease, which was more than what was proposed for a purchase.

Lower Vehicle Costs:

The hybrid lease-purchase structure results in lower costs than an outright purchase.

Encourages Further EV Adoption:

City employees can also purchase EVs through the contract at a discounted rate. This supports the Vulcan Inc. grant priority for Consumer Adoption.

Thinking Beyond Columbus:

Establishing the UTC enables other public entities in Ohio to take advantage of the same favorable contract terms, which may be particularly useful for public entities with smaller fleets.

Background

Smart Columbus, the smart city initiative of the Columbus region, aims to put Columbus at the forefront of mobility innovation to drive economic growth, improve quality of life, foster sustainability and improve safety throughout the region. As the winner of the U.S Department of Transportation's (USDOT) first-ever Smart City Challenge, Columbus was awarded $40 million from USDOT and $10 million from Vulcan, Inc. a Paul G. Allen Family Foundation to transform mobility in the country's 14th-largest city. Since the challenge, Smart Columbus has rallied more than $500 million in aligned investment from the region's public and private sector to scale and sustain the initiative.

Through the Vulcan, Inc. grant, Smart Columbus and its partners aim to decrease greenhouse gas emissions primarily from light-duty transportation through grid decarbonization, electric vehicle (EV) fleet adoption, deployment and expanded use of autonomous and multi-modal systems, consumer EV adoption, and charging infrastructure deployment.

Fleet electric vehicle adoption is one of five priorities in the Smart Columbus Electrification Plan. Fleet electrification was selected by Smart Columbus as a key way to accelerate EV adoption and drive decarbonization for four reasons. First, fleet vehicles often have very high annual mileage and offer a valuable "bang-for-the-buck" when it comes to emission reductions, since these vehicles have a much smaller carbon footprint than comparable gasoline vehicles [1]. Fleet managers also make vehicle procurement decisions based on total cost of ownership (TCO) and can more easily value the potential operating cost savings from EVs. Third, fleets have consistent, predictable drive and use "duty cycles," and can take advantage of centralized charging. Finally, large fleets are a powerful way to demonstrate government leading by example [2].

The objective of Smart Columbus' fleet adoption priority is to introduce EVs to public, private and transportation service provider (TSP) fleets. At the project's outset, Smart Columbus' goal was to add 300 EVs to public fleets, 450 EVs to private fleets, and 30 EVs to car sharing/TSP fleets. Of the 300 public EVs, the City of Columbus committed to incorporate 200 vehicles into its fleet. As part of the Electrification Plan, the City of Columbus and its partners planned to evaluate the various financing mechanisms and policies for EV procurement.

Building Key Partnerships

Meeting the Smart Columbus fleet electrification goal requires collaboration with key project partners within and outside of Columbus. The Fleet Management division of the City of Columbus leads the coordination and execution of the fleet electrification plan for the City. The office has been collaborating with other city divisions to identify specific vehicle replacements and plan for the deployment of charging infrastructure, to help ensure the new vehicles continue to serve the needs of the City.

Other public and private fleets have been energized by the Smart Columbus project into making their own commitment to EVs, thanks in part to analytical, educational and outreach services offered by two local non-profit organizations, Clean Fuels Ohio and the Electrification Coalition. Many of the challenges to meeting Smart Columbus' electrification goals can be overcome or managed through well-coordinated outreach and education. These two organizations have been collectively providing fleet total cost of ownership and suitability analyses, EV demonstrations, outreach, training and other resources to both private and public fleets in the region.

Every additional EV moves the project closer to meeting its goal of reducing greenhouse gas emissions through vehicle electrification. The City of Columbus and other Smart Columbus partners have, and will continue to, engage with the fleets within the region on their collective effort to further fleet electrification. The project's key partners and their roles are described in Table 1.

Lead	CITY OF COLUMBUS FLEET MANAGEMENT DIVISION	200 EVs	• Leader in the public procurement process • Responsible for identifying City vehicles to be replaced by EVs • Produced the bid and contract for the City procurement • Collaborates with the other city divisions on their vehicle replacements
Other Public Fleets	THE OHIO STATE UNIVERSITY	50 EVs	• Contributors to the Smart Columbus "Acceleration Fund" through their independent investment in electrification
	CITY OF DUBLIN	10 EVs	
	FRANKLIN COUNTY	10 EVs	
Private Fleets	AMERICAN ELECTRIC POWER	48 EVs	• Non-profit organization that supports the private fleet electrification process • Experts in fleet electrification • Performed a fleet viability analysis for the City of Columbus • Provide suitability analytical services to interested fleets
	OHIO DOMINICAN UNIVERSITY	TBD	
	LAND GRANT BREWING COMPANY	1 EV	
TSP Fleets	YELLOW CAB OF COLUMBUS	TBD	• Non-profit organization that supports the public and private (transit service providers) fleet electrification process • Focused on education and outreach • Provide analytical services to interested fleets • Organize EV maintenance training courses • Provide vehicle demos to interested fleets • Helped to allocate a $3,000/EV grant from Smart Columbus grant funds for the first 300 public EVs; seeking to do the same for the first 30 EVs in transit service provider fleets.
Non-Profit Orgs	ELECTRIFICATION COALITION	n/a	
	CLEAN FUELS OHIO	n/a	

Major Concerns to EV Adoption

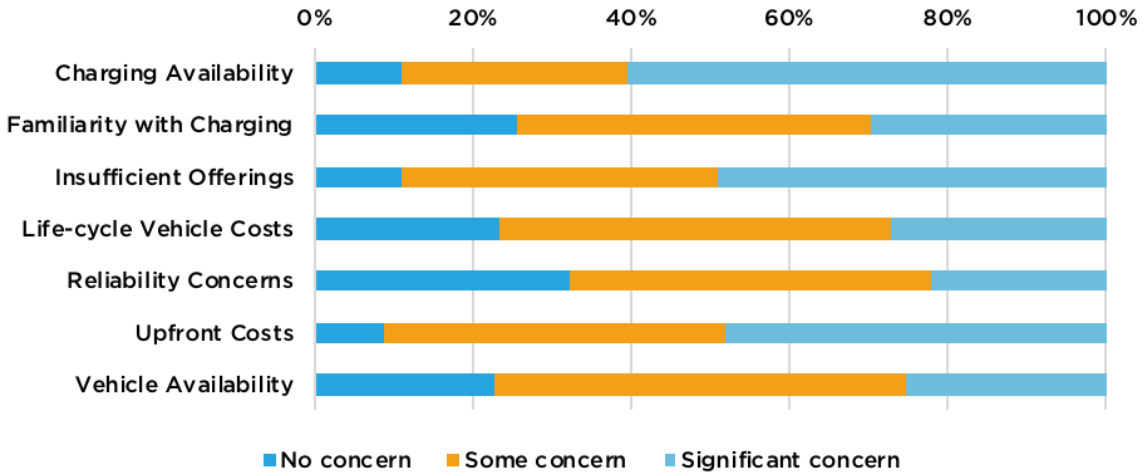
The City of Columbus is not alone in its plans for fleet electrification. Many cities across the country are also undergoing the same decision-making process. A recent nationwide survey of more than 100 fleet managers found that a lack of access to infrastructure, insufficient vehicle offerings and high upfront costs were among the greatest concerns for EV adoption (see Figure 1). Anecdotally, the fleet drivers from the City of Columbus were also concerned about EVs meeting their needs in terms of travel distance ("range anxiety") and vehicle features and performance. Range anxiety is closely related to charging availability, as drivers are concerned that they will not be able to easily recharge to perform their daily duties. Hence, City officials identified concerns about procuring EVs and were aware of the barriers they could face. Part of the goal of the Smart Columbus initiative is to develop and test strategies to overcome EV adoption concerns.

Addressing High Upfront Costs for EV Procurement

Incorporating EVs into a fleet can be challenging, since the higher upfront vehicle costs are often barriers to building interest. Without tax or other financial incentives, EVs can cost thousands more upfront than equivalent conventional vehicles. In fact, the acquisition costs for EVs can be upward of 60 percent of total cost, compared to less than 50 percent in conventional vehicles, as shown in Figure 2. However, fuel costs for EVs can be one-third that of conventional vehicles and maintenance costs can be half as expensive. As a result, EVs can have a lower total cost of ownership in some cases, such as high mileage applications. In addition, financial incentives, such as the federal EV tax credit, can significantly lower the acquisition costs of EVs, greatly improving the vehicle's total cost; public agencies have already demonstrated that the federal incentive can be captured in a procurement [1].

The City of Columbus understood the upfront cost challenge and used a combination of its typical procurement process and new arrangements to overcome it. The City of Columbus operates about 2,000 light-duty vehicles within its fleet, and leverages its size to employ triple-net dealer invoice pricing when purchasing conventional vehicles, in order to lower vehicle acquisition costs (see Box 1). The City planned to use the same concept for EV procurement, and aimed to secure all, or a portion of, the federal tax credit benefit. As a non-taxable entity, the City could not claim the tax credit itself, but knew the credit could be passed on through a purchase or lease deal. A provision of the EV tax credit in the federal code states the vehicle seller can be treated as the taxpayer when an EV is purchased by a tax-exempt entity [1]. Securing a triple-net dealer invoice price, plus tax credit benefits could significantly reduce the upfront cost burden of procuring EVs for the City.

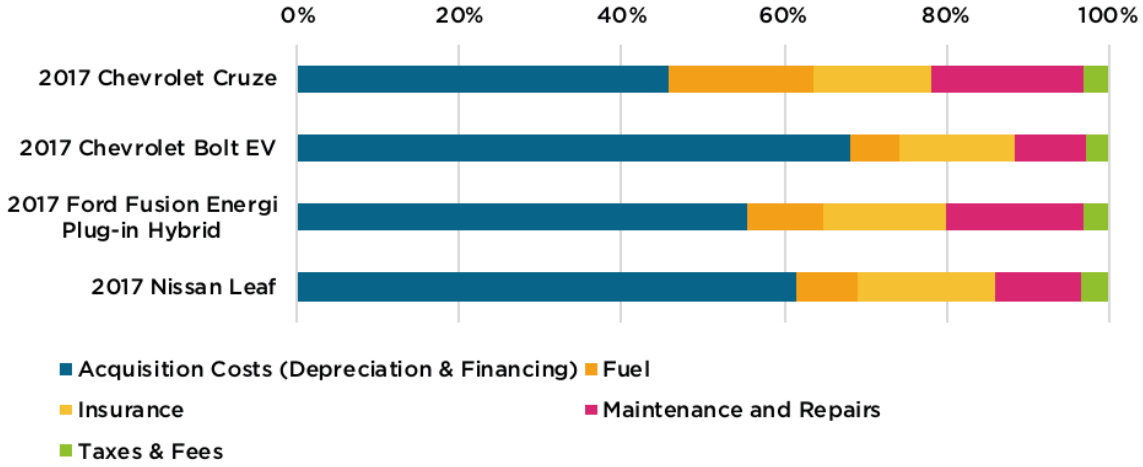
FIGURE 2: MAJOR CONCERNS TO EV ADOPTION AMONG FLEETS



Charging availability and associated range anxiety, insufficient vehicle offerings, and higher upfront costs for EVs are the greatest concerns of fleets.

Source: [1]

FIGURE 3: SHARE OF COSTS ON TOTAL COST OF OWNERSHIP BASIS BY VEHICLE



Vehicle acquisition costs (depreciation and financing) make up most of the costs for EVs on average, which posed a challenge for the City of Columbus with its 200 EV fleet goal.

Source: [1]

BOX 1: TRIPLE-NET PRICING

"Triple-net pricing" or "triple-net dealer invoice price" is the dealer's cost for a vehicle, minus any automaker deals, and includes all add-on options (e.g., power windows). The triple-net dealer invoice pricing strategy is more common in the private sector for large and centralized procurement efforts, which does not describe all public fleets. If achievable, the triple-net dealer pricing can reduce the cost of current and future procurement by simplifying negotiations and is easily replicable. The bid from a dealer will in actuality be an increase over the "triple net" as described at right:

Triple Net Price Bid = Dealer Invoice - Dealer Holdback – Advertising - Fleet Discounts + Dealer Markup

Where:

- Dealer Invoice = Vehicle invoice from the automaker
- Dealer Holdback = Percentage of dealer invoice or suggested MSRP
- Advertising = Marketing funding from the automaker
- Fleet Discounts = Intra-transit credit, automaker bid assistance, or fleet-specific discount. Policies for government bid assistance may vary by automaker
- Dealer Markup = A bid above the cost to the dealer

Overcoming Range Anxiety and Deploying Charging Infrastructure

Upfront costs aside, range anxiety and a lack of charging infrastructure were also identified as major barriers to EV fleet adoption by the City of Columbus. City fleet drivers had concerns about being able to complete their daily work on a single charge, and where and when they could recharge, if needed. Range anxiety is partially a function of vehicle capability, and partially a driver education issue and charging infrastructure issue. Throughout the country, the availability of suitable charging infrastructure remains a challenge.

When the Smart Columbus grant period began in 2016, there were 12 DC fast charging stations (not including Tesla Superchargers) along with some public Level 2 charging and charging at regional workplaces [2]. As of November 2017, 43 DC fast charging ports (all public) and 100 Level 2 ports (85 are public) were in operation in Franklin County, a significant increase from a few years ago [3]. Although EV charging is more accessible today, the City of Columbus only expected to use public charging occasionally and aimed to deploy dedicated overnight charging stations for each new EV within the fleet. This expected charging behavior using a "home base" for fleet drivers is similar to personal EV use, where 80 percent of charging occurs at home [4].

City vehicles are either left in City parking facilities overnight or are taken home by the primary driver. For fleets, prioritizing the deployment of EVs for vehicles that are parked overnight at City facilities have two advantages. First, there is no easy way to reimburse employees for the cost of charging at home. Deploying appropriate charging at City facilities can also ease the management of EVs that are used by more than one employee throughout the day. The City of Columbus evaluated its facilities in order to provide adequate charging for the new fleet vehicles concurrently as it determined which vehicles to replace. In addition to siting the charging stations, Columbus had to determine the type of charging it would provide (see Box 2 for a description of the charging level options); the type determines how quickly EVs can be recharged and the cost of the infrastructure installation.

To further address range anxiety issues, the fleet management division knew they would need to prove to the fleet drivers that the EVs could meet their needs. One approach was to look at the travel distances of each fleet vehicle to assess if the EVs would be compatible. Then, going beyond the vehicle's electric range, the Fleet Management office, in coordination with Clean Fuels Ohio and local auto dealers, provided EV driving demonstrations, showcasing with a Nissan LEAF and a Chevrolet Bolt models.

BOX 2: CHARGING LEVELS

The figure below shows the three levels of charging for electric vehicles. The charging capabilities (miles per hour rates) increase moving from left to right, along with the cost of equipment and installation. Level 1 charging is the least costly option but provides an EV with less than 50 miles of range in 10 hours. Level 2 charging can require electrical system upgrades in some cases. DC fast charging requires the most extensive electrical system upgrades, but also provides the quickest charge.

LOW – AC 120 V | AC LEVEL 1

- Primarily residential (all EVs)
- Uses standard outlet
- Power requirements similar to a toaster
- Up to 1.4 kilowatts
- Can use existing power outlets resulting in no-cost installation
- Charging rate: 3-5 miles per hour

MEDIUM – AC 240 V | AC LEVEL 2

- Residential, workplace and commercial (all EVs)
- Requires high-voltage circuit
- Power requirements similar to an electric clothes dryer
- Up to 19.2 kilowatts
- Equipment and installation costs vary widely (-$6,500 in public and -$2,000 at home)
- Charging rate: 12-75 miles per hour

HIGH – DC FAST CHARGE

- Community/metro and highway Corridors (BEVs)
- Power requirements are up to max power for 15 homes
- Max power varies by system (CHAdeMO: 62.5 kW, SAE Combo: 100 kW, Tesla: 120kW)
- Can have very high equipment and installation costs (up to $90,000 per station)
- Charging rate: 100-300 miles per hour

Improving Vehicle Selection

The national fleet survey results shown in Figure 1 revealed that insufficient vehicle offerings was a major concern in fleet electrification. There are currently 38 models of EVs offered [3], of which, only a portion are in the City of Columbus' price range (approximately $30,000). As upfront costs are already a significant barrier to procurement, more expensive EV options, such as the Tesla Model S and Model X, would not be considered for the City of Columbus. However, Chevrolet, Ford, KIA, Hyundai, Honda, Nissan, Fiat, Mitsubishi, Toyota and Volkswagen all produce EVs that could meet the City's needs at a more accessible price point. Table 2 shows a number of available

TABLE 2: PARTIAL LIST OF 2017 EVS WITH VEHICLE SPECIFICATIONS

MAKE	MODEL	TYPE	BATTERY SIZE	ELECTRIC RANGE (MI)	MSRP	AVAILABLE IN CENTRAL OHIO
Chevrolet	Volt**	PHEV	18.4	53	$33,220	•
	Bolt EV**	BEV	60	238	$36,620	•
Chrysler	Pacifica Hybrid	PHEV	16	33	$41,995	•
Fiat	500e	BEV	24	84	$31,800	
Ford	Fusion Energi Plug-in Hybrid**	PHEV	7.612	22	$33,120	
	C-MAX Energi Plug-in Hybrid**	PHEV	7.612	20	$27,120	•
	Focus Electric**	BEV	33.5	115	$29,120	•
Honda	Clarity**	BEV	n/a	89	n/a*	•
Hyundai	Sonata Plug-in Hybrid	PHEV	9.8	27	$34,600*	•
	Ioniq Plug-in Hybrid**	PHEV	8.9	24	n/a*	•
	Ioniq Electric	BEV	28	124	$29,500	
Kia	Soul Electric	BEV	27	93	$32,250	
Mitsubishi	i-MiEV	BEV	16	59	$22,995	
Nissan	LEAF**	BEV	30	107	$30,680	•
Toyota	Prius Prime	PHEV	8.8	25	$27,100	
Volkswagen	e-Golf	BEV	36	125	$28,995	

*2017 model EVs with battery size, electric range in miles, and MSRP in U.S. dollars. Models with "**" are those that were listed in the City of Columbus Invitation to Bid. MSRPs with a "*" were taken from the vehicle manufacturer websites. "NA" indicates the information was not available. Availability in Central Ohio is as of January 2018.*

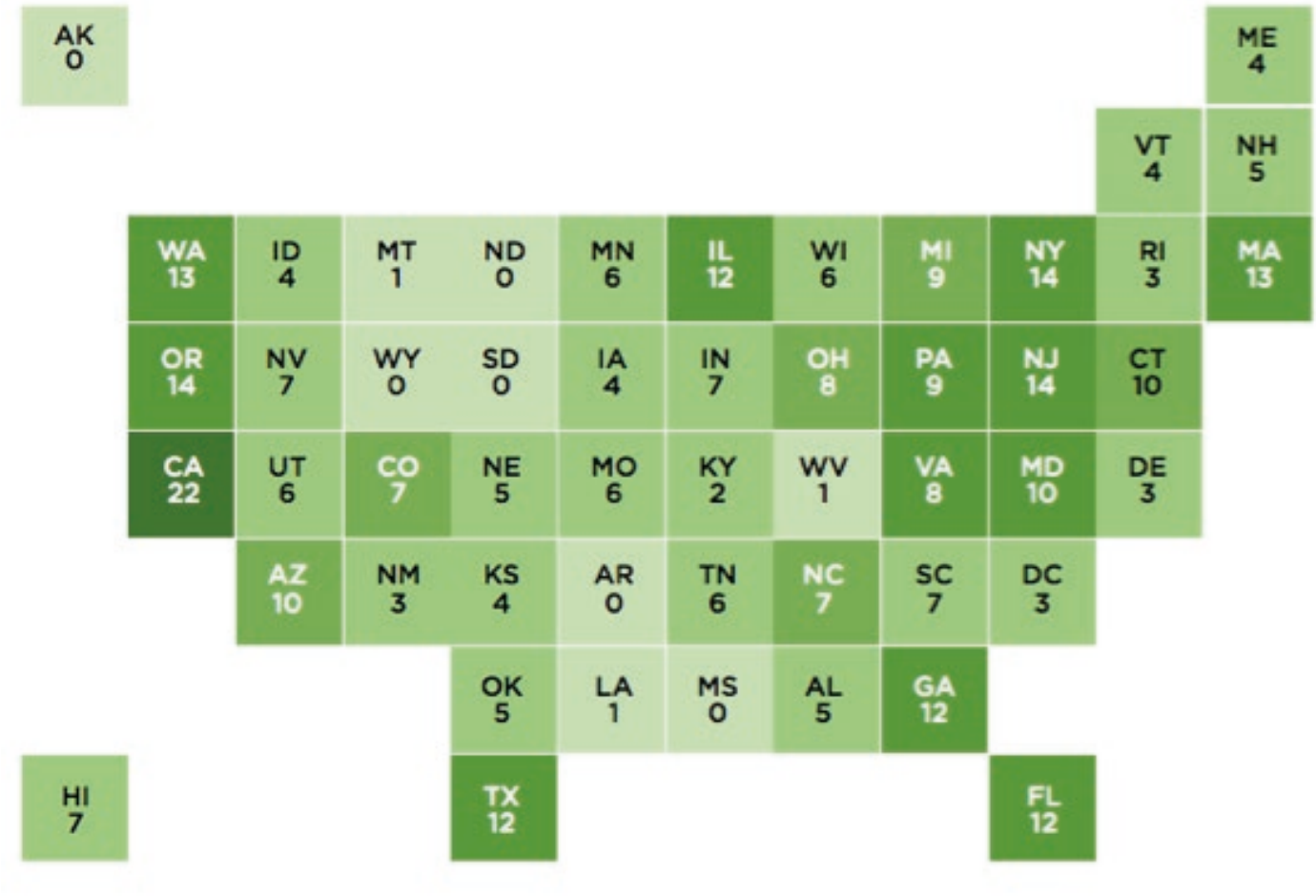
Source: [6]

EVs and their 2017 manufacturer's suggested retail price (MSRP) and electric range. Although the EVs are available for sale in the United States, not all automakers offer them throughout the country (see Figure 3). California dealerships boast the largest offering of EV models, in part due to the state's Zero Emission Vehicle program [5], whereas other regions might find it difficult to procure some EV models. For example, Columbus was interested in the Hyundai Ioniq, as it appeared to meet both price and range requirements (see Table 2), but the Fleet Procurement team was informed that the vehicles would not be available in the central Ohio region.

Additionally, to the benefit of the City, EV battery technology has been rapidly improving; from model year 2015 to 2016, the Nissan LEAF's range increased from 84 miles to 107 miles on a fully charged battery. As Columbus and other fleets continue vehicle procurement, it will be important for City officials to stay apprised of EV offerings and capabilities, and to strategize as to how to gain access to EVs that are typically only offered in select markets (e.g., the Hyundai Ioniq in California). One option to consider is a multi-state or national contract being proposed through Fleets of the Future and EV Smart Fleets, two nationwide initiatives that aggregate fleet vehicle procurements funded by the U.S. Department of Energy [7, 8].

Understanding the barriers facing the City of Columbus and other fleets, the next sections of this case study describe the city's decision-making process and collaborative efforts that enabled the City to complete its first procurement of 93 vehicles.

FIGURE 4: EV MODELS AVAILABLE BY STATE (2015)



There were more EV models available in California than any other state at 22 models (2015 data). The next highest availability was 14 in New Jersey and Oregon, and Ohio had eight models available at that time. This pattern is consistent for 2017 models as well.

Source: [5]

City of Columbus Vehicle Procurement Process

The City of Columbus undertook the process of EV fleet procurement in a systematic way, illustrated in Figure 5. The steps of this process happened concurrently in some cases and are shown to highlight the major markers. Each step is discussed in more detail in the following sections.

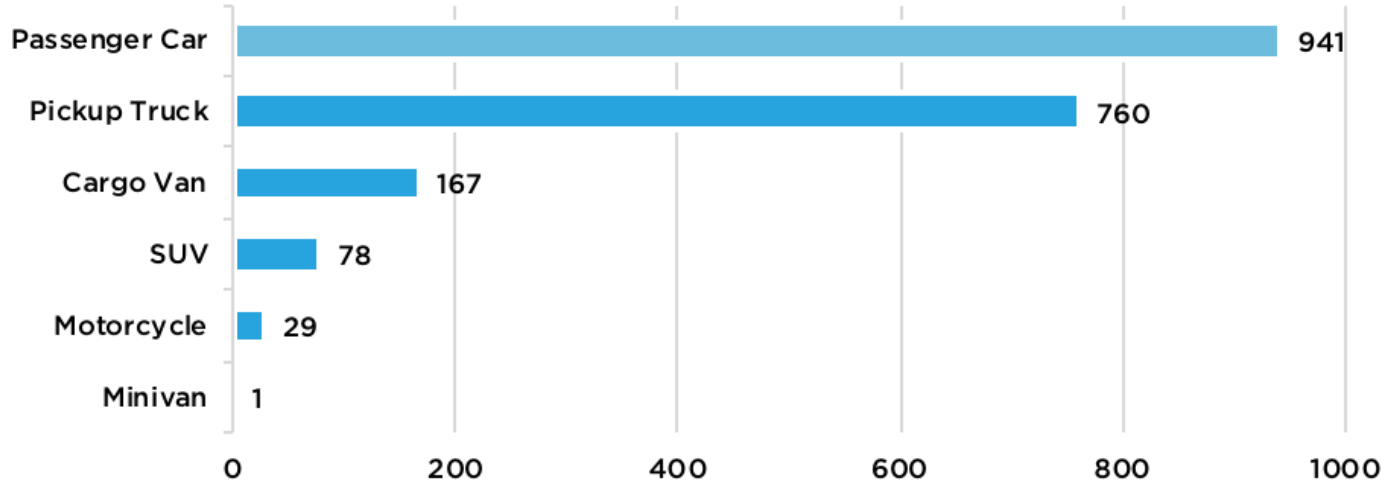
FIGURE 5: MAJOR PROCESS STEPS FOR THE CITY OF COLUMBUS FLEET ELECTRIFICATION

Major process steps for the City of Columbus EV procurement program. Some steps happened concurrently, for example the assessing the city's need for charging infrastructure was critical to identifying candidate vehicles and making vehicle purchases.

Existing Fleet Assessment

The City of Columbus maintains about 2,000 light-duty vehicles in its fleet. The type of vehicle depends on the City division. For example, the Division of Code Enforcement primarily has sedans as their work does not require them to carry around heavy equipment or people, and they also have more regular routes around the City. In contrast, the Division of Public Service has a mix of vehicles including sedans and trucks or SUVs as they manage of variety City systems including refuse, snow and ice planning, and infrastructure management amongst many other responsibilities. Figure 6 shows the City of Columbus' light-duty vehicle count by type. The most common vehicle in the fleet is a passenger vehicle (941 vehicles), followed by 760 pickup trucks. When selecting EV models, it was important for Columbus decision-makers to understand the type of vehicle the fleet drivers were already using, so that they could offer a suitable EV alternative. Currently, only passenger vehicles have suitable EV alternatives in the Columbus market. Additionally, since the entire City's fleet could not be replaced with EVs, an initial screening of the vehicles' annual use and age resulted in a goal of 200 EVs – the number committed within the Smart Columbus grant goals.

FIGURE 6: LIGHT-DUTY VEHICLE COUNT IN THE CITY OF COLUMBUS FLEET BY TYPE



The current vehicles in the City of Columbus fleet by type. Columbus needed to understand the current vehicle types and uses as it developed its plan for replacement of conventional vehicles with EVs. At this time, only passenger cars have suitable EV alternatives for Columbus.

Source: Data provided by the City of Columbus Fleet Management Division

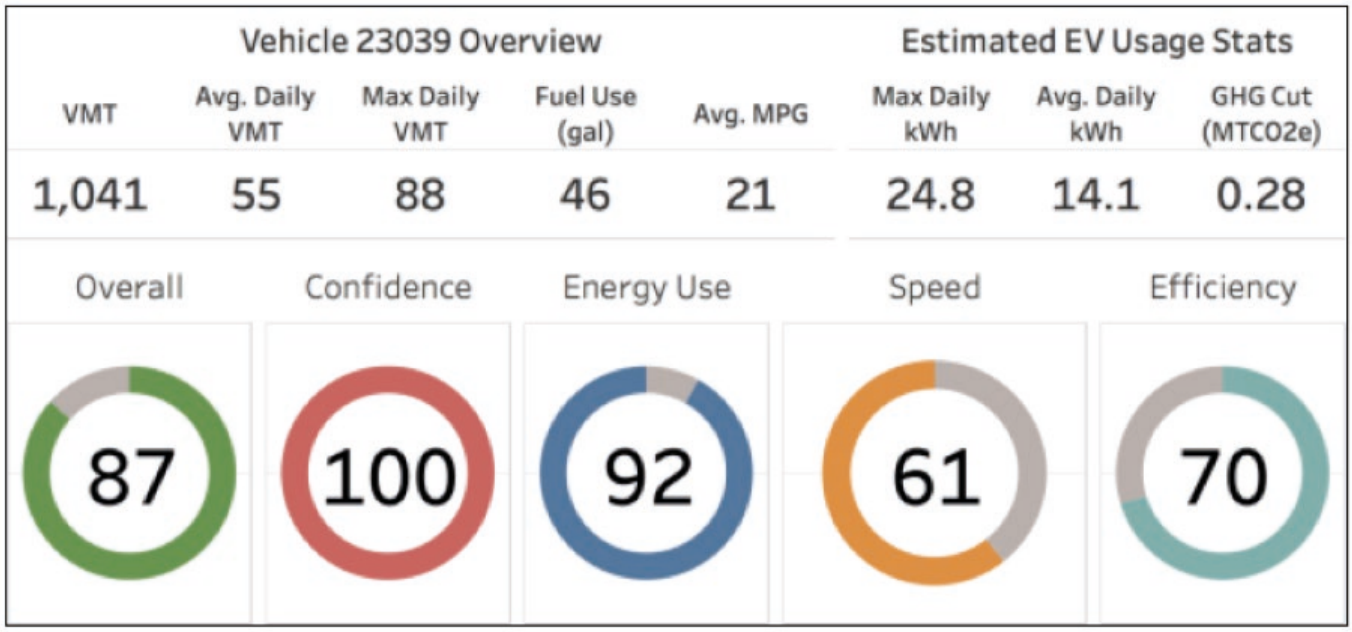
Identifying Vehicles for Replacement by Evaluating Vehicle Data

With the initial filtering of eligible vehicles complete, Columbus and the Electrification Coalition used the financial management information system AssetWorks and Verizon Networkfleet data to further evaluate 109 vehicles that could be replaced by EVs during the first phase of procurement. In addition to duty cycle and age criteria, this initial set of vehicles was selected based on the ability to concentrate charging stations in just a few locations. For example, 50 of these vehicles operate out of the same location, a downtown parking garage used by the City.

The Electrification Coalition helped Columbus conduct a suitability analysis on 109 vehicles from six city divisions (note: not all vehicles had detailed data): Code Enforcement, Fire, Fleet, Public Service, Support Services and Water. The Electrification Coalition evaluated the drive cycles for each vehicle and assigned an overall EV Suitability Score based on confidence in the data, energy use, speed and efficiency. An example of the suitability score for one vehicle, number 23039, is shown in Figure 6. In this case, the vehicle was driven an average of 55 miles per day, with a maximum of 88 miles per day. The rating showed that overall (score of 87 out of 100), the vehicle was a good candidate to be replaced by an electric vehicle. Even more so, as shown in Figure 7, the detailed analysis of where and when the vehicle traveled showed there was often opportunity to charge the vehicle mid-day, if needed.

The Electrification Coalition's full suitability analysis revealed that most of the vehicles considered for replacement would not need to charge mid-day. However, a few drivers in each fleet would need to be prepared to occasionally charge mid-day, by either having a plan to charge their vehicle or by using a non-EV for that high mileage day. The Electrification Coalition performed these analyses on the 89 (of 109) vehicles for which it received data.

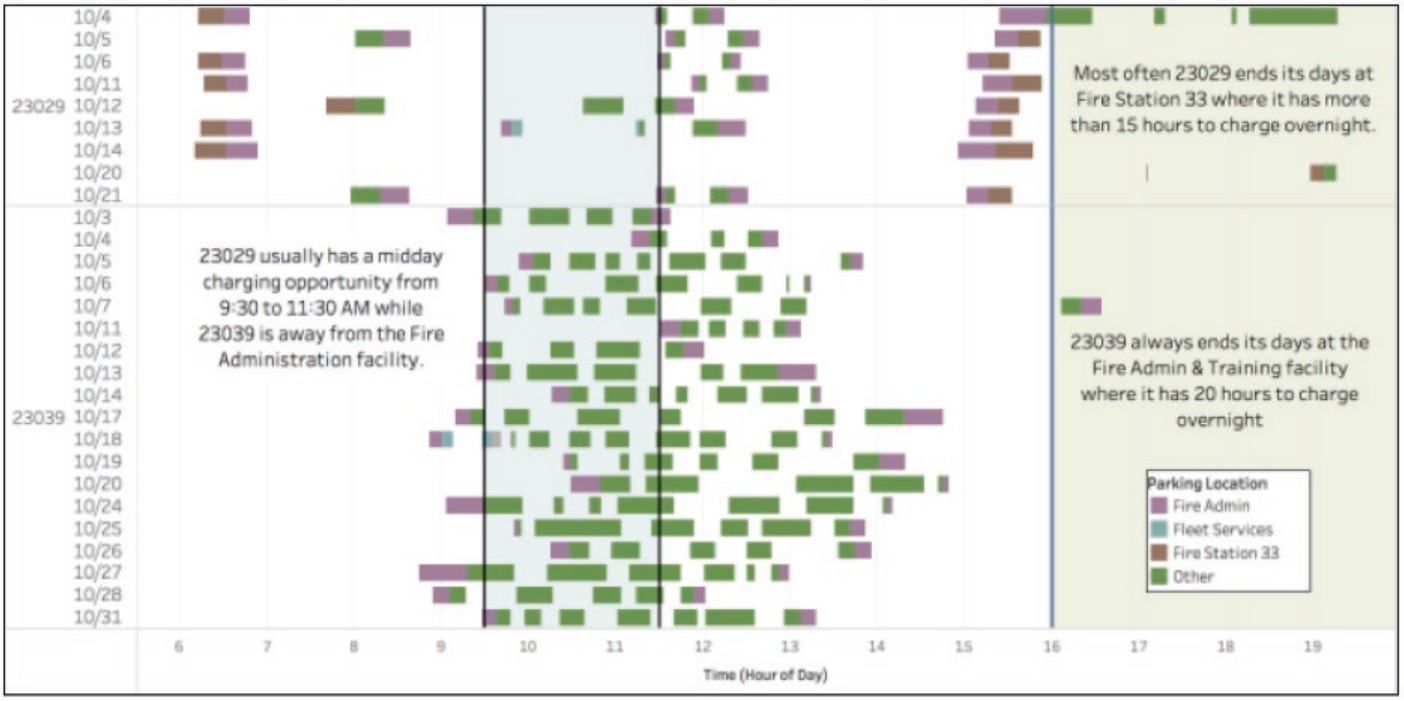
FIGURE 7: EV SUITABILITY SCORE FOR AN EXAMPLE VEHICLE



Suitability analysis results for an example City of Columbus vehicle provided by the Electrification Coalition. The results show that the vehicle is a good candidate for EV replacement based on daily usage.

Source: [9]

FIGURE 8: PARKING LOCATIONS BY TRIP FOR TWO EXAMPLE VEHICLES



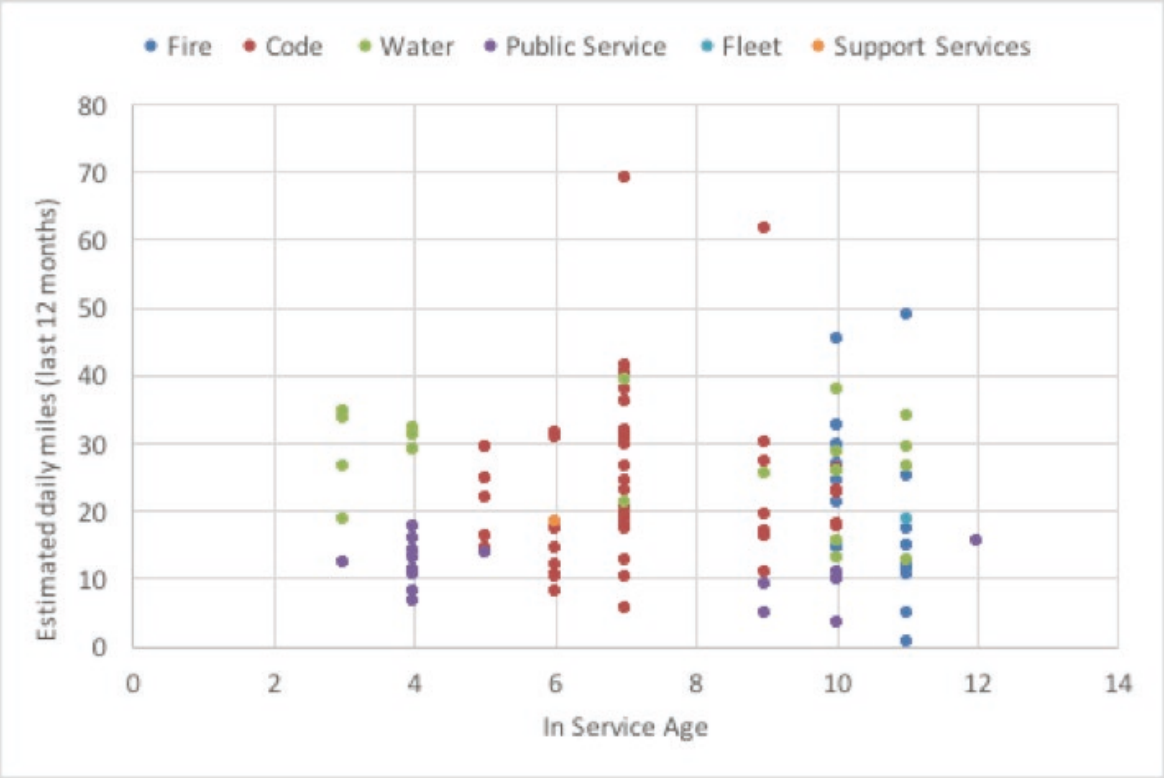
Parking analysis output for an example City of Columbus vehicle provided by the Electrification Coalition. The bars show the starting and end locations and duration of parking over the course of a month. The results show that vehicle 23029 is a good candidate for overnight charging (orange circle) and vehicle 23039 is a good candidate for mid-day charging (red circle).

Source: [9]

Another consideration suggested by the Electrification Coalition was the age of the vehicle (or number of years in the fleet). Many of the fleet vehicles were five or fewer years old, with considerable years of service potential remaining. The Electrification Coalition recommended that Columbus consider moving these vehicles to other divisions and cycling out older, less efficient vehicles as they were to be replaced by EVs.

Figure 8 shows the in-service age compared to the estimated daily mileage (last 12 months, assuming 260 work days) for each of the 109 vehicles analyzed by Columbus and the Electrification Coalition. From the figure, there are 24 vehicles under the age of five years from the Water, Public Service and Code divisions. The City of Columbus employs similar practices already by re-shuffling vehicles around the City fleet, as needed.

FIGURE 8: PARKING LOCATIONS BY TRIP FOR TWO EXAMPLE VEHICLES



Current City of Columbus vehicles being considered for EV replacement in Phase 1 showing estimated daily miles traveled (last 12 months, 260 days per year) by the in-service age. There are 24 vehicles five years or younger that could be transferred to other divisions within the city fleet.

Source: Data provided by the City of Columbus Fleet Management Division

Executing the Vehicle Procurement

Evaluating the Bids for a Universal Term Contract

The City of Columbus fleet management division issued a request for bid for electric vehicles in May 2017. The intent of the City's vehicle purchase program is to spend $2.5 million on EVs for the various City divisions, and to develop a Universal Term Contract (UTC) that could be used by other public entities in Ohio. Though the City normally purchases vehicles, the bid request allowed interested parties to propose open-ended lease procurements, and to pass on all or some of the federal EV tax credit benefit, in order to reduce the upfront costs of the vehicles. Columbus also requested that bidders bid the dollar amount for vehicles over the triple-net dealer invoice.

Bidders' responses to the request for proposal (RFP) followed the triple-net dealer invoice pricing requirement and included opportunities for the City to capture part of the federal EV tax credit for both leasing and purchasing options. Table 3 shows a summary of the EVs included in bids for purchase or lease in the bid responses. Importantly, the vehicle available to the City were not the full set from Table 2, which could present a challenge as the City aims to electrify more of its fleet. Also of note, the bidder that offered leasing included sharing 50 percent of the federal EV tax credit with the City, which was considerably more than bidders that offered only 25 percent of the tax credit for direct vehicle purchases.

TABLE 3: EVS OFFERED BY BIDDERS TO THE CITY OF COLUMBUS

MAKE	MODEL	TYPE	BATTERY SIZE	ELECTRIC RANGE (MI)	MSRP	TAX CREDIT (BUY/LEASE)
Chevrolet	Volt**	PHEV	18.4	53	$33,220	$0/$3,750
	Bolt EV**	BEV	60	238	$36,620	$0/$3,750
Ford	Fusion Energi Plug-in Hybrid**	PHEV	7.612	22	$33,120	$800/$2,000
	C-MAX Energi Plug-in Hybrid**	PHEV	7.612	20	$27,120	$800/$2,000
	Focus Electric**	BEV	33.5	115	$29,120	$1,500/$3,750
Nissan	LEAF**	BEV	30	107	$30,680	$1,500/$3,750

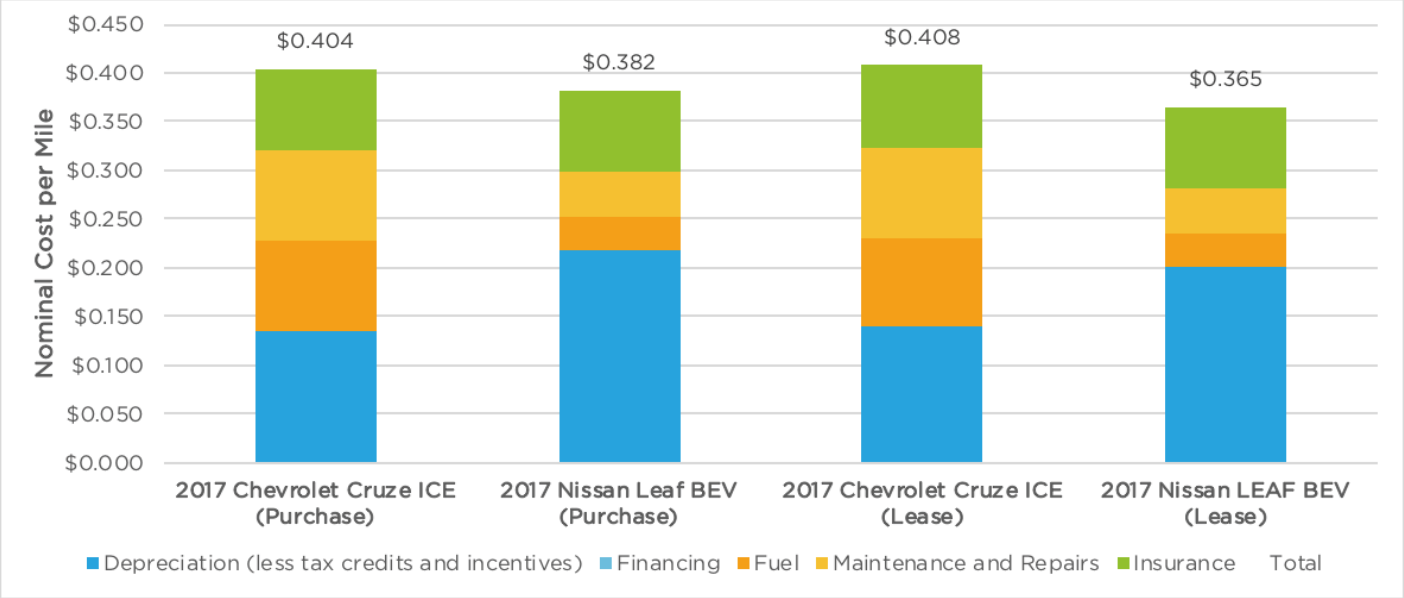
2017 model EVs offered to the City of Columbus by bidders with battery size, electric range in miles, MSRP in U.S. dollars, and tax credit savings. Note the bidder with a purchase option offered to pass along much less of the federal EV tax credit than the bidder that proposed a lease.

Source: [6]

The Fleet Procurement Analysis Tool was used in creating this case study to illustrate the process taken by the City of Columbus to compare the lease and purchase options on a total cost of ownership basis. Figure 9 shows the 2017 Chevrolet Cruze compared to the 2017 Nissan LEAF in both purchase and lease scenarios. The assumptions used were as similar as possible to the anticipated structure of the Columbus vehicle procurements (see Appendix A). In addition to the tax credit benefit being passed on from the bidder, Clean Fuels Ohio helped to allocate a $3,000 grant per EV from Smart Columbus grant funds for the first 300 public EVs purchased. Given its active commitment to 200 EVs, the City of Columbus should receive $3,000 for each of its EVs purchased through the Smart Columbus project.

The financial analysis showed that in both the purchase and lease cases, the Nissan LEAF had a lower total cost of ownership than the Chevrolet Cruze on a cost-per-mile basis. Additionally, the lease option was less expensive than the purchase option for the Nissan LEAF. Ultimately, the City of Columbus awarded the contract to the bidder offering the lease option (Mike Albert Leasing).

FIGURE 10: ESTIMATED COST PER MILE OF EVS PROCURED COMPARED TO CONVENTIONAL VEHICLE



Total cost of ownership on a cost per mile basis is lower for the 2017 Nissan Leaf EV in both the purchase and lease scenario when compared to a conventional 2017 Chevrolet Cruze. Additionally, given the assumptions, the Nissan Leaf would have a lower total cost under the lease option compared to a purchase (see Appendix A).

The Universal Term Contract

The Fleet Management Division worked closely with the winning lessor (Mike Albert Leasing), Purchasing department, City attorneys and City administration to establish lease terms that other public entities in Ohio could also use under a UTC.

The UTC allows Columbus to acquire vehicles through an open-ended lease with half of the costs paid up front and the second after 12 months, at which point the lease will transfer into the public entity's name. The title of the vehicle will remain with Mike Albert Leasing during the 12-month lease, allowing the private entity to capture the tax credit and pass along to the City 50 percent of that value ($3,750 discount for an all-electric vehicle and $2,000 for the Ford Fusion Energi plug-in hybrid). Following the 12-month lease, the vehicle title will transfer to the City. This innovative procurement process allowed the city to capture a portion of the federal EV tax credit and attain the title to the vehicles after 12 months at a lower cost than an outright purchase.

The contract was passed by the City Council in November 2017 and will allow any public entity in Ohio to contract under the same terms for its own EVs, which will allow other jurisdictions to take advantage of the favorable terms the City was able to attain.

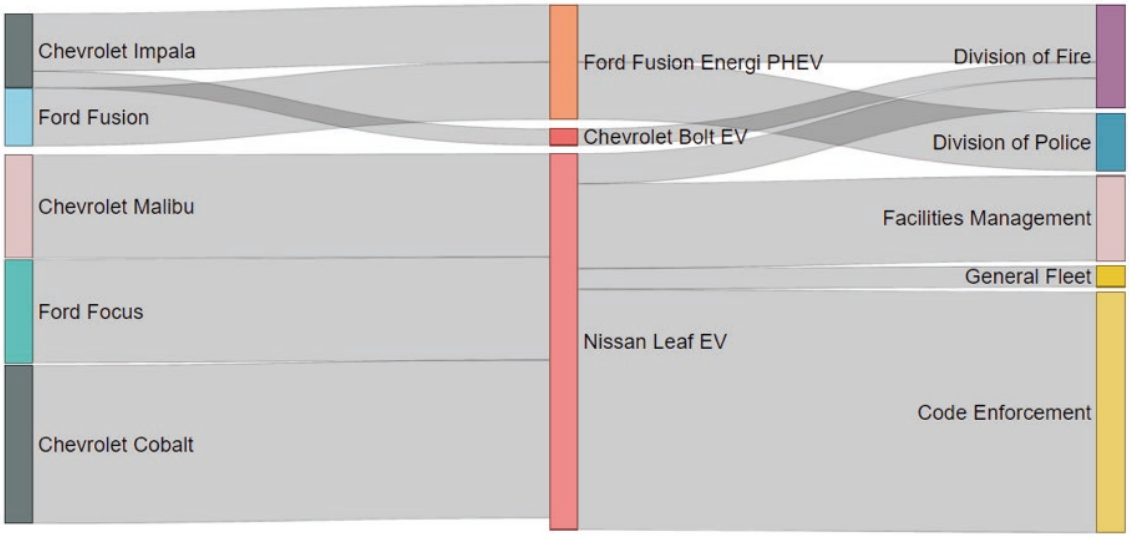
In addition to the UTC, Columbus secured a discount for employees to purchase a vehicle for $900 over the triple-net dealer invoice price from Ricart Automotive. Columbus had included a request to bidders for this benefit to public employees to encourage further consumer EV adoption in the region, in support of the Vulcan Inc. grant's Consumer Adoption priority.

Vehicle Replacements

With a procurement process identified, the City of Columbus worked to identify how many vehicles it could purchase during the first phase. Columbus used driving demos of the Nissan LEAF and the Chevrolet Bolt to demonstrate that the EVs could meet drivers' needs. Incorporating a demo into the decision-making process was critical to earning buy-in from the fleet drivers.

The City of Columbus received approval to acquire EVs through the UTC by the City Council in November of 2017. Columbus completed a purchase order for 93 vehicles, including 72 Nissan LEAFs, 20 Ford Fusion Energi PHEVs and one Chevrolet Bolt in January of 2018; these vehicles will be deployed to multiple divisions within the City government. The breakdown of the original vehicles, their EV replacements, and the division where the EV will be used is shown in Figure 10. As the EVs are integrated into the fleet, Columbus must also manage the installation of the charging infrastructure as drivers cannot start using their new vehicles until adequate charging is available.

FIGURE 11: CONVENTIONAL FLEET VEHICLES, THEIR EV REPLACEMENTS, AND THE CITY DIVISION WHERE THE EV WILL BE USED



A mix of gasoline-powered passenger cars are being replaced with EVs for several divisions within the City of Columbus.

Source: City of Columbus

Infrastructure Deployment

Given that charging infrastructure is a major barrier to fleet EV adoption, the City of Columbus prioritized charging access as part of its EV procurement decision. Data such as that shown in Figure 7 helped to identify daily parking locations (including overnight), which allowed the City to narrow potential charging station locations to nine common parking areas to serve the six divisions deploying EVs. Of the nine common parking areas, Columbus identified three charging primary sites that could best accommodate the 93 EVs in the first phase: 50 Level 2 charging stations in a garage downtown, 16 for the Facilities Management Division, 20 for the Division of Fire. The 10 PHEVs for the Division of Police will not have Level 2 charging during this first phase, but will instead rely on Level 1 charging. According to the City, accommodating charging for the first phase of EV procurement was relatively straight-forward, but the remaining charging stations may be more difficult to site.

Lessons Learned and Guidance for Other Cities

The Smart Columbus initiative gave the City of Columbus an incentive to execute an innovative hybrid lease-purchase contract for EV procurement. The procurement process followed by the City can serve as a model for other jurisdictions looking to acquire EVs. The RFP designed by the City was intentionally flexible, allowing for both purchase and lease options, the capturing of all or a part of the federal EV tax credit, and a discount for the purchase of an EV by City employees. The combination of an innovative contract and persistence from the City and partner organizations resulted in the procurement of the first 93 of 200 EVs for the City.

The success of the City of Columbus' fleet electrification program thus far can be attributed to the collaboration of the many organizations involved in the procurement. Throughout the process, the City identified lessons learned that could be useful to other public agencies beginning their own EV procurement process.

First, the team found that persistence is important to get buy-in from the drivers with range anxiety and to achieve unconventional contracts for public agencies, such as leasing. Not only was the City persistent, but the team practiced a commitment to internal communication that made working toward a shared goal easier to achieve.

Second, allowing for flexibility in the invitation to bid was critical to selecting the final hybrid lease-purchase contract. The project-funded incentives helped the City to overcome the cost barriers for vehicles and charging infrastructure that all public agencies face.

Third, non-profits, including Clean Fuels Ohio and the Electrification Coalitions, were an important part of the team that helped provide education, outreach, and analytical services. The non-profits offered free analytical services to the City and other entities that eased the decision-making process; they recruited fleets to participate in the program; and they offered training and demos to educate fleets throughout the procurement process and beyond.

Finally, the City found the rapidly advancing EV technology was a benefit to the fleet, as they were able to take advantage of the longer-range Nissan LEAF. Keeping apprised of these changes in vehicle offerings from auto manufacturers allowed to City to cost-effectively address range concerns raised by their drivers.

The City of Columbus will continue to work toward the procurement of 200 EVs by the end of the Smart Columbus grant term. These findings and early lessons learned can ensure that they will continue to successfully meet the project goals and serve as a valuable example for other public agencies to follow.

References

[1] N. Nigro and A. Walsh, "Electric Vehicle Procurements for Public Fleets," October 2017. [Online]. Available: http://evsmartfleets.com/wp-content/uploads/2017/10/Electric-Vehicle-Procurements-for-Public-Fleets.pdf.

[2] City of Columbus, Paul G. Allen Family Foundation Smart City Challenge Request for Proposals, Columbus, OH: City of Columbus, 2016.

[3] Atlas Public Policy, "Atlas EV Hub," 13 12 2017. [Online]. Available: https://www.atlasevhub.com. [Accessed 13 12 2017].

[4] Idaho National Laboratory, "Plugged In: How Americans Charge Their Electric Vehicles," September 2015. [Online]. Available: https://avt.inl.gov/sites/default/files/pdf/arra/PluggedInSummaryReport.pdf. [Accessed 11 December 2017].

[5] D. Reichmuth and D. Anair, "Electrifying the Vehicle Market Evaluating Automaker Leaders and Laggards in the United States," Union of Concerned Scientists, Cambridge, 2016.

[6] U.S. Department of Energy, "FuelEconomy.gov," 13 12 2017. [Online]. Available: FuelEconomy.gov.

[7] Fleets for the Future, "Fleets for the Future," 2017. [Online]. Available: http://www.fleetsforthefuture.org. [Accessed 4 January 2018].

[8] EV Smart Fleets, "EV Smart Fleets," 2017. [Online]. Available: http://www.evsmartfleets.com. [Accessed 4 January 2018].

[9] Electrification Coalition, "Electric Vehicle Suitability Analysis," Electrification Coalition, Washington DC, 2017.

APPENDIX A: ASSUMPTIONS FOR FLEET PROCUREMENT ANALYSIS

Below is a table of assumptions for the procurement analysis presented in Evaluating the Bids for a Universal Term Contract. The analysis was completed using version 1.10 of the Fleet Procurement Analysis Tool, available for free from Atlas Public Policy at www.atlaspolicy.com/rand/fleet-procurement-analysis-tool.

Factor	2017 Chevrolet Cruze ICE (Purchase)	2017 Nissan Leaf BEV (Purchase)	2017 Chevrolet Cruze ICE (Lease)	2017 Nissan Leaf BEV (Lease)
Gasoline Price ($/Gallon)	$2.50	$2.50	$2.50	$2.50
Electricity Cost ($/kWh)	$0.108	$0.108	$0.108	$0.108
Inflation	2%	2%	2%	2%
Expected Years of Use/Ownership (Years)	7	7	7	7
Annual Vehicle Mileage (VMT/Year)	15,000	15,000	15,000	15,000
Cost to Insure ($/Year)	$1,178	$1,178	$1,178	$1,178
Vehicle Price ($)	$16,975	$27,712 (90% of MSRP + $100 Dealer Markup)	$16,975	$27,712 (90% of MSRP + $100 Dealer Markup)
Federal Tax Incentive ($)	N/A	$1,500	N/A	
Smart Columbus Incentive ($)		$3,000		$3,000
Lease Term (Years)	N/A	N/A	1	1
Lease Interest Rate (APR - %)	N/A	N/A	3.6%	3.6%

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