Electric Vehicle Accelerator Plan for the City of Ventura

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Prepared by Ventura County Regional Energy Alliance, Community Environmental Council, and EV Alliance

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Contents

Introduction and Context

Electric vehicles (EVs) powered by renewable electricity have major benefits and the potential to make a significant impact on the City of Ventura's emissions and sustainability goals. EVs represent a transformative opportunity for clean mobility for many reasons:

- **Emissions:** EVs produce zero tailpipe pollution, providing clean air benefits. When charged from Clean Power Alliance's 100 percent Green Power electricity rate, which is the default option in the City of Ventura, EV owners will be able to drive on electricity that is either emissions-free or for which emissions have been offset.[1] When charged on Southern California Edison's (SCE) current grid mix, EVs reduce greenhouse gas (GHG) emissions by approximately 75percent per mile compared to a gasoline car, and emission reductions will increase as SCE makes progress toward California's 100percent clean energy by 2045 mandate.
- **Cost savings:** When charged during off-peak hours on Clean Power Alliance's or SCE's Time-Of-Use (TOU) rate plan, fuel costs for EVs in the City of Ventura are approximately one third the cost of diesel or gas. Reduced spending on gasoline is associated with increased local economic development, as fuel cost savings are often spent at local businesses.
- **Maintenance:** EVs have fewer moving parts, resulting in a lower maintenance burden and costs.
- **Driving Experience:** With plentiful torque and quiet, powerful acceleration, EVs provide an excellent experience for passengers, whether in electric sedans or electric buses.
- **Grid Benefits:** By charging when electricity is inexpensive, renewable, and abundant, and reducing charging during times of peak load, EVs can help balance the electric grid.

The State of California recognizes these benefits. In Executive Order B-48-18, Governor Brown established a goal of 5 million Zero Emission Vehicles (ZEVs) on California's roads by 2030.[2] The State also recognizes the many challenges to early EV adoption and has extensive programs and funding opportunities for all sectors. As additional Cap and Trade funding and other revenue sources are available, the State is developing new and innovative programs to surmount barriers to EV adoption. Prepared cities can win much of this first-come, first-served funding, in addition to supporting their residents in leveraging the multitude of benefits of EVs.

To bring the benefits of EVs to the community and City of Ventura, this fleet transition plan addresses three critical nexuses of change:

- **Community Electrification:** Governor Brown set a goal of 5 million ZEVs on the road by 2030. This section explores EV uptake among residents and businesses of Ventura, and how close the community of Ventura is to meeting its portion of this goal. We also examine what level of growth and annual uptake in EV purchases will be required to meet this goal.
  Finally, this section explores what level of charging infrastructure will be required to support expected levels of EV adoption and how the City of Ventura can support anticipated community demand for charging stations.

[1] "Ask Ventura City Hall: Who is my new energy provider?" Ventura County Star, January 20, 2019. https://www.vcstar.com/story/news/2019/01/20/ventura-city-hall-clean-power-alliance-renewable-energy-electricity-southern-california-edison/2628151002/

[2] Full text of Executive Order B-48-18 available at https://www.gov.ca.gov/2018/01/26/governor-brown-takes-action-to-increase-zero-emission-vehicles-fund-new-climate-investments/.

- **City of Ventura Fleet Transition:** The second component of this plan explores opportunities for electrification within the City of Ventura's fleet. The City has 400 vehicles and equipment, and has made strides towards electrification with some of its fleet. The fleet plan explores additional 'quick wins' for electrification, through which the City can take advantage of the cost savings of EVs without deviating from existing vehicle duty cycles. The plan also explores how the City could electrify one eighth of its fleet, in line with California's 2030 goal. Finally, this section explores what barriers would need to be overcome for 100 percent fleet electrification.

- **City of Ventura Workplace EV Initiatives:** The third section of this plan explores how the City can leverage its role as a major employer to enable employees to take advantage of the many benefits of EVs. As the sixth largest employer in Ventura, the City of Ventura employs approximately 650 people, or one percent of the city's workforce. With well-designed workplace EV adoption programs, Ventura can ensure the benefits of EVs reach City employees and use these successes as a catalyst for increased EV adoption amongst the community.

Community Electrification

EV usage by community members of the City of Ventura is crucial to enabling California to achieve its ZEV goals. This section of the City of Ventura EV Transition Plan explores the current status of EV adoption within the city and levels of adoption required to meet Ventura's portion of California's 2030 goal. Critical to widespread EV uptake is the availability of ample charging infrastructure. This plan surveys existing charging infrastructure and compares it to state projections for levels required by 2030.

Proposed targets for City of Ventura EV Accelerator plan implementation include:

- 14,000 ZEVs registered in the City of Ventura by 2030(an increase of over 13,000);
- Adding at least one DC Fast Charger port per year in the City's jurisdiction from 2019 to 2025 to reach the proposed 2025 minimum charging infrastructure targets
- Adding an average of 37 Level 2 charging ports per year from 2019 to 2025 to reach the proposed 2025 minimum charging infrastructure targets
- Developing 30 charging stations across the City's largest employment sites for workplace or shared fleet/workplace utilization
- Transition one eighth of the City fleet to EVs by 2030 (based on the number of vehicles in the City fleet as of 2019, the City would need to transition 21 of their 258 non-public safety vehicles to meet the one-eighth target since there are already 11 EVs in the City fleet. When public safety EVs become available, this goal could be increased.)

Proposed policies and actions to support attainment of these EV targets include:

- Institute a "One Mile, One Charger" policy to prioritize infrastructure development that will close gaps in the charging network and ensure equitable access to EV charging
- Establish a ZEV policy requiring departments to purchase light-duty vehicles according to the following priority structure, as modeled after the State of California Department of General Services vehicle procurement policy: (1) pure ZEVs, (2) plug-in hybrid EVs, and (3) hybrids. This will ensure that ZEVs and hybrids are the first option considered for new vehicles. To make the ZEV first policy binding, the City should implement additional policies to:

- Require that the proposed procurement for each non-ZEV or hybrid option includes a written justification explaining why the department was unable to select a ZEV for the fleet vehicle and provide a cost-benefit analysis
- Continue to centralize fleet procurement authority for the City with an appropriate department head, so they can review the selected vehicles proposed for procurement, approve vehicles as appropriate, and require revisions of selected vehicles if the justification for non-ZEV or hybrid options is lacking

- Engage with or become a local government member of Electric Drive 805, the region's electric vehicle collaborative
- Track the California Division of Measurement Standards updates to proposed regulations for electric vehicle charging systems since this could impact options for charging rate strategies

EV Adoption in Ventura

To date, city of Ventura residents have embraced EV ownership, though sales within the city have lagged behind California as a whole. As of January 2018, Ventura was home to 101,411 vehicles. Of these, only 400 were full battery electric, with an additional 378 plug-in hybrid electric vehicles. These vehicles, in addition to the one fuel cell vehicle registered in the city, compose the 779 ZEVs in the city of Ventura overall.

City of Ventura Vehicle Inventory

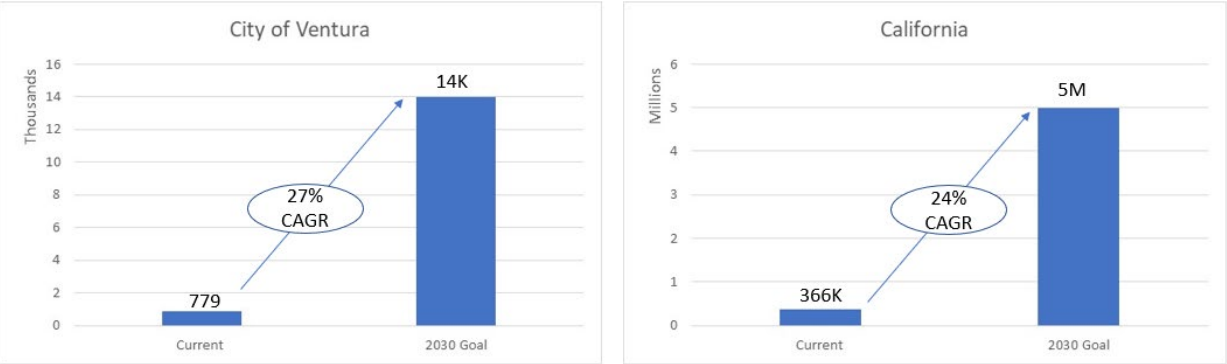
Fuel Type	Count	Percent
Battery Electric	400	0.4%
Diesel	5,071	5.0%
Diesel Hybrid	21	0.0%
Ethanol	6,432	6.3%
Gasoline	85,130	83.9%
Fuel Cell	1	0.0%
Hybrid Gas	3,888	3.8%
Plug in Hybrid	378	0.4%
Butane	1	0.0%
Compressed Natural Gas	5	0.0%
Methanol	15	0.0%
Methane	0	0.0%
Natural gas	64	0.1%
Propane	5	0.0%
Total Plug-in EVs	778	0.8%
Total Zero-Emission Vehicles	779	0.8%
Total Vehicles	101,411	

Source: DMV statistics of vehicles by fuel type by city, as of 1/1/2018. Available online at: https://www.dmv.ca.gov/portal/dmv/detail/pubs/media_center/statistics

While this progress in EV adoption should be acknowledged, EVs compose only 0.8 percent of total vehicles within the city of Ventura. If Ventura is to achieve its share (based on population) of California's goal, the city will need to be home to at least 14,000 ZEVs by 2030, an increase of over 13,000. In order

to achieve this number, the quantity of ZEVs in Ventura will need to grow by at least 27 percent annually (Compound Annual Growth Rate or CAGR). As can be seen in the chart below, this required growth rate is slightly higher than that of the State of California as a whole, which has a required annual growth rate of at least 24 percent.

Ventura vs. California EV Growth Needed to Achieve 2030 Goal



Source: EV Alliance analysis, using data from DMV statistics of vehicles by fuel type by city, as of 1/1/2018 and Governor Brown's EXECUTIVE ORDER B-48-18. Available online at: https://www.dmv.ca.gov/portal/dmv/detail/pubs/media_center/statistic and https://www.gov.ca.gov/2018/01/26/governor-brown-takes-action-to-increase-zero-emission-vehicles-fund-new-climate-investments/.

Between 2012 and 2016 in the county of Ventura, 2.37 percent of new vehicle sales were plug-in electric vehicles.[3] If this composition of new vehicle sales remained constant, the city would have only ~2,750 EVs by 2030. In order for Ventura to achieve its portion of the California goal, the percentage of new vehicles sold that are EVs needs to increase dramatically.

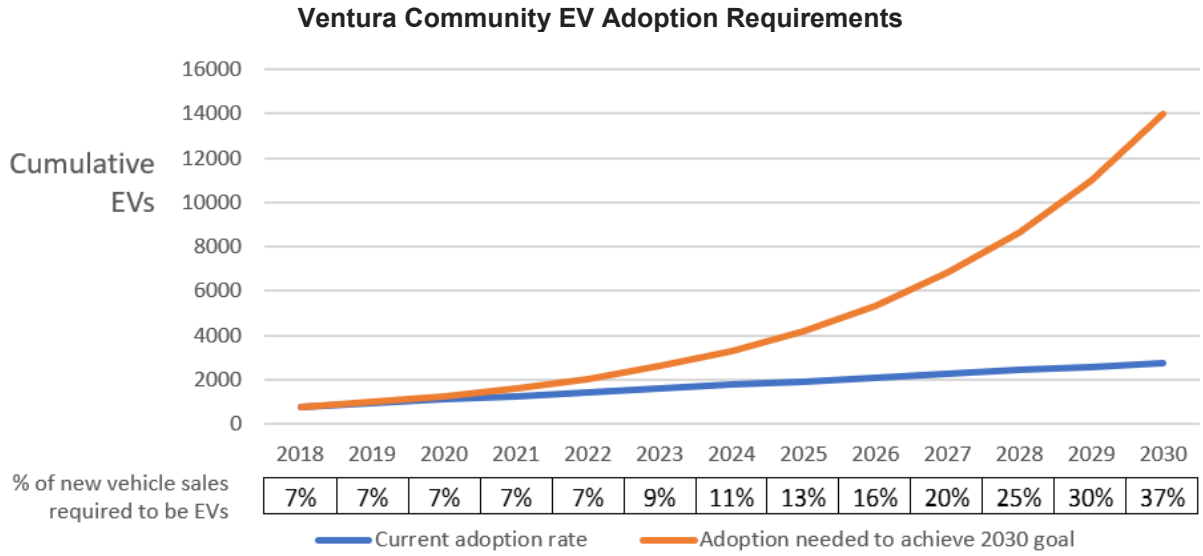
Fortunately, with the widespread release of the Tesla Model 3, as well as other longer-range EVs, 2018 was a remarkable year for EV adoption. According to the Alliance of Automobile Manufacturers, from January to August of 2018 (the latest date for which data is available), 7.07 percent of new vehicles sold in California were EVs. Assuming that this holds true for city of Ventura, they will actually exceed the 27 percent annual growth rate in EV adoption in 2018, leading to approximately 480 new vehicles instead of 212.

Some would argue that this rate of 7.07 percent will be followed by a decline once advanced orders of the Tesla Model 3 are fulfilled, satisfying pent-up demand. However, early results of 2019 U.S. vehicle sales demonstrate a strong trend, with January and February 2019 sales increasing over comparable 2018 sales.[4] Additionally, in 2019 and 2020, many new vehicle models, including SUVs, will be commercially available and more electric vehicles will have longer ranges, which will satisfy previously unmet needs. For purposes of this analysis, we assume that the 7.07 percent EVs of new vehicles sold is plausible in the near future.

[3] Bedir, Abdulkadir, Noel Crisostomo, Jennifer Allen, Eric Wood, and Clément Rames. 2018. ***California Plug-In Electric Vehicle Infrastructure Projections: 2017-2025.*** California Energy Commission. Publication Number: CEC-600-2018-001

[4] https://insideevs.com/monthly-plug-in-sales-scorecard/

The EV Adoption Requirements chart below shows how the percentage of new vehicle sales that are EVs needs to increase in order to support the city-wide goal of 14,000 EVs by 2030. By 2029 and 2030 respectively, EVs must compose 30 percent and 37 percent of new vehicles sold. This is a dramatic increase from the 7.07 percent of today, and can only be achieved with a comprehensive EV-friendly policy portfolio, as well as continued advances in range, vehicle types available, and positive consumer sentiment. EV market penetration will be significantly boosted by decreasing EV costs, with a projected cost parity around 2022, though market forces alone cannot be relied upon to drive the levels of uptake needed.[5]



Source: EV Alliance analysis, using data from DMV statistics of vehicles by fuel type by city. Assumes total vehicle growth scales with County population growth of .37percentover the past year, and 6.6percentof vehicles are replaced with new vehicles annually. EV composition of new vehicle sales at a county level taken from Bedir, Abdulkadir, Noel Crisostomo, Jennifer Allen, Eric Wood, and Clément Rames. 2018. ***California Plug-In Electric Vehicle Infrastructure Projections: 2017-2025.*** California Energy Commission. Publication Number: CEC-600-2018-001. 2018 portion of sales from: Alliance of Automobile Manufacturers (2018). Advanced Technology Vehicle Sales Dashboard. Data compiled by the Alliance of Automobile Manufacturers using information provided by IHS Markit. Data last updated 11/5/18. Retrieved on 2/6/2019 from: https://autoalliance.org/energy-environment/advanced-technology-vehicle-sales-dashboard/

This growth will only be feasible if supported by strong EV-friendly policies, programs and projects, which are discussed in-depth in Chapter 6 of the Ventura County EV Blueprint, a co-deliverable of this project, as well as ample public charging infrastructure. These Ventura County EV Blueprint recommendations are summarized below:

Recommended Actions

1. **Educate tenants on the "electric experience" to create demand for MUD charging.**
2. **Focus programs on new MUD construction** and geographies with public charging gaps.
3. **Deploy public charging at or near larger clusters of apartments and condos.**

[5] https://evobsession.com/ev-revolution-timeline-evs-cheaper-icevs-2022/

4. **Convene utility, industry, and funding partners to coordinate MUD electric vehicle charging deployment.**
5. **Educate and outreach to engage and inspire property managers** to implement step-by-step guides for MUD charging installation.
6. **Focus investment on electric vehicle infrastructure that will serve MUD residents in Ventura County's Disadvantaged Communities.**
7. **Target MUDs with 17 or more units that were subject to the 2013 California Building Code for electric vehicle charging infrastructure development.** As of January 2, 2014, the California Building Code requires three percent of the total number of parking spaces, but no less than one parking space, to be electric vehicle charging station capable (e.g. have stubouts and sufficient electric panel capacity to accommodate electric vehicle charging) at all MUDs with 17 or more units.[6]

A critical foundation of ample public charging infrastructure is needed for this targeted level of EV uptake in Ventura.

Charging Infrastructure in Ventura

Adequate private and public charging infrastructure is critical to enabling widespread EV adoption. Without adequate public infrastructure, drivers will be forced to constrain charging to residences and workplaces, and will be limited by vehicle range. According to a 2017 National Renewable Energy Laboratory (NREL) study, only 26 percent of respondents were aware of charging stations on routes they regularly drove.[7] These 'aware' respondents were much more likely to view EVs positively and consider purchasing them for their next vehicle. In addition to the practical implications of charging access for drivers, awareness of charging access is also correlated with interest and willingness to purchase an EV.

Additionally, residents without easy access to home charging – for instance, residents of MUDs, in which the challenges of installing charging infrastructure can be daunting– will be further prevented from adopting EVs. *(Note: strategies for supporting charging infrastructure in MUDs are discussed extensively in Chapter 3 of the Ventura County EV-Ready Blueprint, a co-deliverable of this project).*

Current publicly available chargers within the city of Ventura are summarized from both PlugShare data and the Department of Energy's Alternative Fuel Data Center below.

Current Charging Infrastructure in Ventura

Station Name	Street Address	Ports			Network	Connector Types
		1	2	DCFC		
Ventura County Government Center	800 S Victoria Ave.		2			J1772

[6] The 2013 California Building Code became effective on January 2, 2014. MUDs with 17 or more units that were permitted and constructed after this date should have the required EV charging station capable parking spaces. For more information, see 2013 Chapter 11. Section 4.106.4.2 of the California Building Code.

[7] Singer, Mark. The Barriers to Acceptance of Plug-In Electric Vehicles: 2017 Update. National Renewable Energy Laboratory, available at: https://www.nrel.gov/docs/fy18osti/70371.pdf

Ventura County Air Pollution Control District	669 County Square Dr.		3			J1772
Pacific View Mall	3295 E Main St.		3			J1772
City of Ventura	501 Poli St.	2	2		ChargePoint	J1772 NEMA520
City of Ventura	555 Santa Clara St.	2	4		ChargePoint	J1772 NEMA520
Ventura County Medical Center	3291 Loma Vista Rd					
City of Ventura	6298 Inez St.		2		ChargePoint	J1772
Ralston Courtyards	5525 Ralston St.	2	2		ChargePoint	J1772 NEMA520
Ventura County Service Building	John F. Johnston Dr.		2		ChargePoint	J1772
City of Ventura	901 S Kimball Rd.		4		ChargePoint	J1772
Ventura County Human Services	855 Partridge Dr.		2		ChargePoint	J1772
Ventura Job & Career Cntr	4651 Telephone Rd.		2		ChargePoint	J1772
City of Ventura	450 E Harbor Blvd.		2		ChargePoint	J1772
Ventura College	4667 Telegraph Rd.		8		ChargePoint	J1772
City of Ventura	75 N Brent St.		2		ChargePoint	J1772
City of Ventura	85 N Brent St.		2		ChargePoint	J1772
City of Ventura	1400 E Thompson Blvd / 336 San Jon Road		2		ChargePoint	J1772
The Players Casino	6580 Auto Center Dr		2		Tesla	TESLA
Pacific View Mall North	3301 E Main St.		1	3	eVgo	CHADEMO J1772 J1772COMBO
Ventura Harbor	1691 Spinnaker Dr.		2		Blink	J1772
Patagonia Corporate Office	259 W. Santa Clara St.		4		Blink	J1772
Patagonia Works Warehouse	85 Julian Street		1		Blink	J1772
Ventura Promenade Parking	460 E Harbor Blvd.	4	4		ChargePoint	NEMA 5-20, J1772
Montalvo Shopping Center	1722 S Victoria Ave.			1		CCS/SAE
Ocean Honda	6450 Auto Center Dr.	1	1			J1772
Paradise Chevrolet	6350 Leland Street		1			J1772
Total		**11**	**60**	**4**		

Source: Plugshare and AFDC data, VCREA, EV Alliance, and Community Environmental Council analysis, data confirmed with site hosts whenever possible, as of March 2019.

To understand the level of charging infrastructure that would be needed to support Ventura's adoption of electric vehicles, the team leveraged analysis from the Electric Vehicle Infrastructure Projection (EVI-Pro) computer simulation tool, jointly developed by the NREL and the California Energy Commission. The EVI-Pro tool is based on simulations of the habits of mainstream drivers, not just the habits of early adopters on whom early charging infrastructure needs assessments were based. From there, the analysis layers on charging needs for different vehicle capacities, charger sharing, travel and charging preferences,

as well as variation in vehicle technology and user behavior. The EVI-Pro tool was designed to support Governor Brown's 2012 Executive Order B-16-2012, which decreed that California had to develop the infrastructure to support 1.5 million ZEVs on the road by 2025.

The EVI-Pro tool produces two outputs, a "high" estimate and a "low" estimate. The high estimate is based on the total number of vehicle charging events over a 24-hour period, divided by two to account for sharing. This methodology is used for both Level 2 and DC Fast Charger calculations. To derive the low estimate, the EVI-Pro tool analyzes the maximum vehicles needing to charge at the same time in a defined area during the day. This 'peak charging demand' estimate provides a conservative estimate of need for chargers.

The EVI-Pro calculations were conducted on a county-by-county level. In order to look at the charger requirements for the city of Ventura, the team scaled the results for Ventura County in proportion to population. We also limited the scope of the Level 2 analysis to publicly available charging stations, including the EVI-Pro categories of both 'destination' and 'public'.

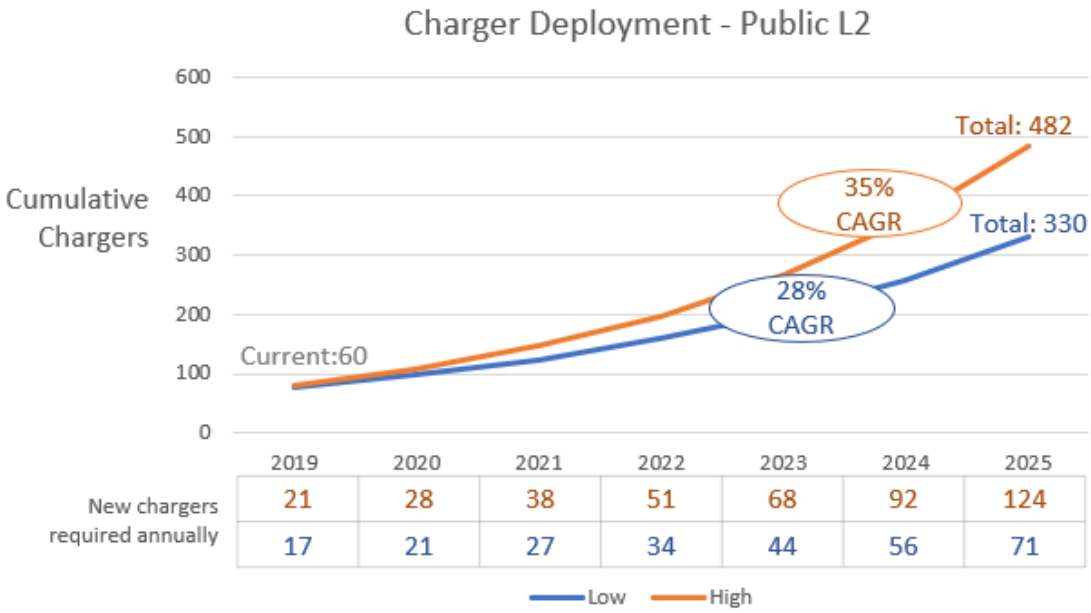
EVI-Pro County Analysis and City Extrapolation

	Scenario	
County of Ventura	**Low**	**High**
Public L2	2546	3719
Fast Chargers	105	296

	Scenario	
City of Ventura	**Low**	**High**
Public L2	330	482
Fast Chargers	14	38

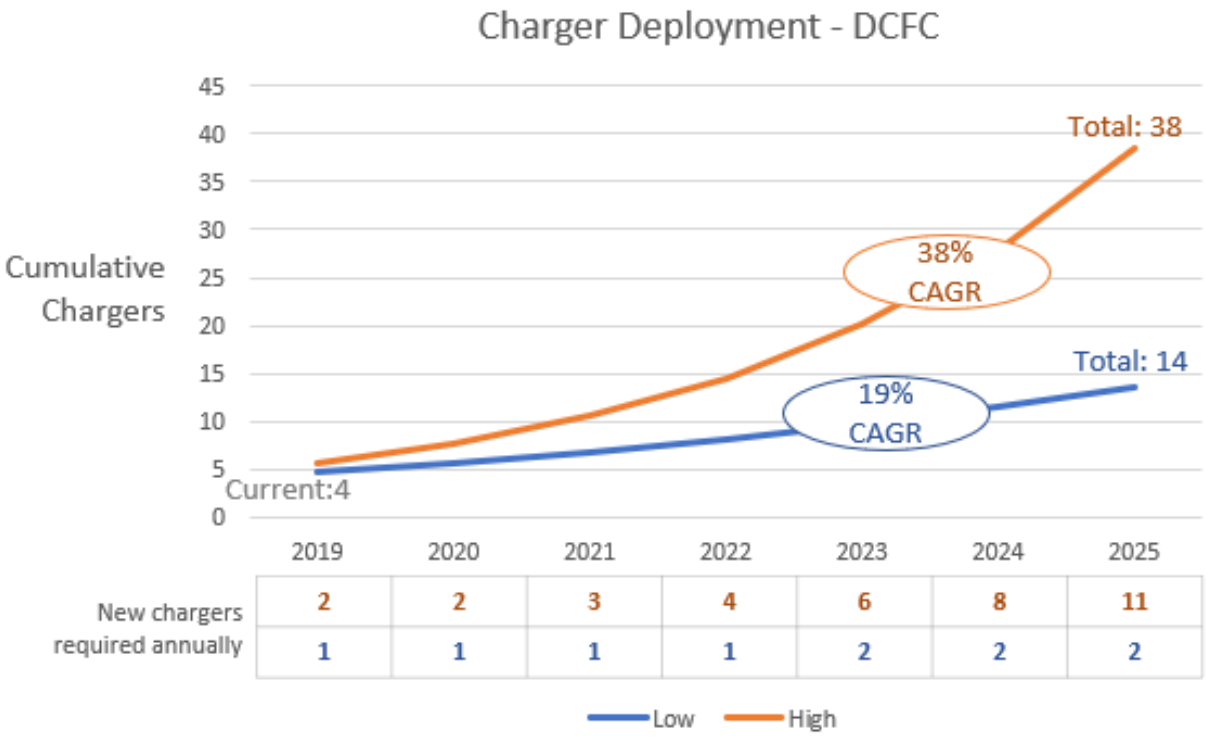
Source: Bedir, Abdulkadir, Noel Crisostomo, Jennifer Allen, Eric Wood, and Clément Rames. 2018. California Plug-In Electric Vehicle Infrastructure Projections: 2017-2025. California Energy Commission. Publication Number: CEC-600-2018-001, EV Alliance analysis.

According to EVI-Pro, the city of Ventura will need to have between 330 and 482 publicly available Level 2 chargers by 2025 to support the level of vehicle uptake required to meet California's 2025 EV adoption goal. This is a dramatic increase from the 60 publicly available Level 2 charging ports currently within city limits and would require 28 to 35 percent year-over-year annual growth (CAGR) to achieve this proposed target, demonstrated in the chart below. The annual charger construction to support this level of infrastructure is significant, and can be seen in the "New chargers required annually" section of the chart below.



Source: EV Alliance analysis, based on EVI-Pro data, 2019.

A similar story exists for DC Fast Chargers, as can be seen in the chart below. Currently, the city of Ventura is home to 4 DC Fast Charger. According to EVI-Pro projections, by 2025 the city will need to have 14 DC Fast Chargers total in the low scenario, and a remarkable 38 DC Fast Charger ports in the high scenario. In order to achieve this growth, the number of DC Fast Chargers within city limits will need to grow by between 19 to 38 percent year-over-year. This equates to Ventura adding between one to two DC Fast Chargers per year in the low scenario, and up to 11 chargers per year in the high scenario. This significant difference in the high and low scenarios is notable, and likely driven by the EVI-Pro methodology for assuming a maximum of two vehicle charges per day for the high scenario, which the EVI-Pro designers recognize is likely an overly generous estimate for DC Fast charger utilization patterns. However, even the low scenario requires DC Fast Charger construction of at least one port per year. Tesla is reported to be adding a supercharger location in Ventura in 2019/2020, which may add eight to 24 DC Fast Charger ports depending on the size of the installation, which hasn't been announced yet. VW may also bring DC Fast Chargers to the city through the Electrify America program, though timing and numbers haven't been announced.



Source: EV Alliance analysis, based on EVI-Pro data, 2019.

Best Practices for Pricing EV Charging

In order to enable a successful increase of EV charging infrastructure, the City of Ventura needs to ensure that a sustainable business model exists for EV charger hosts and providers. Charging pricing has a critical impact on how EV drivers interact with stations, and it is important to ensure best practices are deployed.[8] Unlike refueling at a gas station, EV charging can take a significant amount of time. When one vehicle is charging, access for other vehicles that may need to charge is constrained. Therefore, in aligning pricing to optimize charging behavior, it makes sense to incorporate some connection between time spent charging and price paid. In line with this, minimizing 'dwell-time', or the amount of time that a vehicle is occupying a charger space without charging, is also an important concern.

Generally, pricing strategies for EV charging fall into four different categories – free charging, a flat fee for a connection, a price based on time spent charging, or a fee based on the energy used. Often, some combination of the three fee-based categories is deployed. The benefits and challenges of each approach are summarized in the table below:

Strategy	Benefits	Challenges
Free charging	Encourages utilization and can help incentivize EV adoption in areas with lower uptake	Causes inefficiencies in utilization, excessive dwell time and 'free-ridership'

[8] Winn, Ryan, *Electric Vehicle Charging at Work*. Luskin Center for Innovation: http://innovation.luskin.ucla.edu/sites/default/files/Full%20Report.pdf

Flat fees	Simple to understand, discourages very low efficiency charging (when little charge is needed)	No connection between cost to deliver energy and price paid by driver; provides no incentive for drivers to limit dwell time
Time-based pricing	Discourages charger occupancy in the event of low-efficiency charging, disincentivizes dwell time	Disadvantages slower charging vehicles like plug-in hybrid electrics
Energy per kWh pricing	Simple, clear cost for value delivered, equitable for vehicles with different charging speeds	Critical to get pricing right, as demand is elastic. Pricing too low can incentivize low-efficiency charging. No incentive to minimize dwell time. As a rule of thumb, $0.10 per kWh charging equates to about $1.00 per gallon of gasoline

The project team believes that the best charging strategy includes three elements:

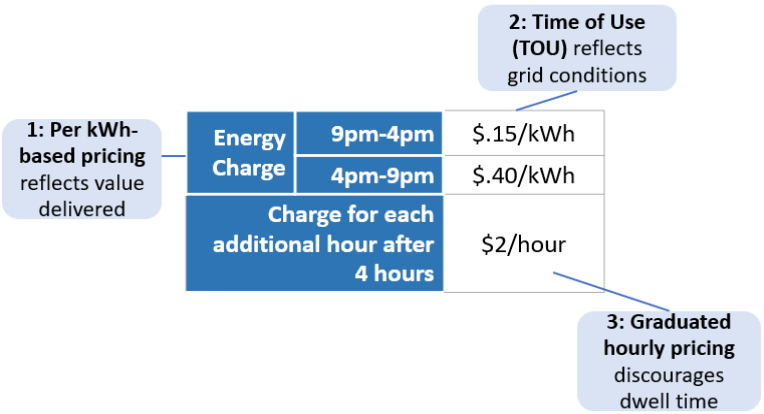
1. While some studies have shown that in some conditions, time-based charging encourages the most efficient charger use,[9] the project team believes that **per-kWh pricing** best aligns the incentives of drivers and charging providers by creating the clearest connection between the cost paid by charging providers and the price paid by EV drivers.
2. Incorporating **TOU-based pricing into per-kWh pricing** reflects grid conditions, and often, the cost of electricity provided by a charging provider. TOU rates for EV charging provide an important incentive to drivers to (when possible) charge during hours when the grid is supplied by plentiful, low-cost solar energy, and minimize charging during the 'evening ramp', when expensive fossil fuel 'peaker plants' come online as solar generation subsides.
3. Incorporation of a time-based pricing strategy known as **"graduated hourly" pricing** provides the incentive to minimize dwell time that is otherwise absent from a stand-alone per-kWh rate. With graduated hourly pricing, station managers implement an hourly charge after a set period of time to discourage utilization of a charger without charging. This is appropriate in some instances – for example, a highly trafficked commercial area with high levels of demand and frequent vehicle turnover – and less for others like workplaces. The team recommends that station managers consider graduated hourly pricing based on locational characteristics and utilization levels.

As of this draft, the California Division of Measurement Standards is in the process of updating proposed regulations for electric vehicle charging systems, which could impact options for charging rate strategies.[10]

[9] Winn, Ryan, *Electric Vehicle Charging at Work*. Luskin Center for Innovation: http://innovation.luskin.ucla.edu/sites/default/files/Full%20Report.pdf

[10] https://www.cdfa.ca.gov/dms/regulations.html

Example: Charging rates reflecting best practices



By deploying a charging strategy that includes a TOU-based per-kWh rate, with graduated hourly pricing, charging managers in the City of Ventura can optimize their EV charger deployments. Driver pricing will be clearly aligned with energy consumed, as well as the greater impact of the cost of supplying that energy to the grid. Drivers will be incentivized to minimize dwell time, thus maximizing the value and access that publicly-available chargers deliver to a community.

Community fleet transition conclusion

EVs can provide enormous savings through both fuel and maintenance costs, while decreasing the environmental impact of driving. With the roll-out of Clean Power Alliance's green tariffs, residents of Ventura are in an even better position to harness the environmental benefits that accompany monetary savings of EVs.

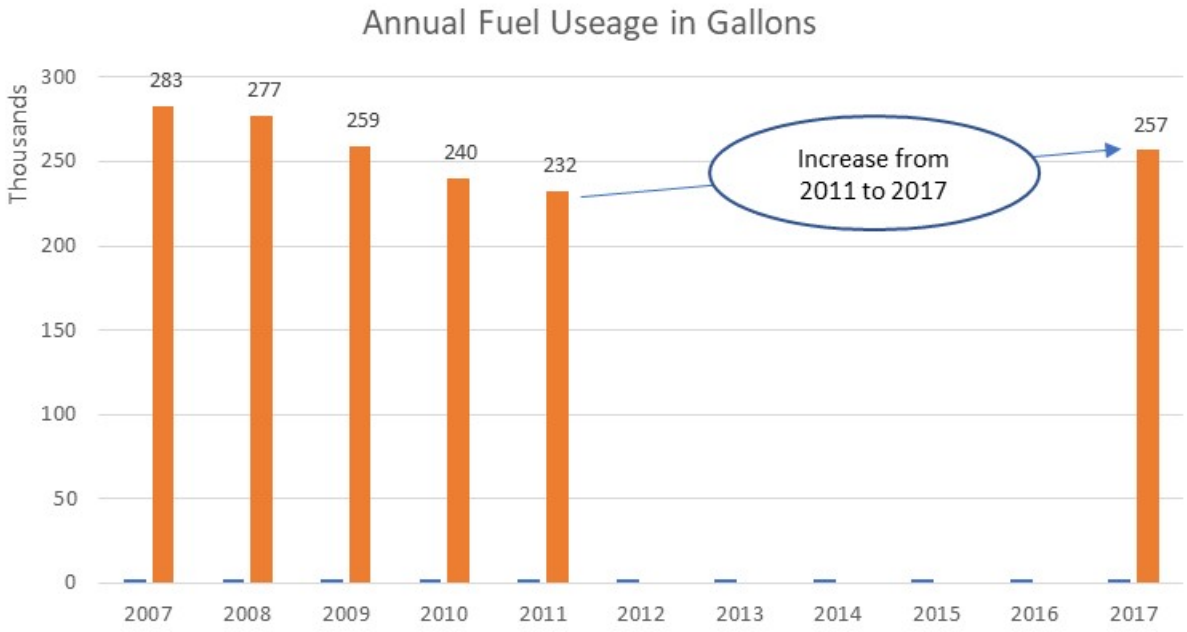
While the community of Ventura has made strong progress in EV adoption, much more is needed if the city is to meet its portion of California's 2025 EV charging equipment goal and 2030 EV adoption goal. Fortunately, EV-friendly shifts in consumer sentiment, in addition to the commercialization of EVs with longer ranges, lower prices, and a wider range of model types, is naturally increasing EV adoption. The City of Ventura can continue to support this with EV-friendly policies, continued EV charger investment with strategic pricing structures, and by providing a strong example with its own fleet. Taking proactive steps to ensure public support for charging infrastructure development and addressing potential concerns before they arise, such as parking capacity issues, will also be key to advancing EV infrastructure development.

City fleet transition

In addition to supporting programs that encourage city residents to transition to EVs, the City of Ventura can model the way towards transportation electrification by electrifying its own fleet. With over 400 vehicles and small equipment, there are several options for increasing the number of EVs within the fleet, though immediate opportunities are limited by available electric vehicle models. This component of the plan first explores actions that the City of Ventura has taken to address vehicle electrification so far. From there, the plan explores the current fleet composition of the City, including prime opportunities for electrification. This plan then identifies how the City of Ventura can transition one-eighth of its fleet – in line with California's 2030 goal of 5 million ZEVs on the roads – and identifies barriers that need to be overcome to achieve 100 percent electrification, as well as incremental steps that the City can pursue immediately.

Ventura Sustainability Strategy and City Actions for Electrification so far

The need to reduce vehicle emissions is recognized throughout City of Ventura's Sustainability Strategy. In the Strategy, published in 2012, the City stated that one goal was to reduce fuel use and vehicle miles traveled. Ventura has made laudable progress to this end. As can be seen in the chart below, the City of Ventura reduced annual gasoline and diesel usage from over 282 thousand gallons in 2007 to 232 thousand gallons in 2011, a reduction of almost 18 percent. This reduction resulted from both procuring more efficient vehicles as well as eliminating underutilized vehicles.[11]



Since 2011, annual usage has begun to increase. This is driven largely by the City of Ventura increasing services offered as the economy recovered after the 2008 recession. These increased services resulted in increased mileage.

The Sustainability Strategy also outlines projects that have been completed, projects 'in-place', and future projects to support this fuel reduction goal. Projects highlighted in the Sustainability Strategy that support reducing vehicle emissions include:

- Select replacement vehicles with highest environmental scorecard rating
- Increase the amount of hybrid vehicles used for non-patrol vehicles at the Police Department. This could also be implemented for Fire Suppression support vehicles
- Prioritize vehicles with high fuel use for replacement based on fuel use as main priority
- Continue to purchase alternative fuel and fuel-efficient vehicles

[11] City of Ventura Sustainability Strategy, 2012:
https://www.cityofventura.ca.gov/DocumentCenter/View/822/Environmental-Strategy-PDF?bidId=

	Responsible	Goals		Timeline	Cost	Funding	Status
Planned Projects/Activities	Responsible Division	Reduce Fuel	Reduce Miles Traveled	Short, Medium, Long*, or Ongoing		Funded or Unfunded	
Increase the amount of fuel efficient vehicles used for non-patrol vehicles at the Police Department. This could also be implemented for Fire Suppression support vehicles.	Fleet	X		Ongoing		Funded	
Prioritize high fuel use vehicles for replacement based on fuel use as main priority.	Fleet	X		Ongoing		Unfunded	Per Fleet Policy
Encouraging ride sharing to and from work as well as to meetings and conferences.	Env. Sust.	X	X	Ongoing			Bring to Green Team in FY13
Provide training to employees to encourage fuel efficient and safe driving behavior.	Fleet & Env. Sust.	X	X	Ongoing			Bring to Green Team in FY13

*Short (active in FY13), Medium (3-5 years), Long (5+ years)

Source: City of San Buenaventura Sustainability Plan, page 9. 2012, available at https://www.cityofventura.ca.gov/DocumentCenter/View/822/Environmental-Strategy-PDF?bidId

While the fleet managers of the City of Ventura understand the need to explore environmental options, they are cautious about untested technology and potential long-term costs of early technology deployments. The electrification approach so far has been focused on deploying tested technology where possible, and ensuring adequate EV charging infrastructure has been installed to enable future EV deployments. Through a thorough evaluation of the potential to electrify the current fleet, the next section of this plan seeks to further support Ventura by identifying 'quick wins' for electrification of the fleet, as well as opportunities to explore more innovative technologies.

Ventura Fleet and Electrification Potential

The City of Ventura currently has 400 vehicles and equipment, including 11 electric vehicles. After excluding public safety vehicles and non-motorized equipment (e.g. trailers), Ventura has a total of 258 vehicles and motorized equipment, including pumps and mowers. Approximately 100 of these are light- or medium-duty trucks. The following section highlights which vehicles have high potential for replacement with EVs:

- **Sedans:** Sedans are the most mature electric technology, with dozens of products from major manufacturers. Rapid advances in battery technology are leading to vehicles with longer ranges, better features, and lower prices. There is a possibility for cost neutrality or even cost savings over existing gasoline sedans due to lower fueling and maintenance costs.

  Ventura has done an admirable job procuring hybrid and electric vehicle technologies, and with dramatic increases in technology and range, accompanied by price decreases, they can continue to push this segment. Of the 31 sedans in the City fleet, 25 are hybrid vehicles, three are plug-in electric vehicles, and three are electric vehicles. As prices continue to lower and ranges continue to expand for EV sedans, Ventura can continue to take advantage of this rapidly evolving vehicle segment.

- **Light- and Medium-Duty Trucks:** The largest share of Ventura's fleet is light- and medium-duty trucks. Unfortunately, there are currently no light-duty electric trucks on the market, though

many brands, including Ford and Rivian, have committed to delivering light-duty electric trucks in the early 2020s. In the meantime, there may be some opportunity to replace some of these vehicles with electric vans or specialty trucks or downsize them to electric carts. The City of Ventura has seven electric utility carts.

Manufacturers such as Phoenix and Motiv are producing medium-duty work truck chassis with ranges of up to 100 miles on a single charge. With generous incentives of $80,000-$95,000 from California's Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP), these vehicles have out of pocket costs just above $100K.

- **SUVs and vans**: Both major manufacturers and smaller companies are currently producing SUVs and vans. Depending on the use case and replacement schedule, these could be acceptable replacements for existing vehicles. By 2020, the variety of electric SUVs in the marketplace should increase significantly, thus broadening the options for fleets looking to electrify SUVs.

  Ventura has procured one of the earliest commercially available all-battery electric SUVs, the 2003 Toyota RAV 4. This early model was produced in limited quantities from 1997 – 2003, and distributed a small amount of the vehicle to businesses and governments in California. The early RAV 4 has a range of 95 miles. The City of Ventura's Senior Environmental Compliance Inspector for Stormwater uses this vehicle exclusively. It is still functioning well, but fleet managers have trouble finding replacement parts and plan to retire the vehicle when significant repairs are needed.

- **Police:** While there are currently no plug-in electric police pursuit vehicles available without requiring aftermarket adjustments, Ford does manufacture a hybrid electric sedan – the Police Responder Hybrid Sedan. The Police department is currently evaluating the Police Responder Hybrid sedan and may be considered for the 2020 model year of police vehicles. The typical duty cycle of a police pursuit vehicle includes frequent idling. Using a hybrid instead of a conventional internal combustion engine vehicle can create significant savings by enabling the engine to turn-off while idling. Ford does produce a plug-in hybrid sedan for detective or other specialized use.

  The police department of Fremont, California recently converted a Tesla Model S to a patrol vehicle. The department is anticipating that the aftermarket conversions will cost ~$40,000, approximately the additional price of purchasing a 'police package' on a Ford vehicle. The department hopes to save on fuel costs and improve operational time with reduced maintenance.[12]

- **Other:** The rest of the fleet is made up of trailers, specialty vehicles such as construction equipment, mowers, and fire trucks. Many of these do not have any EV options available, though fleet managers should pay close attention, as models in many of these categories are expected to emerge in the next decade of California's electrification wave.

[12] https://electrek.co/2019/01/24/tesla-model-s-police-patrol-vehicle-fremont/

One option that the City of Ventura can explore now is electrifying mowers. Rapid declines in battery prices in conjunction with increases in capacity have impacted technology beyond the vehicle world. A recent crop of new electric mowers is hitting markets, and fuel savings lead to price parity in ten years, according to Consumer Reports.[13] While not all commercially-available E-mowers are adequate substitutes for the City of Ventura's industrial equipment, fleet managers should explore currently available electric options in procurement decisions.

Pathway towards California's 2030 goal

If the City of Ventura fleet is to achieve its portion of California's 2030 goal of 5 million ZEVs on the road, it will have to transition approximately one eighth of its fleet to ZEVs. After eliminating equipment that is clearly non-motorized, like trailers, from the vehicle inventory, Ventura has approximately 258 motorized vehicles left (note, this analysis doesn't include public safety vehicles, and once EV options are available the goal should be increased). To transition one-eighth of this fleet to EVs or ZEVs, Ventura needs to ensure that 32 vehicles have no tailpipe emissions.

As mentioned above, the City of Ventura currently has 11 EVs, composed of five electric carts, two electric scooters, three electric sedans, and one electric SUV. With these vehicles, Ventura is essentially one third of the way to achieving its portion of California's goal. In order to transition one-eighth of the current fleet to EVs, the City only needs to transition 21 additional vehicles by 2030 to achieve 32 EVs (assuming the fleet does not grow). While given the broad economic and environmental benefits of electric vehicles, this should be considered the minimum goal, and hitting the target for 21 or more fleet EVs should be very feasible.

The section below identifies which 21 vehicles are leading candidates for electrification. This is divided into two categories – immediate candidates and candidates for the medium term. The list of immediate candidates focuses on vehicles nearing

Case Study: Ojai Ground Maintenance Electrification

Not far from the City of Ventura, the City of Ojai is making tremendous strides in equipment electrification. Taking advantage of the efficiency gains and decreasing prices of battery technology, and with the support of a grant procured through Ventura County Air Pollution Control District, the City of Ojai procured zero-emission grounds maintenance equipment in the fall of 2018.

They're excellent. The tools are light. They seem very durable so far. and it's great.

— Scott Davis, Ojai Public Works Grounds Maintenance Crew

Going forward, the City will use only zero-emissions equipment for all routine maintenance on their 52 acres of municipal property. [13]

[13] Price parity analysis: Consumer Reports, *Electric Lawn Mowers that Rival Gas Models.* April 2017,: https://www.consumerreports.org/push-mowers/electric-lawn-mowers-that-rival-gas-models/, Available models: https://electrek.co/2018/04/26/electric-lawnmower-guide/,

[13]Available models: https://electrek.co/2018/04/26/electric-lawnmower-guide/, Price parity analysis: Consumer Reports, *Electric Lawn Mowers that Rival Gas Models.* April 2017,: https://www.consumerreports.org/push-mowers/electric-lawn-mowers-that-rival-gas-models/

recommended usage maximums in the next few years, for which EV replacements are already widely commercialized.

Immediate Candidates for Electrification – Sedans

As mentioned above, sedans are the most mature electric technology, with dozens of products from major manufacturers. The City fleet has already begun adopting some plug-in hybrids, so there is already initial familiarity among City staff with the technology. As such, sedans provide easy wins when moving towards EVs in the City fleet.

Near Term Vehicle Recommendations for Electrification - Sedans

Priority	City Department	EQ #	Description	Model Year	Lifetime Mileage	Latest Annual Usage	Recommended Usage	Remaining until Rec Usage
1	Police	0193	09 FORD CROWN VICTORIA (SET)	2009	120,411	8,539	125,000	4,589
2	Public Works	0120	TOYOTA PRIUS-CH	2004	110,542	2,360	125,000	14,458
3	Public Works	0121	TOYOTA PRIUS-YD	2004	86,833	6,449	125,000	38,167
4	Police	0217	FORD FUSION SE HYBRID	2013	85,118	12,137	125,000	39,882

Duty cycles can vary widely, and some fleet managers express concern about charging vehicles that regularly have to make extended, 300mile + trips. Two of the four vehicles identified above belong to the Ventura Public Works Department, which has several other sedans. If the two Public Works Department vehicles above were replaced with battery-electric vehicles, the EVs could be used for trips within the range of one charge, and plug-in hybrid or hybrid vehicles could be used for longer trips. In the longer term, ample charging infrastructure should exist so that the time commitment of recharging an EV is roughly equivalent to that of refueling a conventional vehicle. With sufficient charging infrastructure in place, battery-electric vehicles will be able to replace conventional gasoline-fueled vehicles for longer trips.

Battery-Electric Vehicles – Chevy Bolt, Nissan Leaf

- Pure electric vehicles
- 150-238 mile range
- $20,000-$27,000 after incentives

There are over two dozen all-electric and plug-in hybrid sedans currently on the market from major manufacturers. Four EV sedans are most commonly purchased by government fleets, the Chevy Bolt,

Nissan Leaf (both pure EVs) and the Honda Clarity and Toyota Prius Prime (both plug-in hybrids). The MSRP of the electric vehicles $20,000-$27,000, after incentives, is similar to the MSRP of the Toyota Prius, $23,475. The EV sedans' 106-133 mpg equivalent is much higher than the Toyota Prius' 52 mpg.

Plug-in Hybrid Vehicles – Honda Clarity, Toyota Prius Prime

- Plug-in hybrids
- 25-48 mile EV range, then 42-54 mpg hybrid mode
- $21,300-$24,400 after incentives

Sedans present a compelling value proposition for transitioning to electric, even over a relatively short timescale. Looking only at fuel savings alone, a Chevrolet Bolt creates enough savings to recoup incremental upfront purchase cost in less than five to eight years, depending on annual mileage. If maintenance savings are included, which this payback period can accelerate by up to one-third.

Years to Breakeven – Sedans

Electric Vehicle

Manufacturer	Chevy
Model	Bolt
Fuel Economy	28 kWh/100 mi
Miles / $	27.5
Upfront cost*	$24.6K

Conventional

Manufacturer	Chevy
Model	Malibu
Fuel Economy	32 mi/gallon
Miles / $	9.6
Upfront cost	$22.0K

Annual miles driven	Years to breakeven
8K	8.4
9K	7.5
10K	6.7
11K	6.1
12K	5.6
13K	5.2
14K	4.8

Source: 2019 EV Alliance analysis, based on data from the Department of Energy's Fueleconomy.gov. *Electric Vehicle upfront cost includes currently available California and National incentives. Price of electricity is $0.13/kWh, assumes charging at SCE's off-peak Commercial & Industrial EV rate, that includes a demand charge holiday. Price of gas based on average price in Ventura County in March of 2019, per https://gasprices.aaa.com/?state=CA.

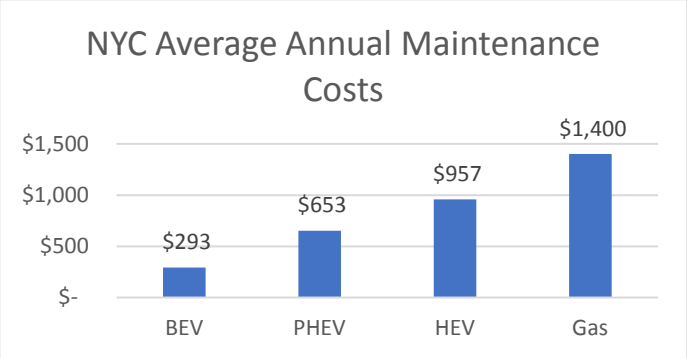
Case Study: Realized maintenance savings for New York City and County of Alameda

Many reports and manufacturers tout the extensive savings on maintenance that EVs provide to fleet managers, but do these emerge in the context of real fleets? New York City and the County of Alameda, both early adopters of EV technology, have made maintenance savings data available.

Vehicle Model	System	Number	2018 Maintenance Cost
Bolt	All electric BEV	93	$204.86
Focus	Gas	11	$1,805.24
Focus Electric	All electric BEV	7	$386.31
Fusion	Gas	62	$1,621.34
Fusion Energi	Hybrid Gas/Electric Plug in	154	$496.73
Fusion hybrid	Hybrid Gas/Electric	205	$1,310.89
Leaf	All electric BEV	149	$344.14
Prius	Hybrid Gas/Electric	1,131	$893.31
Taurus	Gas	38	$922.67
Volt	Hybrid Gas/Electric Plug in	43	$1,210.40

Source: DCAS Client Program, CY2018, accessed at: https://bit.ly/2FFIM5M.

The average annual maintenance costs for NYC's vehicles vary significantly, from a high of $1,621 for the Ford Fusions, to a low of $205 for the Chevy Bolts. When you look at the weighted average by vehicle type, a clear pattern emerges.



The battery electric vehicles in the fleet have by far the lowest annual maintenance costs, followed by the plug-in hybrid vehicles, the hybrid vehicles, and finally, the conventional internal combustion engine vehicles.

The maintenance costs from the County of Alameda have a less dramatic, but still significant, story to tell. For their EV fleet, the County recorded a maintenance cost per mile of $.035, compared to $.079 for their conventional fleet. Phillip Kobernick, the Logistics Manager for the County of Alameda, credits this to avoided oil changes for fleet EVs, as well as time savings. Oil changes are their biggest hard cost for combustion engine vehicles. "And labor is way down because [EVs require] about a 45-minute inspection… while the customer waits. ICE PM services are much longer."

Medium-term Vehicles for Electrification

When exploring fleet electrification in a two to five year time horizon, light-duty trucks present a potential opportunity. A number of companies, from start-ups like Rivian to major manufacturers like Ford and Tesla, plan to produce commercially available electric or plug-in hybrid pickup trucks starting in 2020. Given that many of the pickup trucks will likely reach their recommended usages in this timeframe, these vehicles could make excellent candidates to replace aging trucks.

Medium Term Vehicle Recommendations for Electrification

Priority	City Department	EQ #	Description	Model Year	Lifetime Mileage	Latest Annual Usage	Recommended Usage	Remaining until Rec Usage
5	Parks	0589	FORD F250	2006	119,582	8,975	125,000	5,418
6	Water	0335	FORD F250 EXT.	2006	117,721	8,639	125,000	7,279
7	Public Works	0401	FORD F-250 UTILITY	2003	116,302	6,263	125,000	8,698
8	Wastewater	0811	CHEV SILVERADO	2004	75,440	2,733	85,000	9,560
9	Public Works	0433	CHEV2500	2003	114,641	9,058	125,000	10,359
10	Fire	0034	CHEV SUBURBAN 4WD (B110)	2006	112,339	2,652	125,000	12,661
11	Public Works	0695	FORD F250 UTILITY W/LIFT GATE	2003	112,288	10,726	125,000	12,712
12	Fire	0073	CHEVY TAHOE PPV (A1)	2012	109,638	14,932	125,000	15,362
13	Parks	0587	CHEV 2500	2003	109,317	6,232	125,000	15,683
14	Public Works	0690	FORD F250 UTILITY	2006	108,076	5,300	125,000	16,924
15	WasteWater	0838	CHEV 2500 UTILITY	2004	106,965	3,653	125,000	18,035
16	Community Development	0100	DODGE DAKOTA MP-CH	2001	105,834	8,805	125,000	19,166
17	Water	0334	FORD F250 W-LIFTGATE	2006	105,245	6,597	125,000	19,755
18	Water	0387	FORDF250 XL UTILITY	2001	103,863	5,118	125,000	21,137
19	Parks	0524	DODGE2500	2001	103,778	4,613	125,000	21,222
20	Water	0380	FORD F150	2006	102,504	8,620	125,000	22,496
21	Public Works	0691	FORD 250 UTILITY	2004	99,513	9,533	125,000	25,487

Source: EV Alliance analysis 2019.

The list of pickup trucks for potential replacement with EVs was derived by examining which of the City's pickup trucks were nearing their maximum recommended use. Given annual mileages, many of these vehicles will be scheduled for replacement within the next 1 to 5 years, which is a prime opportunity to take advantage of the new electric trucks on the market. While Ford has only announced the development of a Class 2a vehicle – an E-F150 -- and many of the vehicles up for replacement soon are Class 2b (Ford F250, Chevy 2500, etc.), departments should evaluate if a Class 2a vehicle can be a feasible substitute.

Prototypes of Ford (left) and Rivian EV Pickup Trucks

Source: InsideEVs.com, Teslarati.com

Another option to consider is whether the use cases and duty cycles of any of the pickup trucks nearing maximum recommended usage could be replaced by any other currently available vehicles. Some options for replacement include:

- **Medium-Duty Trucks:** Both Motiv and Phoenix have medium-duty customizable work trucks that are currently commercially available. If the use case of an existing vehicle could be better served by a truck with a greater payload, these options should be considered. Likewise, Chanje provides electric medium-duty vans, available to lease at essentially price parity for similar conventional vehicles (~$1,300 - 1,400/month). If a vehicle is primarily used for equipment transportation or equipment or delivery, a Chanje van would be a suitable replacement.

Motiv Work Truck

- All-electric
- Up to 100 mile range

Phoenix Zeus Electric Flatbed

- All-electric
- Up to 100 mile range
- ~$130,000 after incentives

- **Chrysler Pacifica Plug-in Hybrid Vans:** If a truck is primarily used to transport equipment, materials, or people, it may be worth exploring replacement with a Chrysler Pacifica plug-in hybrid van. The vans have ample interior space and can achieve 33 miles on a single charge before switching to hybrid mode.

Chrysler Pacifica

- Plug-in hybrid
- 33 mile EV range, then 32mpg hybrid mode
- $35,000 after incentive

Similar to sedans, the Chrysler Pacifica has a compelling value proposition. While the plug-in hybrid is slightly more expensive than the conventional vehicle, with the right duty cycles, a fleet can rapidly achieve cost parity when looking at savings from fueling alone. If maintenance savings are layered on top of this, the payback period decreases further.

Years to Breakeven – Vans

Electric Vehicle

Manufacturer	Chrysler
Model	Pacifica Plug-in Hybrid
Fuel Economy	33 mi electric 32 mi/gallon hybrid
Miles / $	15.4 electric 9.6 hybrid
Upfront cost*	$31.0+K

Conventional

Manufacturer	Chrysler
Model	Pacifica
Fuel Economy	22 mi/gallon
Miles / $	6.6
Upfront cost	$27.0+K

Annual miles driven	Years to breakeven
8K	6.0
9K	5.6
10K	5.2
11K	4.9
12K	4.7
13K	4.4
14K	4.2

Source: 2019 EV Alliance analysis, based on data from the Department of Energy's Fueleconomy.gov. *Electric Vehicle upfront cost includes currently available California and National incentives. Price of electricity is $0.13/kWh, assumes charging at SCE's off-peak Commercial & Industrial EV rate, that includes a demand charge holiday. Price of gas based on average price in Ventura County in March of 2019, per https://gasprices.aaa.com/?state=CA. Assumes vehicle is fully charged every night and that annual mileage is divided between 220 days per year, or approximately 4 days per week.

- **SUVs:** Depending on the specific vehicle use-case, replacement with an SUV can be a feasible option. Hyundai recently began production of the Kona, an all-electric SUV, and Mitsubishi released the plug-in hybrid Outlander in 2018. If the truck is primarily used to transport materials or equipment, an SUV could provide a suitable alternative.

Mitsubishi Outlander

- Plug-in hybrid
- 22 miles EV range (74 mpge), then 25 mpg hybrid mode
- $27,500 after incentives

Hyundai Kona

- 258 mile range
- 120 mpge
- <$30,000 after incentives

- **Sedans:** If a truck is primarily used for personnel transportation, the department should explore whether that vehicle could be replaced by an electric sedan, like one of the many options

discussed above. Not only would this provide significant operating savings over a pickup truck, but the upfront price would also be lower.

With simple, cost-saving procurement decisions over the next five years, the City of Ventura could position itself to be well aligned with California's 2030 goal of 5 million electric vehicles on the roads. The currently available electric sedans present 'quick wins' in which the City can capture both the environmental and the cost-saving benefits of EVs. With the myriad of electric pickup trucks entering the marketplace in 2020 and beyond, the City of Ventura should also be able to begin transitioning light-duty trucks, the largest category of its fleet.

Electrifying 100 percent of City of Ventura's fleets

In the long run, if California is going to meet its climate goals, the City of Ventura should explore what barriers need to be overcome to enable the fleet to transition to 100 percent electric. Additionally, the California Air Resources Board recently passed the Innovative Clean Transit Rule, which mandates that state transit agencies move to 100 percent emissions-free transportation options by 2040, and is exploring similar regulation in other industries.[14] Fortunately, the electric vehicle industry is developing rapidly, and affordable, long-range vehicles are at the very least in planning phases in all market segments.

Fleet managers should keep abreast of new electric models becoming available through industry tradeshows, ongoing collaboration with local organizations such as Ventura County Regional Energy Alliance and the Community Environmental Council, and through engagement with the region's EV collaborative, Electric Drive 805. Battery costs will continue to decline, and the total cost of ownership savings over conventional ICE vehicles should continue to improve. Furthermore, as California's grid becomes cleaner, the environmental benefits of vehicle electrification will only become greater.

The challenges of transitioning an entire fleet to electric are real. In addition to strategically procuring electric vehicles based on model availability and fleet needs as discussed above, there are other incremental changes fleets can make to ease the transition. These include:

- **Leasing:** Given the rapid development of EV technology, vehicle leasing can be an enticing option for fleet owners reluctant to commit to vehicle purchase, as well as enabling a public fleet to monetize the federal tax credit. Many dealers offer lease options for light-duty vehicles, and the Climate Mayors EV Purchasing Collaborative has standardized pricing and leasing options. For medium- and heavy-duty vehicles, fleet consulting services like Zeem Solutions offer lease options. Electric vehicle manufacturer Chanje has partnered with Ryder to provide panel vans for flexible leases. Penske is also in the early stages of developing a medium- and heavy-duty lease option.

[14] California Air Resources Board, "Zero Emission Airport Shuttle Regulation". Hearing date scheduled for February 21, 2019, more information available at: https://ww2.arb.ca.gov/rulemaking/2019/asb19

Lease vs Buy Analysis

CLIMATE MAYORS
Nissan Leaf

Acquisition Price	$26,528.00		
Federal Tax Credit	$7,500.00		
Lease Term	24 Month	36 Month	48 Month
Per month lease payment	$599	$489.08	$423.35
Full lease cost (Payment multiplied by term)	$14,377	$17,606.88	$20,320.80
Residual value %	30%	25%	20%
Residual value buy-out price	$7,958.40	$6,632.00	$5,305.60
Total Cost to own the vehicle	$22,335.36	$24,238.88	$25,626.40
Cash Price of Vehicle	$26,528.00	$26,528.00	$26,528.00
Lease vs Buy Savings	$4,192.64	$2,289.12	$901.60

*Maintenance, repairs, licensing/registration, and insurance costs are NOT included
**Sales Tax will be charged on the monthly lease payment at the appropriate rate

- **Interdepartmental vehicle sharing:** As a medium-sized city, Ventura vehicles are often not driven out of the city and thus have relatively low annual mileages. This can make payback periods longer than for electric vehicles that are driven more and thus experience greater operational savings from the lower fueling cost of electricity. Prioritizing replacement of vehicles that are driven the most, or exploring options to electrify pool vehicles that can be managed to have higher annual mileages, will lead to faster payback.

  Interdepartmental sharing policies can ensure that EVs are used as much as possible for range-appropriate trips. This enables maximization of electric vehicle miles traveled (eVMT), which subsequently maximizes operating savings for fleets. While coordination is needed for cohesive vehicle scheduling, the benefits of this can be far reaching, and can increase awareness and pave the way for an incremental shift to EVs. The City of Ventura has an online car sharing system that maximizes the utilization of the car sharing pool vehicles, which assists in maximization of current VMTs.

- **Sharing of charging infrastructure**: Developing charging infrastructure for EVs can significantly add to the costs of EV fleet deployments. By grouping EV chargers together and ensuring charging access is shared across departments, fleet managers can significantly cut down on infrastructure costs. As City of Ventura fleet vehicles are predominantly limited to a few sites – City Hall, the City Maintenance Yard, Police and Fire Headquarters, Fire Stations and the Water and Wastewater Treatment Plants – this is less of a concern. Assuming Ventura continues to move forward with fleet electrification, fleet managers can continue to build 'charging centers' as appropriate in each central site. However, it will be critical to ensure equal access for various departments' vehicles given the charging infrastructure available.

Policies to support electrification

Transitioning to electric vehicles can be daunting. As studies have shown,[15] one of the biggest barriers to EV adoption is lack of awareness. The tendency to continue to purchase already known and familiar

[15] Singer, Mark. The Barriers to Acceptance of Plug-In Electric Vehicles: 2017 Update. National Renewable Energy Laboratory, available at: https://www.nrel.gov/docs/fy18osti/70371.pdf

options influences decision-making, including municipal fleet procurement decisions. Several agencies have tried to use internal policies to circumvent these tendencies. Some examples of these are described below:

- **Santa Monica:** The City of Santa Monica has instituted what is known as the "Sustainable Fleet Administrative Instruction". The Instruction has a number of innovative components, including that "The City shall make every effort to obtain non-gasoline and non-diesel equipment that is the most cost-efficient, fuel-efficient, and emit the least pollutants and GHG emissions."[16] In addition, the document contains instructions to optimize equipment utilization (and thus reduce the total quantity of equipment) and reduce equipment size.

- **California Department of General Services:** In 2012, Governor Brown mandated that zero-emission vehicles compose 10 percent of state light-duty vehicle purchases by 2015 and 25 percent by 2020. The California Department of General Services (DGS) has developed with innovative guidance and programs to ensure State of California fleet procurement is aligned with these goals. First, DGS will not approve any state fleet purchases unless that state agency follows a rigorous data collection process. DGS then uses this data to evaluate whether the vehicle at hand requires replacement, and what ZEV options are commercially available. While this is not without challenge – DGS must balance emissions goals with special performance vehicles that are exempt from the ten percent mandate – DGS has compiled a toolkit of methods to 'nudge' purchasing behavior toward ZEVs.[17]

  DGS also instituted a "ZEV and hybrid vehicle first" policy. Not only does this incrementally raise the ZEV purchase percent mandate by 5 percent annually, reaching 50 percent in 2025, but it also "requires departments to purchase light-duty vehicles according to the following priority structure, when available on the statewide contract: (1) pure ZEVs, (2) plug-in hybrid EVs, and (3) hybrids". [18]

The City of Ventura is encouraged to adopt a policy similar to the City of Santa Monica or California DGS. These policies present clear and simple methods to influence procurement behavior and ensure the City achieves the goal of one eighth fleet electrification.

Conclusion – municipal fleet electrification

The City of Ventura can not only stand as a model for other organizations in the community by incorporating a strong fleet electrification program, but can also take advantage of the immediate cost benefits that EVs bring. In the short term, the City of Ventura is presented with a number of opportunities to transition sedans, SUVs, and vans to all-electric or plug-in hybrids at cost parity or even cost savings over gasoline vehicles. By developing policies to increase eVMT on EVs, such as putting EVs into use cases with employees such as inspectors that travel high mileages, and using software to assign pool vehicles daily to employees driving significant mileage, fastest payback and savings can be achieved.

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[16] Administrative Instruction II-4-22, "Sustainable Fleet". City of Santa Monica, Effective date: December 12, 2015.

[17] "Greening California's State Fleet". Evan Speer, Chief of Office of Fleet and Asset Management, California DGS. Accessed 2/9/2019 at: https://slideplayer.com/slide/13710044/

[18] State of California Green Fleets – Major Initiatives, Accessed 3/13/2019 at https://green.ca.gov/fleet/about/initiatives/.

Additionally, a slew of new vehicle models will become commercially available in the early 2020s. Ventura fleet managers should continue to keep a keen eye on pickup truck availability, as these compose a large portion of the municipal fleet and present an excellent opportunity to align Ventura with California's goal of 5 million vehicles on the road by 2030.

Workplace Electrification

Employee commuting can compose a large portion of an organization's environmental footprint; in many cities employee commuting is much more resource intense than fleet vehicle usage. Additionally, most workplace commutes can be completed by sedan – the most mature and cost-effective electric technology currently available. By ensuring that employees are aware of the cost and environmental benefits of commuting with EVs, the City of Ventura can both help employees save money and reduce its greater environmental impact. Furthermore, by encouraging EV purchases amongst employees, additional EV purchases become more likely among employees' friends, family, co-workers, and extended network through the "the first EV on the block" phenomena.

In order to understand both employee commuting practices, as well as employee attitudes towards EVs, the project team provided a survey to all employees of the City of Ventura. The survey was co-developed by the EV Alliance, the Community Environment Council, and the City of Ventura, and underwent many iterations to ensure that messaging was aligned with City Manager preferences. Categories of EV awareness and barriers to adoption were adapted from NREL's *The Barriers to Acceptance of Plug-in Electric Vehicles: 2017 Update*.[19]

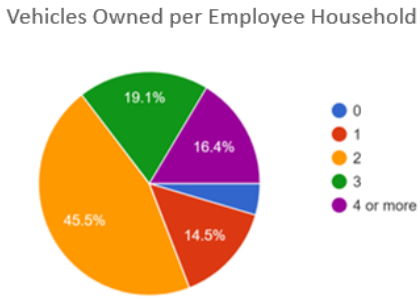
The survey was sent to employees twice. First, it was included with a newsletter on March 7, 2019. A subsequent reminder was sent out on March 28, 2019. Remarkably, a total of 100 employees responded to the survey, over 17 percent of City of Ventura employees.

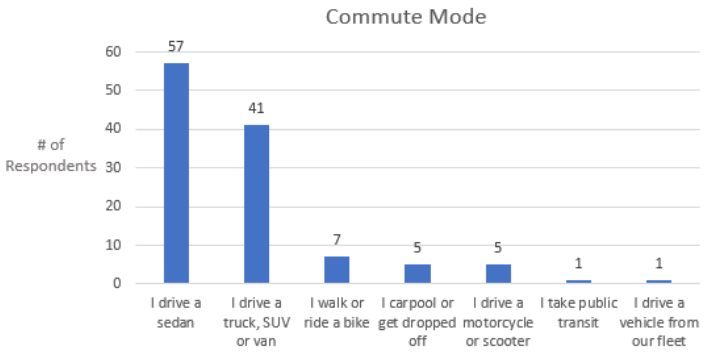
Commuting Patterns

The vast majority of respondents are vehicle owners and vehicle commuters. 95 percent of respondents own at least one vehicle in their household and 84 percent drive a sedan, truck, van or SUV for their commute. These vehicle-heavy commuting patterns lend to significant potential savings if City of Ventura employees' transition to electric vehicles.

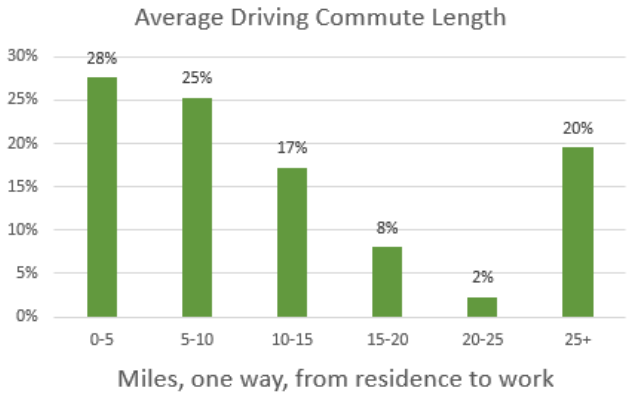
Notably, only seven respondents walk or ride a bike to work, only five occasionally carpool, and only 1 takes public transit. Given that 28 percent of commuting drivers live within five miles of their workplace (as can be seen in the *Average Driving Commute Length* chart below), it seems like there are additional opportunities to encourage employees to bike or take public transportation to work.

[19] Singer, Mark. National Renewable Energy Laboratory, available for free online at: https://www.nrel.gov/docs/fy18osti/70371.pdf





53 percent of employees that commute by vehicle live within ten miles from work. 17 percent live within 10-15 miles from work, eight percent live within 15-20 miles from work, two percent live within 20-25 miles, and 20 percent live further than 25 miles from work. Even among the furthest category, the longest commute is 60 miles each way, a total of 120 miles round trip. While not an enviable commute, this is well within range of some 2019 battery EVs.



The average driving commute is 12.8 miles each way. Assuming that an employee commutes to work five days a week, 48 weeks per year, the average City of Ventura employee that drives will commute a total of 6,162 miles annually.

Cost Comparison – EV Commute vs. Conventional

Category	#	Notes
Off peak EV rate	$0.16	Per kWh
Gas per gallon	$3.6	US Energy Information Administration - California
Gas miles/gallon	32	Chevy Malibu
EV miles/kWh	3.6	Chevy Bolt
Annual gas cost	$693	Per year from commuting alone
Annual electricity cost	$276	
EV savings	$417	
Total EV savings	~$800+	Per year based on average mileage driven in US

The costs of these miles add up. If driving a conventional sedan (the Chevy Malibu was used as an example), and paying $3.60 per gallon of fuel, an employee driving 6,162 miles per year to commute will spend $693 annually. Compared to an EV (the Chevy Bolt), fueled during nighttime hours at Clean Power Alliance's off-peak rate, driving electric would cost only $276 annually. Each year, an employee would save $417 per year by driving electric. If we expand these savings to the 84 percent of employees that commute to work by sedan, van, SUV, or truck, Ventura employees stand to gain ~$210,000 in total each year.

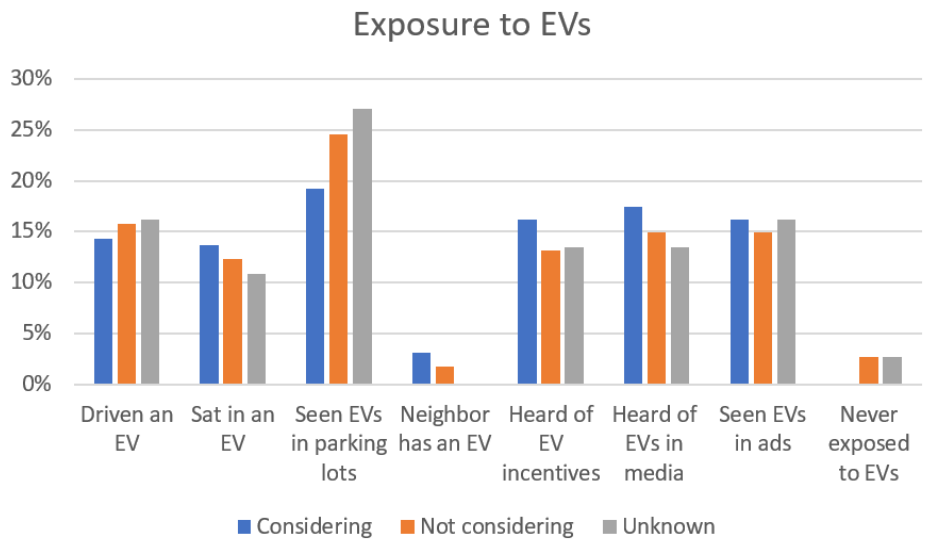
The estimate of $417 in annual savings only considers travel for workplace commuting. The average annual mileage for drivers in the United States is 12,000 miles per year. Based on this national average, many City employees will drive approximately 6,000 additional miles each year for their non-commute travel and could therefore see twice the estimated savings, or over $800 per year, from driving an EV.

Employee Interest in EVs

Based on the survey results, five percent of City of Ventura employees currently own EVs. If these results are representative of the employees as a whole, City of Ventura employees are five times ahead of the City of Ventura population in EV adoption. However, it is likely that the owners of EVs were more interested in responding to an employee survey on EVs than the employee population as a whole, so respondents may overrepresent EV owners.

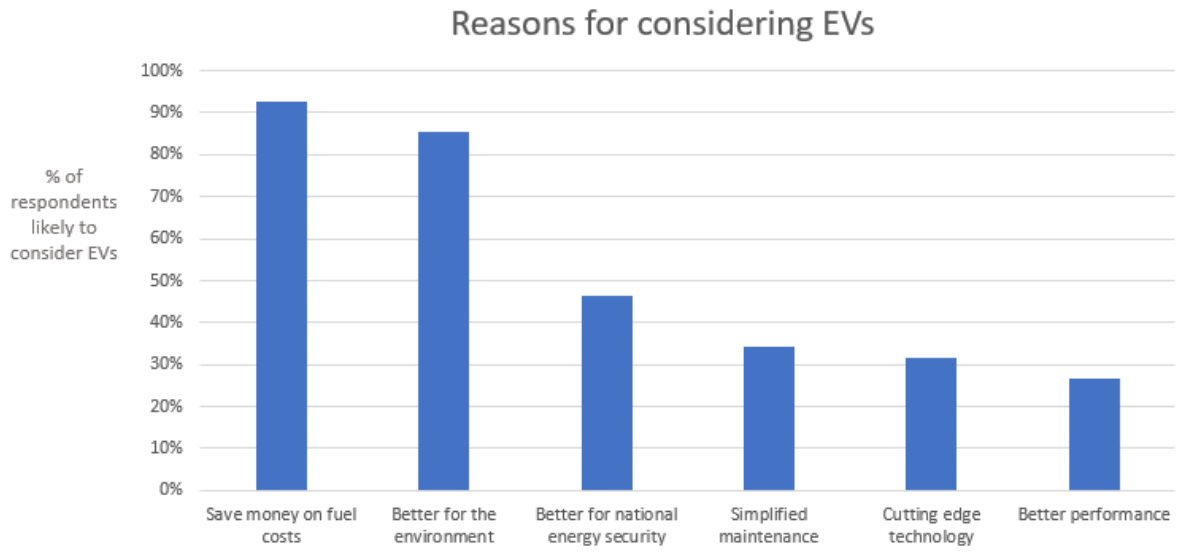
Of the 95 percent of respondents that do not currently own EVs, interest in EV uptake is substantial. 43 percent of non-EV owning respondents said that they would consider purchasing an EV for their next vehicle, with nine percent expecting to purchase an EV for their next vehicle, and 34 percent expecting to consider EVs.

A similar portion of respondents do not expect to consider an EV for their next vehicle purchase. 40 percent of total respondents indicated that they are not considering an EVs for their next automobile, with 14 percent answering that they 'will not purchase or lease an EV', and 25 percent doubting they will consider an EV. Interestingly, in the category of respondents not likely to consider an EV, there is a slightly higher tendency to respond with more certainty ('will not purchase' versus 'doubt will consider') than in the category likely to consider an EV ('expect to purchase' versus 'expect to consider'). 17 percent of respondents do not know if they will consider an EV for their next vehicle purchase.



Few patterns emerge when examining the connection between employees' previous exposure to EVs and their likelihood to consider an EV for their next purchase. There is not a strong connection between likelihood of considering an EV and actual experience riding or driving a vehicle. If anything, exposure to EVs provides more certainty in decision making. Respondents whose neighbor had an EV are either considering or not considering EVs for their next vehicle purchase; none are unknown. In comparison, those that have never been exposed to EVs are either not considering EVs or do not know. Ultimately, exposure to EVs increases propensity to have an opinion about whether one's next vehicle will be an EV.

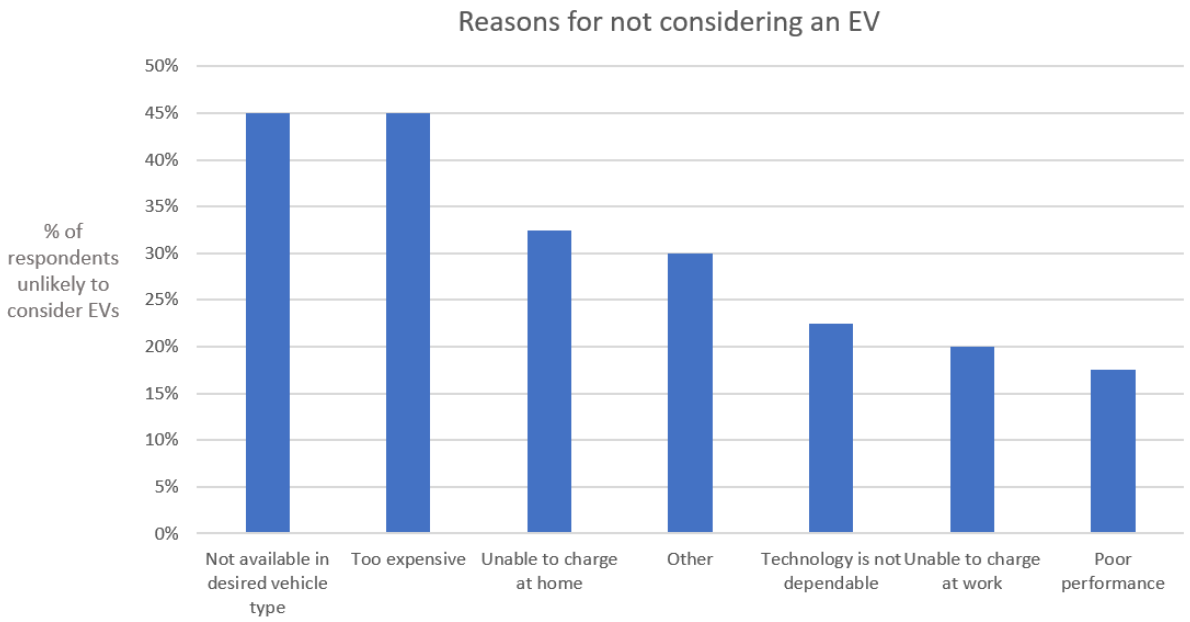
However, other factors beyond exposure likely play a stronger role in whether an employee is open to considering an EV for his or her next vehicle.



A number of reasons drive employees to either expect to purchase an EV for their next vehicle or to consider purchasing an EV for their next vehicle. The most common reason cited for considering EVs was the potential to save money on fuel costs. Second to this was the environmental benefits that fueling with electricity brings over conventional fossil fuels. The least frequently cited reason to consider EVs was better performance, implying an opportunity to better inform employees of the performance benefits of the latest generations of EVs.

Barriers to EV adoption

In spite of the enthusiasm of the 43 percent of employees expecting to consider an EV for their next vehicle purchase, 40 percent of employees have their own rationale for not considering an EV for their next purchase. The leading causes of this sentiment are that EVs are not available in an employee's desired vehicle type and that they are currently too expensive. Following these are that an employee is unable to charge at home.



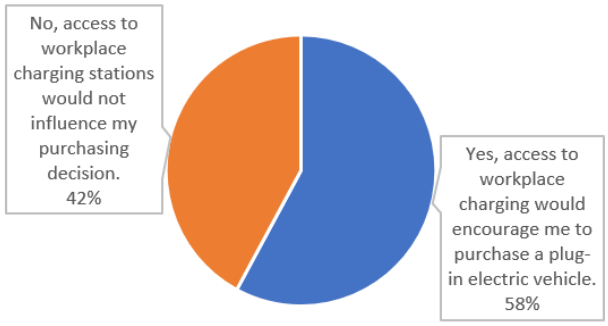
This suggests that the main deterrents against EVs for employees are related to maturity of the market (price and model availability) rather than anything intrinsic about electric technology. Given the various models of plug-in SUVs that have become available since 2018, as well as the plug-in Pacifica Hybrid Minivan, there may be more vehicle type options currently available than employees are aware of. Additionally, assuming Ford, Rivian, and the other manufacturers that have promised electric pickup trucks in 2020 make good on their production schedules, there should be a host of new vehicle types available to satisfy the needs of City of Ventura employees.

Even with the generous incentives available within California, the purchase price of some new EV models is still greater than their conventional counterparts. The City of Ventura should encourage employees to look at total cost of ownership instead of just purchase price, as the fuel and maintenance cost savings of EVs often offset upfront costs, especially with the commuting duty cycles driven by some employees. A useful tool that allows comparison between specific vehicle costs for user-inputted duty cycles is available from the Department of Energy at https://afdc.energy.gov/calc/.

Additionally, the City should educate employees about the growing market for used EVs, as well as non-ownership options to procure an EV. For example, while EV leases can vary throughout the year, the least expensive EV leases are available for no money down, $200 per month, after incentives (many EV drivers utilize as a down payment the $3,500 combined incentive from California and SCE).[20] This low cost combined with gas savings can make an EV the most affordable vehicle an employee could drive. In addition, the City should target low-moderate income employees ($75,300[21] to $100,400[22] for a family of four, depending on the state incentive program that is being accessed), who qualify for an increased California Clean Vehicle Rebate, allowing them to lease an EV starting at $100 per month.

[20] Charge!!! http://ev-vin.blogspot.com/2016/07/current-lease-offers-for-selected-evs.html
[21] California Clean Vehicle Rebate Project https://cleanvehiclerebate.org/eng/income-eligibility#LMI
[22] California Clean Vehicle Assistance Program https://cleanvehiclegrants.org/eligibility/

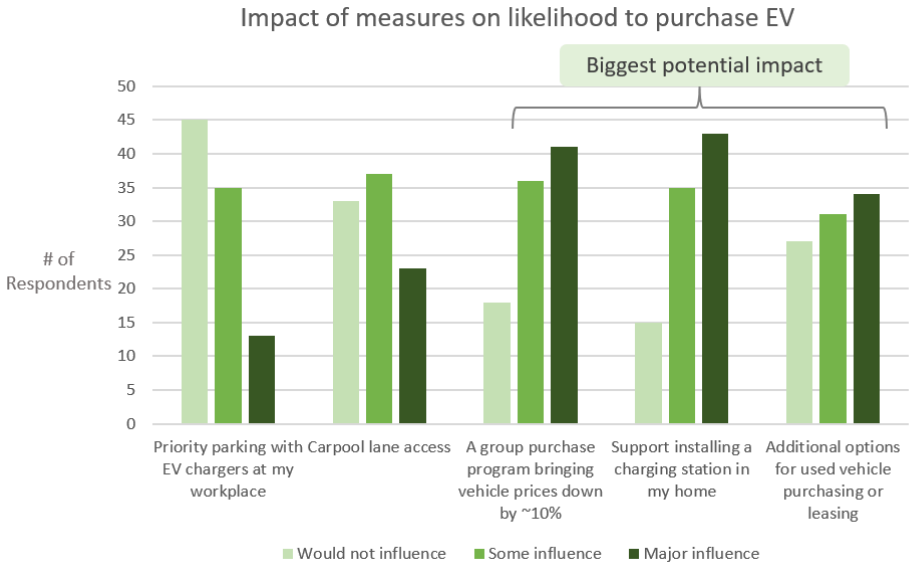
There are two approaches to supporting employees who cite the inability to charge at home as a barrier to EV ownership. For those who live in multi-unit dwellings (MUDs) or those who utilize street parking, the opportunity to charge at work can be a crucial factor for enabling EV ownership. By building ample EV charging infrastructure at all City of Ventura employee parking areas and effectively managing charging behavior, a lack of at-home charging access can be overcome. It is worth noting that 58 percent of survey respondents said that additional access to workplace charging would increase their likelihood of purchasing an EV.



Other employees may need additional support purchasing and installing chargers in their home. These employees can be directed to either SCE's EV charging incentives (varying from $500-1500 depending on rate) at https://evrebates.sce.com/homeinstallation, or Electric Drive 805's charging support at https://www.electricdrive805.org/rebates-incentives-for-charging-stations/.

Employee Programs to Overcome Barriers to EV Adoption

In the final section of the survey, employees selected which potential measures would influence their likelihood of purchasing an EV. Most respondents said that carpool lane access and priority workplace parking would either not influence or have some influence on their likelihood of purchasing an EV, indicating that traffic and parking congestion are not major challenges for employees.



Many more respondents selected 'major influence' or 'some influence' for the final three measures, which reflects some trends seen throughout the survey. Both a group purchase program and additional options to purchase or lease used vehicles would lower the initial acquisition cost of an EV – a challenge cited by many respondents. It is unsurprising that this was ranked highly in terms of utility.

Finally, many respondents said that installing home charging would also have either 'some' or a 'major' influence on their likelihood of purchasing an EV. This reflects the previous ranking of 'inability to charge at home' as a major barrier to EV adoption for many employees. As discussed above, depending on the nature of the challenge, this can be addressed in multiple ways. If an employee simply needs technical or financial support to install charging infrastructure in their home, he or she can be directed to the charging resources on Electric Drive 805's site. Easy access to workplace charging can substitute for home charging, in the case of residents of MUDs or those that utilize street parking.[23] The City of Ventura should also consider developing shared fleet/employee chargers. Each charger could have a dedicated fleet EV space in front of it, with employee EV spaces on each side. The fleet car could charge at night, and the employee cars during the day, which would allow one charger to serve three to five EVs. High utilization of each charger greatly reduces the capital and monthly costs of chargers.

Finally, the City should pursue long-term policies and code changes to enable EV-friendly MUDs, which will be needed as transportation in California becomes more and more electrified. For a full discussion of policies to promote EV-charging in MUDs, please see the Ventura County EV Blueprint document, a co-deliverable of this project. The City should consider these long-term policies and code changes in the future General Plan update.

Conclusion

California has ambitious plans for vehicle electrification, with a goal of 5 million vehicles on the road by 2030. If the City of Ventura is to represent its share of EVs, the number of EVs in the city will need to grow by at least 27 percent each year. Fortunately, as upfront prices decrease, fueling savings grow, and vehicles become available with longer ranges and in more vehicle types, EV uptake is naturally accelerating. Extensive opportunities for electrification exist, within the community, the City of Ventura fleet itself, and among employees of the city. With proper policies, infrastructure investment, and employee programs, the City of Ventura can ensure that it is on the forefront of this electric wave.

[23] Veloz has resources for workplace charging at http://www.veloz.org/documents/

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