City of SACRAMENTO
Department of Public Works

REQUEST FOR INFORMATION (RFI)

Zero Emission Vehicle Program Implementation

(bid #: I2015113012)

Responses due:
November 22, 2019 at 4:00 pm PDT

Submit electronically, in PDF format, via the City of Sacramento's online bid center at:

https://www.planetbids.com/portal/portal.cfm?CompanyID=15300

City Representative for RFI:
Jenna Hahn, Sustainability Analyst, Department of Public Works

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1. Introduction

The purpose of this Request for Information ("RFI") is to seek information from parties interested in partnering with the City of Sacramento ("City") to develop and implement programs to accelerate zero emission vehicle (ZEV) adoption and foster electric vehicle (EV) infrastructure and awareness.

For over 20 years, Sacramento has been a leader in innovative ZEV policies, programs, and deployment. In 1994, the City Council adopted a policy that first established the City's EV Parking Program, providing discounted parking to EV drivers in City-owned parking garages. Since then, the City has been working actively to provide public EV charging at City facilities, aggressively incorporate low-emission vehicles and zero-emission vehicles into fleet operations, and supporting ZEVs in the community. The City of Sacramento has a goal of supporting 75,000 zero emission vehicles in the community by 2025, as established in the 2017 EV Strategy.

Sacramento continues to be uniquely poised to implement and test various programs to increase deployment of zero emission vehicles, including EVs. The City is rapidly emerging as a test bed for ZEV deployments, with a history of strong partnerships for innovative EV initiatives. The region, community, and private sector continue to collaborate and test strategies to support the growing ZEV market and make ZEV adoption more feasible for diverse community members. Success in these areas promises to deliver environmental and economic benefits, with improvements to quality of life.

Not only can ZEVs be cheaper to operate and maintain, but they are cleaner and deliver a host of community benefits such as improving air quality and reducing greenhouse gas emissions. These are benefits that can be enjoyed locally, but also contribute to the overall health of the region. Increasing EVs and other types of ZEVs is a critical strategy for achieving long-term climate action and mobility goals and provides a key opportunity to participate in and strengthen an emerging ZEV industry.

The City received funding from the California Energy Commission's (CEC) Phase 1 EV Ready Communities Challenge in June 2018. The City was one of nine Phase 1 awardees, and one of only three awardees in the Central Valley. Using this grant funding, the City retained consultants to develop updated data and actionable EV blueprint planning tools to further implement the City's EV Strategy and align with Statewide EV goals. The City submitted final EV blueprint grant deliverables in August 2019. Participation in Phase 1 allows the City to compete with other Phase 1 communities for Phase 2 implementation funds; the solicitation release is anticipated in late 2019 or early 2020. Details regarding application requirements, focus, or funding amounts have not yet been released by the CEC. Deliverables from the EV blueprint provided a multitude of recommendations and options that the City could potentially pursue with Phase 2 implementation funds intended to advance EV access and adoption.

The information received from this RFI will equip the City to confirm and evaluate near-term, fundable project opportunities with a focus on underserved, low-income and disadvantaged communities (see Figure 3 in **Attachment 3** for a map of priority areas to site public EV chargers or programs, for example). By identifying a short-list of detailed, fundable projects and potential implementation partners, the City will also prepare to compete for grant solicitations anticipated in the next year. In addition to the CEC Phase 2 EV Ready Communities Challenge implementation funds, other anticipated funding opportunities include the

Sacramento Area Council of Governments (SACOG) Green Region Program, California Air Resource Board (CARB) Clean Mobility Voucher Pilot Program, and others as available and appropriate. These funding solicitations can leverage other investments in the community, such as the Sacramento Metropolitan Air Quality Management District's Community Air Protection Program to implement Assembly Bill 617 and other incentive programs to accelerate the deployment of zero-emission technologies; Green-City "Sac-to-Zero" programs including infrastructure, car share, and ZEV shuttle/bus programs; and investments by the Sacramento Municipal Utility District for vehicle and equipment incentives. The information will assist the City in the following: developing a pipeline of priority projects, informing and empowering regional partners to improve collaboration and EV strategies, and determining if additional considerations are necessary prior to program design and roll out.

The City intends for this RFI to demonstrate funding readiness, including potential implementation partners, and thereby increase the City's competitiveness for upcoming solicitations. The City is also interested in understanding any additional the barriers that potential ZEV implementers experience trying to implement more ZEV-related work in Sacramento. Respondents to this RFI have the opportunity for early engagement, relationship building, and co-learning with the City.

Following review of responses to this RFI, the City may elect, at its discretion, to issue a Request for Proposals ("RFP") at a later date to solicit specific proposals for program implementation. The future award of any funding is dependent on the City successfully securing competitive grant funds. This RFI is a key step in developing competitive project proposals for those funding solicitations.

Written questions should be submitted via the Planet Bids website where the RFI has been posted under the "Q&A" tab. Questions will be answered as they are received. Answers to all questions will be posted on the Planet Bids website. The deadline to submit questions is November 4, 2019 at 4:00 pm PDT. Questions submitted after that time will not be addressed.

Parties responding to this RFI must submit: One (1) electronic PDF copy of the response (uploaded to Planet Bids). Any other method of submission besides posting to Planet Bids will be rejected. No late responses will be accepted. The City is not responsible for any technology issues that delay or prevent timely electronic positing of submissions to Planet Bids.

Any submittal received prior to the date and time specified above may be withdrawn or modified by written request of the responder. To be considered, however, the modified submittal must be received by the time and date specified below.

All responses must be posted to Planet Bids by 4:00 PM PDT on Friday November 22, 2019:

https://www.planetbids.com/portal/portal.cfm?CompanyID=15300

2. RFI Schedule

The following represents the schedule for this RFI. Any change in the schedule provided below will be communicated by posting an addendum to the RFI on Planet Bids.

Activity	Date
Release Date	October 28, 2019
Deadline to Submit Written Questions to Planet Bids	November 4, 2019 at 4 pm PDT
Final Issuance of Responses to Questions	November 8, 2019 by 4 pm PDT
Response Deadline	November 22, 2019 at 4 pm PDT

3. Background

Sacramento seeks to build on the early progress achieved from the regional collaboration and planning efforts, including projects, policies, and programs identified in the City's EV Strategy. The EV Strategy established a vision of Sacramento serving as a "Green City," the EV Capital of California, with a robust zero-emission mobility system that provides significant improvements in local air quality, mobility, and access.

With an expansion of ZEVs, Sacramento is working to increase mobility and access for disadvantaged and low-income communities. The City seeks to foster ZEV technologies and programs while increasing the efficiency of each vehicle trip on the road. City efforts are focused on equitable access to mobility options and ZEV benefits that don't rely on personal car ownership, working to consolidate trips with more passengers in fewer vehicles and reduce overall vehicle miles traveled. The City continues to focus on options to deploy a network of ZEVs in shared mobility programs and ensure that ZEVs are working to fill the first-mile/last-mile gap to transit and improve the connectivity of areas underserved by transportation options.

The deployment of ZEVs in the city can also support a growing industry for advanced transportation technologies. Well-designed ZEV programs can spur local business and encourage new economic enterprises, delivering jobs to Sacramento's workforce. Realizing an electrified community will be based on connecting low-income and disadvantaged communities to the new ZEV mobility service economy. Additionally, the City seeks to leverage ZEVs as part of a broader transportation electrification push within the region, using ZEVs to maximize the benefits of energy storage, increase renewable power, and spur advanced vehicle-to-grid applications that optimize the grid. Implementation of this vision will require sustained partnership and increased levels of collaboration with public and private stakeholders, including new levels of engagement with community leaders on ZEV mobility issues.

As of January 2019, the EV Blueprint estimated a baseline of 4,644 ZEVs in the City of Sacramento. However, the City expects this number to be well over 6,000 by release of this RFI, based on updated DMV registrations since the close of the EV Blueprint project and from the deployment of Electrify America's car share programs, Gig and Envoy, which have added more than 300 additional EVs to the City this year alone. ZEV adoption in Sacramento is lower than other areas of the state: Sacramento is the fifth largest metropolitan area by population in CA yet is not in the top 30 cities for EV deployment. Sacramento residents tend to replace vehicles at approximately half the rate of the state on average, likely contributing to a slower rate of EV adoption.

While the number of ZEVs on the road in Sacramento currently represent just under 1% of all vehicles, there are some positive market trends, including:

- 3.3% of new vehicle sales are EVs
- Sacramento is 5th in the number of public chargers per capita
- Sacramento is in the top 3 of California cities for EV promotion actions
- There are already dozens of EV models available on the marketplace and dozens of additional EV models have been announced that are anticipated through 2020.
- Numerous innovative ZEV programs have recently launched in Sacramento with a focus on expanding access to clean mobility options for low income communities to participate in ZEV programs and/or ownership.
  (ICCT 2018)[1]

Over 600 public charging connectors are available within Sacramento, and the community is one of the densest areas for Direct Current Fast Chargers (DCFC) in the nation. However, the vast majority of public level 2 chargers and DCFC are concentrated in the downtown core. This is largely a legacy of investments that serve areas with high amounts of commuters and regional visitors. While the Energy Commission estimates that 88 percent of current EV drivers get most of their charging needs met at home, this may change as the EV market grows. The City seeks to continue supporting a more diverse array of EV drivers, including in neighborhoods where charging options are limited and for residents without a garage or dedicated off-street parking. Locating public charging infrastructure outside of the downtown core emerged as a recurring theme from EV Blueprint community engagement activities, as well as from networks and organizations the City participates in beyond the EV Blueprint efforts.

The City of Sacramento has supported or directly implemented numerous EV initiatives to date, including, but not limited to, the following:

- EV Parking Program
- EVSE at City facilities
- ZEV acquisition and EV procurement commitments in the City's fleet
- Curbside charging pilots
- EV charger permitting streamlining
- Electrify America's Green City "Sac-to-Zero" initiative (and associated projects for EV car shares, charging infrastructure and EV buses/shuttles)
- Our Community CarShare
- Regional coordination with the Sacramento PEV Collaborative

More background information can be found in **Attachments 1- 5** of this RFI, which represent select tasks from the 2019 EV Blueprint deliverables. Please note that information provided in the attachments does not represent finalized approaches, but rather recommendations and thinking at time of task submission. EV work is dynamic and evolving. Not all ideas represented in the attachments represent a preferred approach by the City.

[1] International Council on Clean Transportation. Briefing: California's continued electric vehicle market development. May 2018. https://theicct.org/sites/default/files/publications/CA-cityEV-Briefing-20180507.pdf

4. Potential Projects of Interest

The City is requesting information from parties interested in implementing EV projects or programs focused on EV infrastructure, increasing EV deployment, and/or removing barriers to EV uptake; specifically, the City requests feedback from organizations that would enter into agreement(s) with the City to deliver services or infrastructure. Through these responses, the City is seeking information to develop fundable projects and budgets. The City is interested in receiving ideas for any of the topics – or combination of topics – listed below.

- **Service to Low-Income and Disadvantaged Communities** – there continues to be a high need for clean, affordable mobility options in disadvantaged communities, with high opportunity for ZEVs and EVSE. Low income and disadvantaged communities often lack access to clean mobility options, are disproportionally affected by environmental burdens, and have a history of underinvestment.
- **Electric vehicle supply equipment (EVSE) at City facilities** – the EV Blueprint project identified recommended locations to add EVSE at City-owned properties (see **Attachment 1, 2,** and **3**). The City wants to increase public charging access at land it has direct control over and that can better serve the community. This work should focus on community centers and libraries (improvements to EVSE at parking garages are currently underway through CALeVIP).
- **E-Mobility Hubs** – these centers can serve as areas of connectivity where multiple modes of travel converge and are of interest to many private and public organizations. These locations can provide an integrated suite of mobility modes and technology—safe walking and biking, transit connections, and cars; amenities like lockers, Wi-Fi, smartboards, wayfinding, and enjoyable waiting areas; and technologies like dynamic parking management strategies, real-time traveler information, and real-time ridesharing. **Attachments 1, 2,** and **5** provide more information, including conceptual drawings and anticipated costs.
- **Job training** – The growing ZEV industry, markets, and programs present opportunities to create new green jobs, accelerate workforce training opportunities, and build a pool of local skilled labor. For example, there will be a crucial need for more electricians and EV service technicians (see **Attachments 1** and **4**). New programs could focus on providing training opportunities for local youth and establishing a pipeline of certified workers to deploy and operate local ZEV investments, helping to create clear paths to employment within the community. The City and partners seek to understand how to leverage ZEV investments to create jobs for people within local communities.
- **Education and Outreach –** Public education and outreach campaigns can help break down the many myths and misperceptions that persist about the benefits, cost, incentives, and capabilities of EVs. Outreach must be done in culturally appropriate manners in collaboration with trusted community stakeholders. Outreach efforts must also be respectful of community member time and focus on connecting ZEV activities to direct quality of life concerns. Education and engagement are critical to ensure that programs grow out of community-based design methods and are responsive to local needs and priorities, connecting communities to the benefits of improved mobility and ZEV technologies while demonstrating that ZEVs are for everyone.
- **Scalable ZEV programs –** Sacramento has numerous examples of innovative ZEV deployments, including both infrastructure and ZEV programs. The City seeks ideas for replicable programs to bring early successes to scale that fill transportation gaps through micromobility or other programs.

Yet these programs need clear paths for sustainable funding. For example, a nexus exists between mobility and health. Poor mobility creates a barrier for many individuals to access healthcare and healthy eating options. Studies suggest that by investing in mobility, the healthcare sector could more directly and cost-effectively improve patient health, avoiding higher costs to treat issues once they become chronic, which have been exacerbated over time by poor mobility.

- **Affordable Housing –** the City seeks creative ideas to explore how public investments in affordable housing can ensure local workforce employment, require building electrification, and deploy critical EV charging infrastructure. Ideas can help create a prototype for future programs.
- **Other** – The City is also interested in learning more about high-impact ideas that are not listed above.

5. Program or Project Considerations

The City is looking for program or project idea(s) that integrate community engagement in a meaningful way and prioritize implementation in low income and/or disadvantaged communities, with consideration for proximity to multifamily housing, community gathering places/assets, and/or City facilities in particular. The City is also seeking program or project idea(s) that focus on implementation outside of the Downtown core; for example, areas highlighted in Figure 3 of **Attachment 3** demonstrate priority areas for siting EV charging infrastructure to attain a more equitable distribution. These areas also reflect some of the City's communities where opportunities abound to improve mobility options. These considerations are the cornerstone to how the City will select potential programs, projects, and partners. Other considerations the City is interested in include:

- How well would the program or project idea(s) address the goals established in the City's EV Strategy?
- How well would the program or project idea(s) help reduce per capita vehicle miles traveled?
- How well would the program or project idea(s) increase adoption and use of EVs and/or EV infrastructure?
- To what extent would the program or project idea(s) increase community outreach, education, and/or participation?
- To what extent would the program or project idea(s) be implemented in low income and/or disadvantaged communities?
- To what extent does the program or project idea(s) break down systemic or historic disparities and address social determinants of health?
- How many living wage green jobs could the program or project idea(s) create or support? How many of these would be jobs that could be filled with local youth through workforce training programs?
- To what extent does the respondent have local expertise? Have they worked with any existing local initiatives? Do they have existing relationships or partnerships?
- To what extent is the program or project idea(s) replicable and scalable?

6. Submittal Requirements

All references to the maximum number of pages are to a single-sided page, not including tabs or section dividers. The minimum font size for the body of the text shall be 12 point. Responses should be limited to no more than 30 pages. Including attachments. Responses must be uploaded to Planet Bids as one PDF file and must include the following information:

- Cover letter.
- Qualifications, including relevant project experience and examples.
- Proposed idea(s) and description for high-impact EV program and/or project implementation.
- Rationale for proposed program and/or project idea(s).
- Theory of change for proposed program and/or project idea(s).
- Options to scale up or down based on available funding.
- Estimated budget for program and/or project implementation. Budget should include, as relevant: available funding/sources, costs for labor, equipment/supplies, operations, outreach and education, personnel, consultants or consulting time, etc.
- Timeline to deliver project concept for program and/or project activation.
- Proposed business or operational structure.
- Proposed site improvements, if relevant.
- Proposed engagement or opportunities for the local community in program and/or project.
- Expectations and role of the City.
- Preliminary metrics to measure community impact and success of proposed program and/or project idea(s).
- A disclosure identifying any actual, apparent, or potential conflict of interest that may result from partnering with the City on potential idea(s).
- Whether the proposing entity is a Local Business Enterprise, which is a business entity that has a legitimate business presence in the City of Sacramento or unincorporated County of Sacramento.

7. Questions

Written questions should be submitted via the Planet Bids website where the RFI has been posted under the "Q&A" tab. Questions will be answered as they are received. Answers to all questions will be posted on the Planet Bids website. The deadline to submit questions is November 4, 2019 at 4 pm PDT. Questions submitted after that time will not be addressed.

It is recommended that you do not contact City departments, City staff, or other parties directly. Information provided by any source other than Planet Bids may be invalid and responses which are submitted in accordance with such information may be declared non-responsive.

In the event that additional information becomes available, or it becomes necessary to revise any part of this RFI, written addenda will be issued and posted on the Planet Bids website: https://www.planetbids.com/portal/portal.cfm?CompanyID=15300.

Any amendment to this RFI is valid only if in writing and issued by the City through Planet Bids website. It is the respondent's sole responsibility to monitor this website for possible addenda to this RFI. Failure of the respondent to retrieve addenda from the Planet Bids site shall not relieve the respondent of the requirements contained therein.

After the City has reviewed the information received through this RFI, the City will evaluate information received and determine whether to issue an RFP or refrain from further action.

8. General Terms

The City reserves the right to terminate or modify this RFI process at any time and to reject any and all RFI responses. The City reserves the right, at its sole discretion, to discuss with one or more parties who respond to this RFI, or may choose at its sole discretion, not to discuss with any respondents. This RFI process does not constitute any type of offer and creates no contractual obligation or other liability to the City. City will not pay any costs incurred by respondents in preparing a response to this RFI. Non-participation in the RFI process does not preclude interested parties from responding to a future RFP for the Site, if any.

Responses to this RFI become the exclusive property of the City and may be disclosed upon receipt of a request for public disclosure pursuant to the California Public Records Act.

Responding parties shall disclose any financial, business or other relationship with the City that may have an impact upon the outcome of this RFI. Responding parties shall also list current clients who may have a financial interest with the City that would be affected by the outcome of this RFI.

Any selected tenant will be required to comply with City insurance requirements as determined by the City's Risk Manager.

Attachment 1: Sacramento Electric Vehicle Blueprint – Phase 1 EV Ready Communities Challenge, Final Project Report

CALIFORNIA
ENERGY COMMISSION

California Energy Commission
Clean Transportation Program

FINAL PROJECT REPORT

Sacramento Electric Vehicle Blueprint

Phase 1 EV Ready Communities Challenge

Prepared for: California Energy Commission

Prepared by: City of Sacramento

Gavin Newsom, Governor
Month 2019 | CEC-600-2019-XXX

California Energy Commission

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ACKNOWLEDGEMENTS

Several organizations, departments and people played key roles in the development of this project. The City of Sacramento would like to acknowledge them here. First, we would like to thank the lead consultant, Frontier Energy, for their hard work and dedication to this project. Second the City wants to recognize the invaluable input from the sub-consultants, DKS and Lucy and Company. Lastly, the Department of Public Works, who oversaw this project, would like to express gratitude for the collaboration between and among the Sacramento PEV Collaborative as well as City departments, including Community Development and Economic Development. This project would not have been possible without the efforts of all the involved organizations and departments.

PREFACE

Assembly Bill (AB) 118 (Nùñez, Chapter 750, Statutes of 2007), created the Clean Transportation Program (also known as the Alternative and Renewable Fuel and Vehicle Technology Program). The statute authorizes the California Energy Commission (Energy Commission) to develop and deploy alternative and renewable fuels and advanced transportation technologies to help attain the state's climate change policies. AB 8 (Perea, Chapter 401, Statutes of 2013) re-authorizes the Clean Transportation Program through January 1, 2024, and specifies that the Energy Commission allocate up to $20 million per year (or up to 20 percent of each fiscal year's funds) in funding for hydrogen station development until at least 100 stations are operational.

The Clean Transportation Program has an annual budget of approximately $100 million and provides financial support for projects that:

- Reduce California's use and dependence on petroleum transportation fuels and increase the use of alternative and renewable fuels and advanced vehicle technologies.
- Produce sustainable alternative and renewable low-carbon fuels in California.
- Expand alternative fueling infrastructure and fueling stations.
- Improve the efficiency, performance, and market viability of alternative light-, medium-, and heavy-duty vehicle technologies.
- Retrofit medium- and heavy-duty on-road and non-road vehicle fleets to alternative technologies or fuel use.
- Expand the alternative fueling infrastructure available to existing fleets, public transit, and transportation corridors.
- Establish workforce training programs and conduct public outreach on the benefits of alternative transportation fuels and vehicle technologies.

To be eligible for funding under the Clean Transportation Program, a project must be consistent with the Energy Commission's Clean Transportation Program Investment Plan, updated annually. The Energy Commission issued grant funding opportunity GFO-17-604 under the Clean Transportation Program to fund projects for Phase I of an expected two-phase effort for electric vehicle-ready communities. Phase I planning blueprints will identify the actions and milestones needed to proceed towards implementation of an electric vehicle-ready community. In response to GFO-17-604, the City of Sacramento submitted application #9, which was proposed for funding in the Energy Commission's Notice of Proposed Awards dated April 6, 2018, and the agreement was executed as ARV-14-042 on July 24, 2018.

ABSTRACT

The City of Sacramento was a proud award recipient of the California Energy Commission's (CEC) Phase 1 EV Ready Communities Challenge. The goals of this project were to develop actionable blueprint planning tools that further implement the City's Electric Vehicle (EV) Strategy and align with Statewide EV goals. This effort:

- Built on early, collaborative EV planning efforts led by the City with regional partners.
- Reviewed EV deployment data tracked progress to develop accurate, updated EV baseline metrics
- Evaluated how best to accelerate EV infrastructure in new construction
- Conducted technical work to develop recommended siting and prototypes for community wide EV charging infrastructure.
- Conducted extensive community engagement with business and industry, community members and key community-based organizations and partners, with a focus on disadvantaged and underserved communities
- Developed work products to equip the City for implementation of EV-related mobility initiatives and maximization of economic benefits, including evaluation of early pilots in Sacramento, and analysis of EV infrastructure service models and best practices for local hire and workforce development
- Analyzed lessons from early pilots and recommended next steps to accelerate innovative EV programs, such as car share, or visible community projects such as e-mobility hubs
- Prepared the City to compete for future funding solicitations and implement the City's adopted EV goals

Sacramento is uniquely poised to implement and test various programs to increase deployment of electric vehicles. The City is rapidly emerging as a test bed for EV deployments. As a mid-sized community with a diversity of land uses, its lessons are applicable to many other Californian cities. The region, community, and private sector in Sacramento are supportive and successfully collaborating to advance EV deployment in Sacramento, with the goal of testing strategies that can be duplicated statewide and across the nation. Success in these areas promises to deliver environmental and economic benefits.

Keywords: California Energy Commission, City of Sacramento, electric vehicle (EV), EV charging, electric vehicle supply equipment (EVSE), mobility, zero-emission vehicle (ZEV), plug-in hybrid electric vehicle (PHEV), plug-in electric vehicle (PEV), community EV planning, EV codes

Please use the following citation for this report:

Hahn, Jenna, Jennifer Venema. 2019. *Sacramento Electric Vehicle Blueprint: Phase 1 EV Ready Communities Challenge*. City of Sacramento. Publication Number: CEC-600-2019-XXX.

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EXECUTIVE SUMMARY

The City of Sacramento was a recipient of the California Energy Commission's (CEC) Phase 1 EV Ready Communities Challenge.[1] The goals of this project were to develop actionable blueprint planning tools that further implement the City's *Electric Vehicle (EV) Strategy* and align with Statewide EV goals.[2]

This report presents highlights and key lessons learned from the seven tasks and associated sub-tasks. A key objective of the project team is to ensure that outcomes of the challenge are useful to community partners and other jurisdictions as they continue their EV deployments and investments; due to the extensive nature of the reports, staff is still examining the most effective way to share key outcomes. It is anticipated that selections from tasks will be made available on the City website and by request.

Each task was designed to strengthen the City of Sacramento's understanding of the unique EV context, opportunities and barriers within the City and equip the City to realize policy goals; some tasks built on previous tasks and others were standalone documents or resources that can be used moving forward. As a result of the effort, the City is better equipped to prioritize, implement, and test community and industry supported EV programs, projects, and polices.

The team analyzed existing data and projections and used over twenty data sources to develop a local EV model and infrastructure siting prioritization tool. Extensive stakeholder engagement helped inform recommendations and evaluate constraints and opportunities to accelerate EV adoption and EV supply equipment (EVSE) deployment in new and existing construction. As a result, the team identified priority locations for the City to invest in throughout the City. Some of the strongest recommendations from this report include amending building and city codes to increase the amount of EVSE, installing EVSE at select City facilities, developing EV economic programs to meet the future job demand, and investing in an e-mobility hub pilot.

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1 https://www.energy.ca.gov/contracts/GFO-17-604/

2 http://www.cityofsacramento.org/-/media/Corporate/Files/Public-Works/Electric-Vehicles/EVStrategy_171212_FINAL_CityOfSacramento.pdf?la=en

CHAPTER 1: Administration

Summary

The City of Sacramento (City) worked with the California Energy Commission (CEC) to manage, administer, and complete the proposed project, meeting the minimum expectations established in the scope of work. The City used CEC grant funds to issue a request for proposals (RFP) for a consultant to supplement a major barrier of limited staff resources. Through the RFP, the City selected Frontier Energy as the successful lead consultant (with DKS Associates and Lucy and Company as sub-consultants). The team was selected due to their combined expertise and ability to complete technical tasks, prepare planning and report documents, and facilitate community engagement. The City leveraged City staff time as in-kind match to complete groundwork and analysis that supported the consultant-lead project.

Further, the City sought review and advice of local partners to provide guidance and feedback on the project in a highly participatory manner.

In addition to the in-kind match, City staff oversaw compliance with grant terms and conditions, provided effective project management and delivery, and disseminated work products and lessons learned.

CHAPTER 2:
Task 2 Electric Vehicle Deployment Plan

Summary

Task 2 equipped the project team to conduct the remaining tasks, providing the technical baseline data from which the project team could analyze and address opportunities in new construction, existing construction, and through community programs as described in the following tasks. The project team engaged community partners and representatives of disadvantaged communities to vet the maps and help prioritize areas for infrastructure development, accounting for community priorities that other electric vehicle (EV) models may not account for.

Task 2.1: Electric Vehicle Data and Forecasts

The purpose of **Task 2.1** was to collect, analyze and summarize EV adoption, EV infrastructure, modeling tools, and EV forecasts in light of the City's goals from the EV Strategy, including a goal to achieve 75,000 zero-emission vehicle (ZEVs) in Sacramento by 2025. Accurate and comprehensive EV data can be difficult to collect and confirm. This task provided important context for the remaining Blueprint deliverables. The project team examined technical data related to electric vehicles, including the current population of zero emission vehicles in Sacramento, current charging infrastructure, vehicle ownership and new car sales, and projected timelines for the growth of the EV market. In addition, the task included an assessment of a range of demographic and land use factors, such as Sacramento's population and housing, characteristics of disadvantaged communities, opportunities to increase EV adoption and potential limiting factors, future land uses, car sharing, and more.

Table 1 shows the calculations used to arrive at the baseline estimate of 4,664 total ZEVs and 2,390 battery electric vehicles in Sacramento zip codes as of January 1, 2019.

Table 1: Estimated Baseline of All ZEVs as of January 1, 2019

	EV	FCEV	PHEV	Total
DMV 1/1/18 registrations	1,887	79	1,751	3,717
CVRP rebates 1/1/18-9/30/18	290	26	219	535
Additional 30% ZEVs that did not apply for rebate	87	8	66	161
Estimated ZEV registrations 10/1/18- 12/31/18	126	11	95	232
Total estimated vehicles in Sacramento on January 1, 2019	2,390	2,131	124	4,644

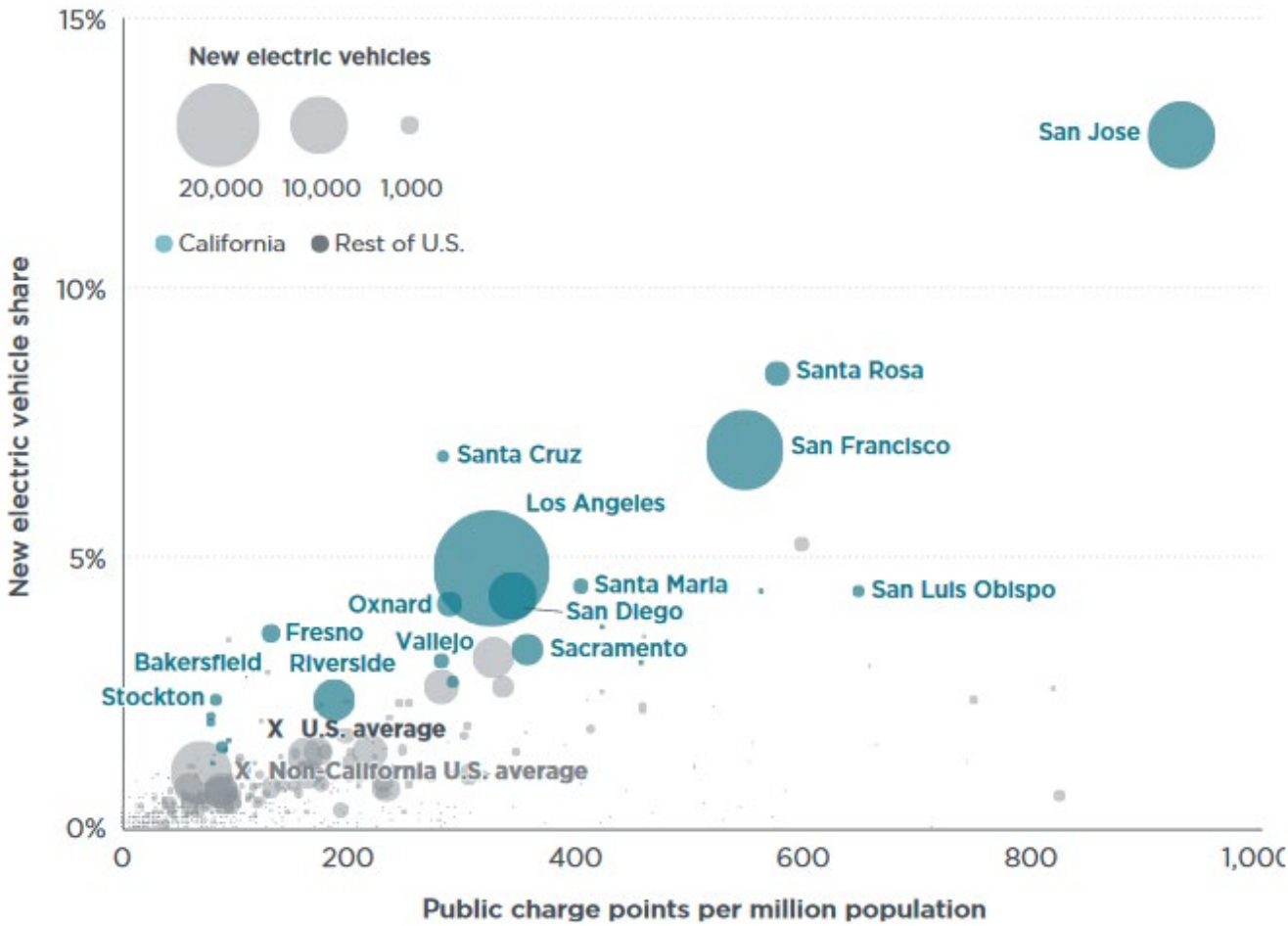
Source: City of Sacramento

ZEV adoption in Sacramento is lower than other areas of the state. The International Council on Clean Transportation (ICCT) publishes an annual report that quantifies EV market growth across California local markets.[3] The report calls out that Sacramento is the fifth largest metropolitan area by population and

3 https://www.theicct.org/sites/default/files/publications/CA-cityEV-Briefing-20180507.pdf

has a high percentage of public chargers per capita (**Figure 1**), yet is not in the top 30 cities for EV deployment.

Figure 1: Correlation of ZEV Adoption and Public Charging in Major Metro Areas



Source: Lutsey, Nic. 2018. *California's Continued Electric Vehicle Market Development*. ICCT, May 2018. https://theicct.org/sites/default/files/publications/CA-cityEV-Briefing-20180507.pdf.

Based on anticipated vehicle sale trends and the availability of ZEV options, **Task 2.1** identified the immense challenge in phasing out a fossil-fuel based fleet to achieve the City's targeted ZEV adoption levels. Even if over 40% of the new vehicles registered in Sacramento by 2023 were ZEVs, and 77% by 2025 were ZEVs, by 2025 just under 30% of Sacramento's vehicle stock would be ZEVs. These scenarios assume that Sacramento would capture 1.3% of new vehicle light-duty registrations every year, and are illustrated in **Table 2**.

Table 2: Illustration of Percentage of New Vehicle Sales Needed to Reach ZEV Target

Date	Registered ZEVs (Cumulative)	Total Vehicles	Assumed new registrations (ZEV and non-ZEV)	Assumed percentage of registration that are ZEVs	New ZEV registrations as a % of all new vehicles
1/1/2018	3,717*	591,134[1]	26,000***	0.63%	3%
1/1/2019	4,644**	617,134	26,000	0.75%	4%
1/1/2020	8,000	643,134	26,000	1.24%	15%
1/1/2021	12,000	669,134	26,000	1.79%	23%
1/1/2022	18,000	695,134	26,000	2.59%	35%
1/1/2023	27,000	721,134	26,000	3.74%	42%
1/1/2024	38,000	747,134	26,000	5.09%	65%
1/1/2025	55,000	773,134	26,000	7.11%	77%
1/1/2026	75,000	799,134		9.39%	
Total registered ZEVs – 2026 (estimated)			**208,000**		

Source: City of Sacramento. *From DMV data on 1/1/18. **Based on estimates developed in Task 2.1. *** Only assumes light-duty vehicles. Does not include new trucks, buses, or medium-duty vehicles that are included with DMV data.

According data from the Alternative Fuels Data Center and PlugShare,[4] Sacramento has 110 public and workplace charging locations that are open and under construction (as of April 2019). When all are completed, the sites will have 612 connectors, as listed in **Table 3**. Most chargers are in parking garages and lots, and at the area's largest employers including the Sacramento Municipal Utility District (SMUD), Kaiser, University of California (UC) Davis, government buildings, and colleges. The highest density of public chargers is within the Downtown core, leaving major gaps throughout the City, especially in disadvantaged communities.

Table 3: Public charging connectors available and under construction in Sacramento

Total Charging Connections	612
Level 1 (wall outlet—full charge in 8+ hours)	72
Level 2 (full charge in 4-6 hours)	454
DC Fast Charging (full charge in less than an hour)	39
Tesla-only (uses a specific connector)	47

Source: Alternative Fuels Data Center, PlugShare

Based on analysis conducted with the Electric Vehicle Infrastructure Projections (EVI-Pro)[5] model, the project team estimated that Sacramento would require more than 730 additional workplace Level 2 charging connectors, over 390 public Level 2 charging connectors, and over 300 DC fast charging connectors in addition to the public charging connectors currently available and under construction. Single family homes are estimated to need more than 53,000 additional at-home charging connectors. Car-sharing and on-demand transit may fill some of the gap by reducing the number of cars per household and compliment the City's other efforts to reduce vehicle miles traveled. These alternative forms of

4 https://www.plugshare.com/

5 http://www.energy.ca.gov/altfuels/2017-ALTI-01/documents/

transit may also alleviate inequities in education, employment, and health in Sacramento's disadvantaged communities.

As transit buses, school buses, and local delivery vans are adopted, they may have a larger impact on greenhouse gas reduction targets than light-duty vehicles. Medium and heavy-duty vehicles often need different infrastructure than passenger cars and light trucks but could present opportunities for co-locating charging equipment that could serve both vehicles.

Task 2.2 & 2.3: Local EV Model & User Guide

Tasks 2.2 and **2.3** developed a local model for EV deployment and an EV modeling user's guide so that data collected and analyzed in **Task 2.2** could be replicated in the future by both City of Sacramento staff as well as other cities, if interested. The guide described the process used to determine the number of EVs and electric vehicle supply equipment (EVSEs) in Sacramento at the beginning of 2019 and helped lay the groundwork for identifying actions the City of Sacramento can take to foster charging infrastructure deployment. Maps and forecasts were developed at the census tract level, which is not a perfect match to the City of Sacramento's boundaries. However, census tracts provided a consistent location for data from multiple sources, including:

- CalEnviroScreen (CES) identification of disadvantaged communities
- Clean Vehicle Rebate Program (CVRP) Data
- Census data
- Department of Motor Vehicles (DMV) data
- California New Car Dealers Association 2017 Vehicle Statistics
- EVI-Pro tool
- City of Sacramento's 2035 General Plan – forecasted population growth
- American Community Survey
- Alternative Fuels Data Center
- PlugShare
- UC Davis
- Sacramento Area Council of Governments (SACOG)

The data was used to develop the initial maps listed below, providing a foundation for ongoing analysis in later tasks. Maps produced for these tasks included:

- Locations of Existing Level 1 (L1) EV Charging Stations (Public and Private Connectors)
- Locations of Existing and Planned Level 2 (L2) EV Charging Stations (Public and Private Connectors)
- Locations of Existing and Planned Level 3 (DCFC) Charging Stations (Public and Private Connectors, Within and Adjacent to City of Sacramento)
- Locations of Publicly Owned Properties (Including City Facilities)
- Disadvantaged Areas Lacking Convenient Charging Access (Greater than 1/4 Mile from Existing/Planned Electric Vehicle Service Equipment)
- Plug-In Electric Vehicle Adoption Density Estimate by 2025 (by Census Tract) Assumes 35% Adoption Rate using UC Davis EV Toolbox
- CVRP Rebates: 2015-2018 (City Census Tracts)

- Existing Multi-Unit Dwellings (MUD) Density by City Census Tract Apartment Complexes of 3 or More Units
- Neighborhoods Likely to be Feasible for Car Sharing (two scenarios) American Community Survey (ACS)
- Potential Home and Workplace EVSE Demand Generators

Task 2.4: Sacramento EV Infrastructure Deployment Plan

The goal of this report was to establish Sacramento's EV Infrastructure Deployment Plan that described considerations about and target locations for deployment of charging infrastructure (EVSE) to support 75,000 EVs in Sacramento. This report pulled from the data in preceding tasks and other tasks that were conducted in parallel, including **Task 4.1**, which evaluated the current status and utilization of public and workplace EVSE.

In order to determine the scope for this task, the project team evaluated infrastructure needs based on findings from **Task 2.1** and other work products. To support 75,000 light-duty EVs, in addition to the existing charging connectors, it is estimated that Sacramento needs to add:

- 738 workplace L2 charging connectors
- 398 public Level 2 charging connectors
- 399 DC fast charging connectors
- 6,600 multifamily charging connectors
- 53,733 Level 1 or Level 2 charging connectors at single-family residences

The need for public and workplace charging, and other electric mobility programs, is greatest in Sacramento's disadvantaged communities that are disproportionately burdened by multiple sources of pollution and socioeconomic vulnerability. The report presented many options to address this gap, including options for requirements for EVSE in new construction, parking regulations, options for charging at public facilities, car sharing and shared mobility charging programs, and engagement and education. Later tasks examine these opportunities in greater detail.

Most notably, as a part of **Task 2.4**, the project team, in conjunction with stakeholders, developed a tool to assign scores/priority for EVSE investment by census tract using data in the EV Blueprint tasks (EVSE Priority Siting Tool). The score indicates the need for electric vehicle charging infrastructure based on twenty weighted variables. Each category (variable) was assigned a method of "Absolute" or formula-based "Ranking" and a relative weighting that could be adjusted over time, depending on specific priorities or challenges. The criteria can be adjusted based on technology, organization type and specific project priorities. For example, for projects looking to site DCFC, prioritizing census tracts with dwell times less than 2 hours could be an appropriate method to identify opportunities; whereas for projects looking to site L2 and L1, prioritizing dwell times greater than or equal to 2 hours could identify more appropriate opportunities. As a result, each census tract received a "need score," with 1 as the tract that had the most need for EVSE and 112 as the tract for the least need, for any given scenario. The tool is designed to use data to inform and guide conversations and EVSE siting decisions. However, it was designed as a starting point rather than be relied upon as the only decision-making criteria. The role of the tool as a supportive analytical resource is also reflected in its limitations: the tool focuses on identifying priority census tracts and does not narrow down to specific parcel recommendations.

Weighting factors were developed with input from City of Sacramento staff and the Sacramento Plug-in

Electric Vehicle (PEV) Collaborative steering committee. To maintain objectivity in rankings, a decision was made to limit values of the weighting factors for any single category as follows:

- +1: Average weighting
- +3: Higher than average weighting (limited to 20% of all factors)
- +5: Highest priority weighting (limited to 10% of all factors)
- <1: Lower than average weighting (limited to 20% of all factors)

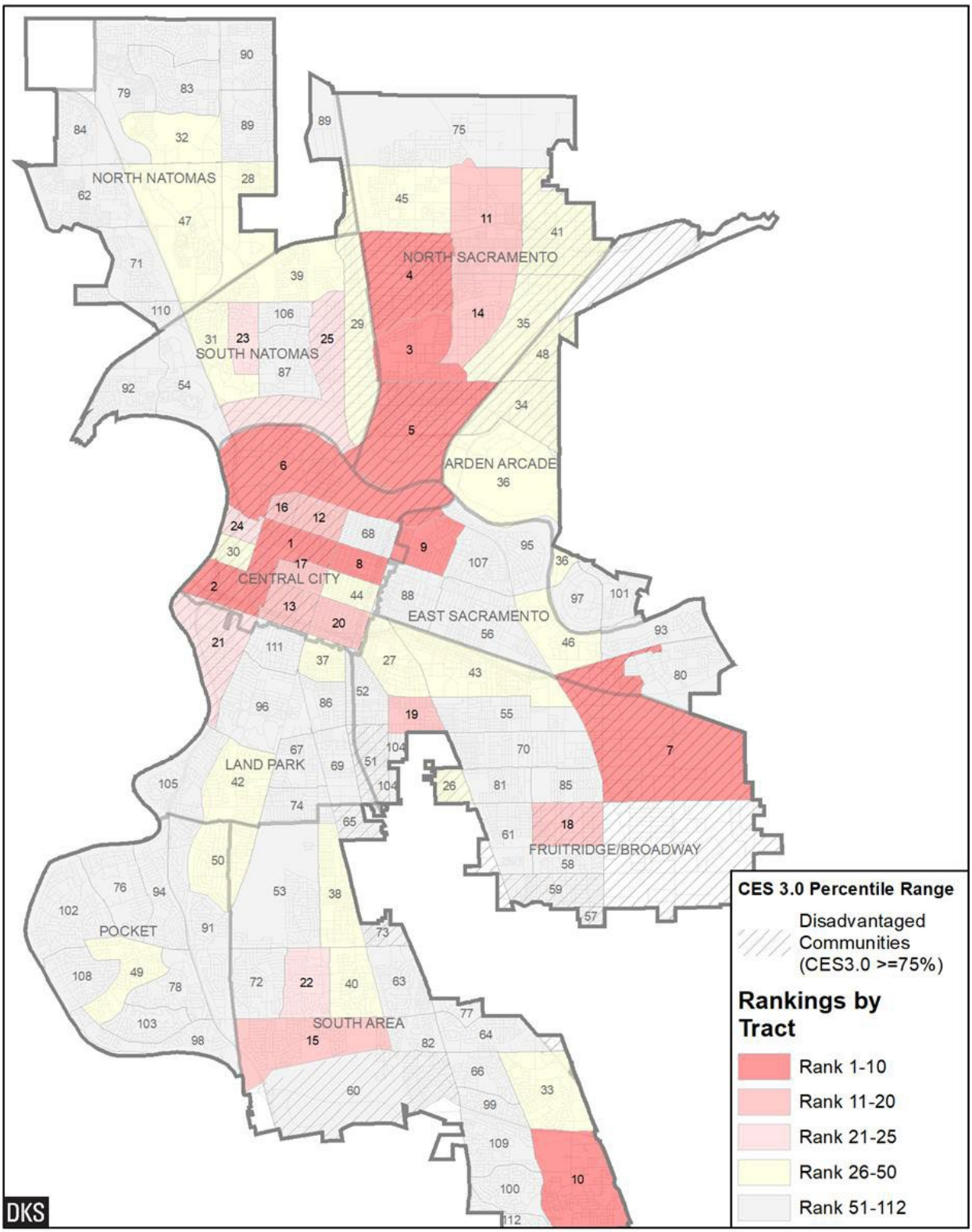
One scenario the team ran was to identify highest opportunity locations of City-owned properties that could potentially host public EV charging for nearby residents, with a focus on low-income and disadvantaged communities. Therefore, of the 20 total categories, the highest weighting factor of 5 (shown in bold in **Table 4** below) was selected for two categories (low-income residents and City-owned properties such as libraries, community centers, and parks). The higher-than-average weighting factor of 3 was selected for three categories (disadvantaged communities, percentage renters, and multifamily dwelling units). The lower-than-average factor of 0 (shown in red) was selected for two categories (jobs based on ACS data and vacant residential zoned acreage). The lowest-priority weighting of -1 (shown in red) was selected for the two existing EVSE categories, representing the fact that exiting EVSE does not necessarily support the need for additional EVSE nearby. The remaining 11 categories have an average assumed weighting of +1. The results of this scenario are displayed in **Figure 2**.

Table 4: Example Census Tract Weighting Factors, Scenario 1

Weighting Category	Weighting Type	Weighting Factor	Total %
Low Income	**Absolute**	**5.0**	2 10%
City Owned Properties (Libraries, Community Centers, Parks)	**Relative**	**5.0**	
Percent Renters	**Relative**	**3.0**	3 15%
Disadvantaged Communities (CES 3.0)	**Absolute**	**3.0**	
Multi-Family Dwelling Units	**Relative**	**3.0**	
CVRP Rebates	Relative	1.0	11 55%
City Owned Parking	Relative	1.0	
Employment (based on Parcel Land Use)	Relative	1.0	
SACOG Growth in Households	Relative	1.0	
SACOG Growth in Employment	Relative	1.0	
Work Based Dwell: >=2 hours (existing)	Relative	1.0	
Non-Work Based Dwell: <2 hours (existing)	Relative	1.0	
Non-Work Based Dwell: >=2 hours (existing)	Relative	1.0	
Work Based Dwell: >=2 hours (growth)	Relative	1.0	
Non-Work Based Dwell: <2 hours (growth)	Relative	1.0	
Non-Work Based Dwell: >=2 hours (growth)	Relative	1.0	
Jobs (ACS)	Relative	0.0	2 10%
Vacant Residential Zoned Acreage	Relative	0.0	
Existing EVSE (Level 2)	Relative	-1.0	2 10%
Existing EVSE (DCFC)	Relative	-1.0	

Source: City of Sacramento

Figure 2: Results—Census Tract Opportunities, Example Ranking for Intersection of City-Owned Land and Low-income Residents, Scenario 1



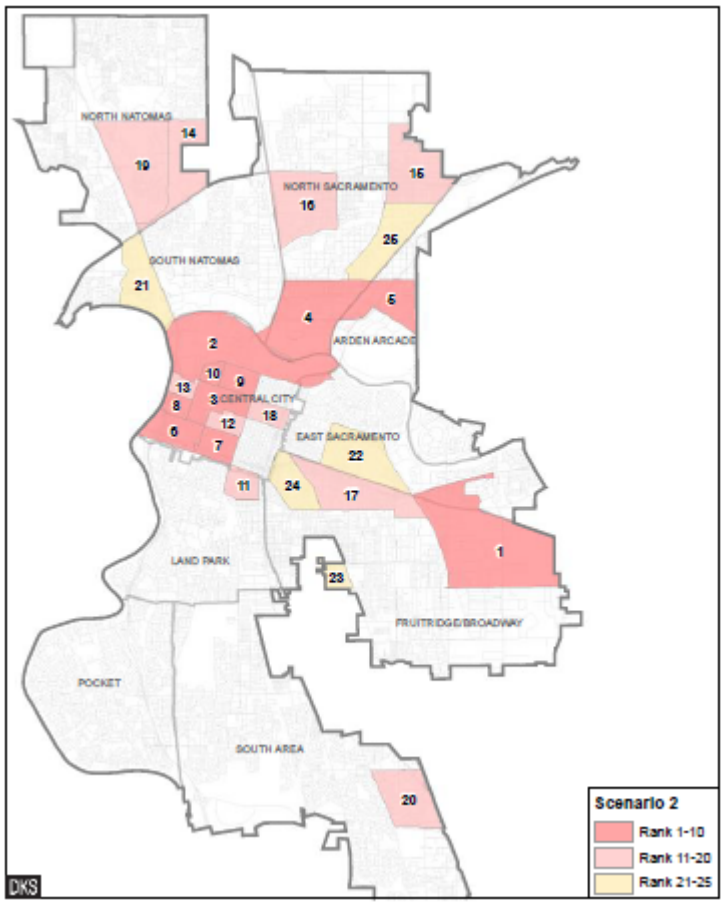
Source: DKS Associates

To demonstrate how results change when an organization uses different weighting factors for different purposes, the team created two other scenarios:

1. A second scenario focused on business charging in low-income communities. This scenario gives most weight to jobs and job growth factors; with the second highest weighting placed on low income, CES score, and workplace dwell time criteria (**Figure 3**).
2. A third scenario focused on residential charging in low-income communities with vacant land. This scenario gives most weight to low income and percentage renters; and the second highest weighting placed on criteria of vacant residential land, household growth, and non-work dwell time (**Figure 4**).

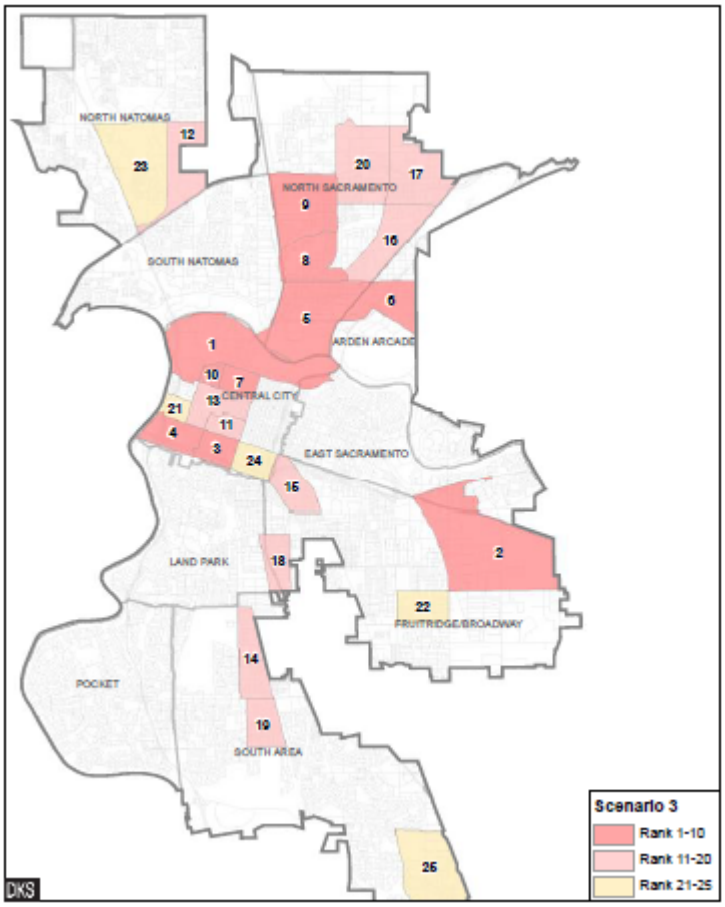
As the Sacramento EV Strategy continues to roll out, City staff, partners or other cities can quickly update the spreadsheet, which also contains geo-coding information that can be loaded into ArcGIS, Google Earth, and other map-based software to create a visual display. Data and methods for updating are explained in detail in the report.

Figure 3: Census Tract Opportunities:
Example Ranking of Business Charging Opportunities in Disadvantaged Communities, Scenario 2



Source: DKS Associates

Figure 4: Census Tract Opportunities:
Example Ranking of Residential Low-Income Opportunities with Vacant Land, Scenario 3



Source: DKS Associates

The team also developed a turnkey tracking spreadsheet to track vehicle deployment by quarter. Each year, the user can create a new tab in the spreadsheet and a new "starting number" (links to data sources are embedded in the spreadsheet). Tracking the number of ZEV cars, trucks, and buses on the road helps the City better understand deployment and infrastructure needs. Data linked in the tracking tool includes: CVRP Rebates + 30%, Clean Cars 4 All (new and used), California Air Resources Board (ARB) Clean Mobility, ARB Clean Off-Road Equipment (CORE), school bus awards, City fleet vehicles, County fleet vehicles, electric car share vehicles in the city, electric car share trips, other car share vehicles, other car share trips, ZEV buses, ZEV bus riders.

CHAPTER 3:
Community Electric Vehicle Planning Blueprint

Summary

Using information from **Task 2**, the project team evaluated options for advancing EV infrastructure in new construction and private property (both new and existing construction). To initiate the task, the consultant team evaluated constraints and opportunities, accounting for Sacramento's policy context and unique challenges for housing construction. This task included a cost-effectiveness report (which compared costs of different levels of EV-readiness in new construction), stakeholder meetings to further understand and inform EV opportunities for new development, recommendations for the City's code and permitting framework to accelerate EV-readiness in new construction, and a presentation to the Planning and Design Commission. All these tasks resulted in a blueprint report summarizing Sacramento's approach to advance EVSE in new construction.

Findings from the various **Task 3** components resulted in recommendations to amend the California Green Building Standards Code (CALGreen) and City Code, addressing the following components:

- Recommendations for code updates for EV-readiness and infrastructure requirements in the City Building and Construction Code (Title 15) for the next cycle of the California Building Code in 2019, which included recommendations to exceed mandatory CALGreen standards by recommending a requirement for EV ready parking spaces instead of EV capable spaces.
- Recommendations for updates to the City Planning and Development Code (Title 17) to incentivize and/or require EV-readiness through land use standards, including additional guidance for implementation of the City's 2040 General Plan update.

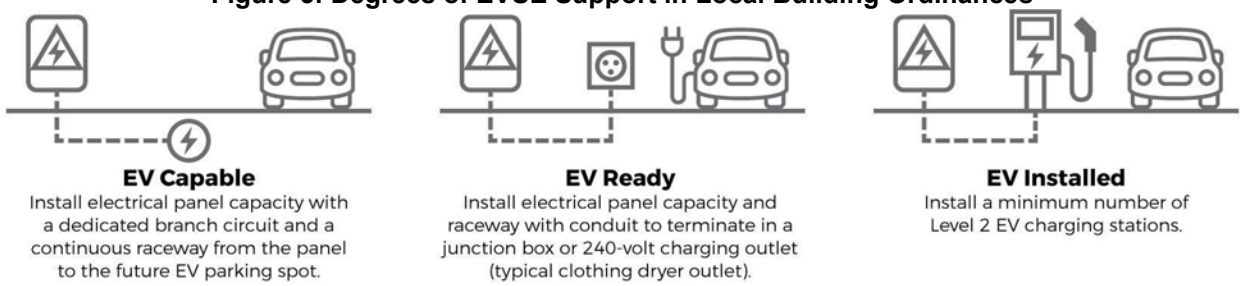
Task 3.1: Evaluate Constraints and Opportunities to Accelerate Electric Vehicle Supply Equipment (EVSE) in New Construction

This memo identified the existing building codes that determine EVSE in new construction, summarized reach codes and best practices/lessons learned or implemented in other cities, and modeled the energy used by an EV to new construction to help identify local ordinances, reach codes, and incentives to encourage more EVSE parking spaces than required by state code. This information prepared the team for engagement with affordable housing providers and local developers to help determine recommended options to accelerating EV infrastructure.

CALGreen dictates the measures that the built environment must put in place to meet climate reduction goals set forth in Assembly Bill 32, including "facilitating future installation of electric vehicle supply equipment". New codes are adopted every three years and outline mandatory, Tier 1 and Tier 2 requirements. 2019 starts a new code, with changes effective January 1, 2020. As in previous code cycles, it requires EV Capable parking spaces, meaning that the building includes capacity in the electrical panel and spacing for wiring for a building inhabitant to install wires, circuits, and plugs for EV charging equipment at a future date. EV Capable parking spaces do not require installation of a junction box or outlet, nor do they require installation of EVSE with a vehicle connection. Accordingly, EV Capable spaces

ensure capability for future EV charging infrastructure, but do not guarantee the installation of EV supply equipment. In other words, EV Capable spaces provide opportunities for potential EV charging connections if someone chooses to complete the installation, but EV Capable spaces do not ensure an actual charging connection for a vehicle is ever installed. **Figure 5** explains the different levels of EVSE support.

Figure 5: Degrees of EVSE Support in Local Building Ordinances



Source: City of Sacramento

The 2019 CALGreen codes will go into effect on January 1, 2020. The new code cycle requires:

- Single-family residences, including townhomes and duplexes, be EV Capable
- Non-residential new construction and major alterations ($200,000 or 1,000 square feet) to have up to 6% of parking spaces be EV Capable.
- Multifamily dwelling construction to have 10% of parking spaces be EV capable

Table 5 lists the non-residential EVSE requirements and voluntary measures that go into effect on January 1, 2020.

Table 5: Non-Residential EVSE Requirements and Voluntary Measures

Total number of parking spaces	Number of required EV Capable spaces	Tier 1 Required EV Capable spaces	Tier 2 Required EV Capable spaces
0-9	0	1	1
10-25	1	2	2
26-50	2	3	4
51-75	4	5	6
76-100	5	7	9
101-150	7	10	12
151-200	10	14	17
201	6% of total	8% of total	10% of total

Source: CALGreen

The report listed many opportunities and their associated benefits and constraints within building code, parking regulations, and city planning (including opportunities in the General Plan update). The report also outlined the process for the City to enact a local ordinance with the California Building Standards Commission (CBSC) to demonstrate the reach code is "reasonably necessary because of local climatic, geological, or topographical conditions." Because EVSE does not reduce energy use or save costs related to the building or parking lot, cost justification for local ordinances is typically based on retrofit costs. The jurisdiction must submit for reach code certification each time CALGreen is updated. Prior to filing with CBSC, the City must undergo a formal public input process. Cost is also a

consideration for reach codes. Understanding the process is essential to guide public engagement and future implementation of any reach codes the City pursues.

Task 3.2: EV Infrastructure Cost-Effectiveness Study for Sacramento

Completing a cost-effectiveness study for EVSE in Sacramento equipped the City of Sacramento and its contractors to conduct public outreach to gain feedback about possible City code changes. This information can also be used in justification for future reach code ordinances.

The list below shows estimated costs per parking space for each degree of EV support during new construction. Costs independent of building type or size.

- **EV Capable – $800 per parking space** for compliance with base CALGreen requirements, per the cost estimate ARB used in the CALGreen cost justification
- **EV Ready** – an average of costs reported by other jurisdictions and confirmed in stakeholder interviews. Sacramento stakeholders stated that **$1,100 total costs per EV Ready parking space** is a valid mean number based on 2019 construction costs. This represents an 11% increase over the mandatory costs.
- **EV Installed** – a pedestal-mount Level 2 EVSE that is not networked and does not accept payment was found to be approximately $3,000 according to 2015 and 2017 Department of Energy reports. Stakeholders stated that wall mounted EVSE can cost less than $3,000 and networked EVSE can cost more, but construction costs were about the same. Stakeholders agreed that **$6,000 per EVSE** was a valid mean cost. This represents a 60% increase over the mandatory costs.

The Energy Code (Title 24 Part 6) of the California State Building Codes will require additional energy efficiency measures and solar panels on all new construction. Discussion of increasing photovoltaics (PV) to support EVSE is a topic of interest to many stakeholders. However, this report concluded that a local ordinance that would require non-residential construction to install additional solar to offset the energy used during vehicle charging would not pass the cost-effectiveness requirement. Therefore, the City decided not to pursue this any further.

Lastly, it's important for developers and electric service providers to understand how adding EV parking spaces will impact the overall load profile on the utility, especially on the local transformers serving those developments. This is a complex issue requiring detailed utility data and was beyond the scope of this project, but to provide some initial indication of potential impacts the project team completed preliminary modeling to provide initial guidance on load impacts.

Task 3.3: Convene Stakeholder Meetings on EV Opportunities for New Development

Task 3.3 aimed to engage stakeholders to provide feedback and recommendations for a preferred option to accelerate EVSE installation in new construction. The team hosted three 60 to 90-minute focus group sessions, one for each of the following local stakeholder groups: developers, affordable housing and EV mobility and technology companies. The focus group participants were asked questions in an interactive setting; the open and free discussion generated ideas and insights the City of Sacramento can use going forward. Participants also discussed program barriers to provide service to low-income and disadvantaged communities. Overall, the three groups were supportive of proposals to introduce a local ordinance to

require EV Ready instead of EV Capable, and highlighted the importance of complementary programs to accelerate adoption in underserved communities. The participants provided general feedback including their perspective for related benefits, challenges, and opportunities.

Task 3.4: Recommended EV Readiness Framework

This task developed recommendations for the City's code and permitting framework to accelerate electric vehicle readiness in new construction. Recommendations included amendments and evaluation of other jurisdiction's efforts to exceed the CALGreen standards for EV compliance. The report listed options that the team thought were likely most-feasible for the City of Sacramento to implement in 2019 and 2020.

To submit an ordinance to the CBSC, the City must submit amendments documents including:

1. Cover letter
2. Proof of Publication (if required by City of Sacramento)
3. Copy of Signed Ordinance
4. Copy of Findings (usually the staff report submitted to City Council)

The ordinance must contain the language in the code with redlining of proposed changes. **Task 3.4** includes draft materials and code revisions for both the recommended CBSC (Building Code) revisions as well as City Code revisions. City staff can use these materials as a starting point to implement changes to various codes to increase EVSE, pending direction from City leadership and additional stakeholder vetting.

Task 3.5: Commission, Committee, and Council Hearings

City staff presented options for revised and new codes to the City's Planning and Design Commission on June 13th, 2019. This was the first formal public forum to discuss options to go beyond CALGreen minimum requirements. As discussed above, rather than pursuing Tier 1 or 2 as some other jurisdictions have done, recommendations from this project emphasize the cost-effectiveness of requiring EV Ready spaces in lieu of all mandatory EV Capable spaces required by CALGreen. Staff will use this material to bring forward recommended options for consideration by City leadership, providing balanced, cost-effective options to increasing EVSE in the City. The Planning and Design Commissioners reviewed and commented and were generally supportive of requiring EV Ready spaces and further accelerating EV infrastructure through other components of City Code. Planning Commissioners discussed issues such as progress towards EV goals and how to site what type of chargers and where.

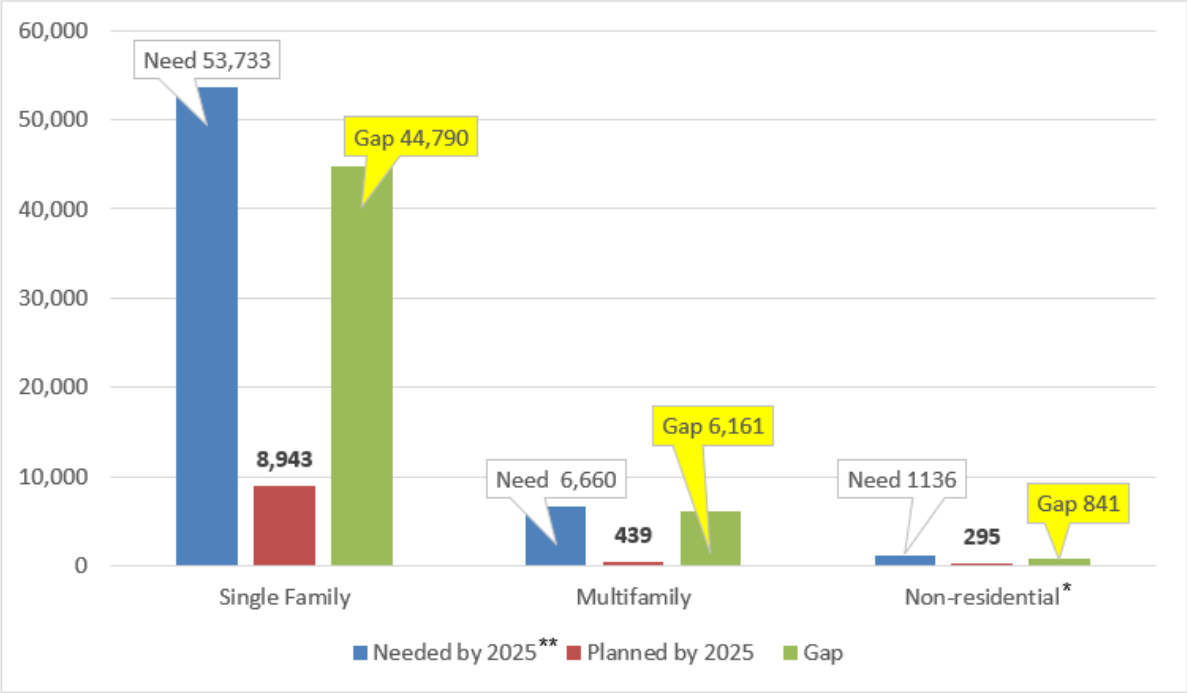
Task 3.6: Community EV Planning Blueprint

The goal of this task was to prepare a blueprint report summarizing Sacramento's approach to advance EVSE in new construction and compiling all findings from the preceding **Task 3** deliverables. This report also identified the contribution of future EVSE in new construction to achieve the goal of 75,000 zero emission vehicles by 2025.

Using data from **Task 2.1** and **2.4** and data provided by the City of Sacramento Community Development Department to project the number of EV spaces expected from new construction, the project team estimated the gaps in infrastructure that would still exist (as shown in **Figure 6**). The analysis in this task showed that the minimum code requirements will still result in a large gap in infrastructure (both public and private) needed to support 75,000 EVs by 2025, and the gap is greatest in disadvantaged

communities. DCFC was not included in the gap assessment since installation of DCFC are voluntary and dependent on many other factors that are difficult for the team to project. However, based on how quickly funds were reserved and provisionally reserved for DCFC rebates through the California Electric Vehicle Infrastructure Project (CALeVIP) in spring 2019, the City expects to see a significant increase in DCFC units available throughout the region by 2021.

Figure 6: Expected Gap in Charging Infrastructure by 2025



Source: City of Sacramento. *Public and workplace L2 chargers. ** Needed in addition to existing charging connectors.

Building and city codes are tools that cities can use to increase EV infrastructure. Summary of options for code revisions or other mechanisms to achieve City goals:

1. Begin the process for adopting a local ordinance that requires EV Ready as mandatory in single-family residential, multifamily, mixed-use, and non-residential new construction and major alterations in 2020.
2. Revise the "Transportation management plan measures" (City code 17.700.070) to specify that above-code EV charging and EV car share programs are acceptable measures.
3. Revise "Development standards for off-street parking facilities" (City code 17.608.040) to describe the location, size, and signage required for EV spaces in parking lots and structures.
4. Add a new section to "Development standards" that requires EV support in new parking structures that require electricity.
5. Revise the "Parking requirements of land use type and parking district" (City code 17.608.030) to require EV support consistent with the building code in stand-alone parking lots and structures.

6. Revise “Alternatives to standard parking requirements; other modifications” (City code 17.608.060) to enable developers to install above-code EVSE to deviate from minimum parking requirements.
7. Revise “Waiver of minimum and maximum parking requirements” to require that parking spaces above the maximum be constructed as EV installed.
8. Create a new code using tree shading requirements for parking lots (City code 17.612.040) as a guideline that will require minimum EVSE compliance for parking lot construction projects.
9. Coordinate with businesses and educators to develop a business case for EVs by increasing the workforce and supporting synergetic projects for car-sharing.
10. Support and/or seek funding for an e-mobility hub pilot, ideally in partnership with other agencies and local groups, for a project at a park-and-ride lot in a low-income/disadvantaged community. Consider leveraging funding from the upcoming Clean Mobility Voucher project and grants from SACOG.
11. Identify opportunities for increased insight from data collection and analysis.

The Sacramento EV Blueprint demonstrates that new construction alone cannot meet the need for charging infrastructure. To encourage more infrastructure, EV charging also needs an attractive business case. During the Sacramento EV Blueprint project, the City identified five approaches that may reduce costs of installing EV infrastructure or remove other barriers to deployment:

1. Job training – the project identified a crucial need for more electricians.
2. Hotels and car-sharing – because visitors often use rental cars, taxis, or ride-hailing, they already expect to pay for local transportation. Shifting that transportation to a shared EV scenario can increase the number of EVs in Sacramento, increase EVSE usage, build a profit model for car-share providers, and reduce the number of cars on Sacramento streets.
3. EVSE at City facilities – the team used the EVSE Priority Siting Tool and input from stakeholders to identify five recommended locations to add EVSE at City-owned properties: Hagginwood Community Center, Oak Park Community Center, Samuel C. Pannell Community Center, Martin Luther King Jr. Library, Oakbrook Park (under construction). (Refer to the description in **Task 2.4** for more background on the EVSE Priority Siting Tool.)
4. E-Mobility Hubs – these centers can serve as areas of connectivity where multiple modes of travel converge, and are of interest to many private and public organizations. These locations can provide an integrated suite of mobility modes—safe walking and biking, transit connections, and cars; amenities like lockers, wayfinding, and enjoyable waiting areas; and technologies like dynamic parking management strategies, real-time traveler information, and real-time ridesharing. The report included conceptual drawings and anticipated costs.
5. Disadvantaged Communities – the project team identified disproportionate need for EVs and EVSE in disadvantaged communities, with concepts for how services and infrastructure can better meet their needs. For example, in addition to recommendations for cost-effective Level 2 EVSE at existing community centers in disadvantaged communities, **Task 6.3** identifies recommended

components for e-mobility hubs that provide cross-cutting benefits, such as provision of e-commerce lockers that can provide storage for food banks or other services critical to the community.

Ongoing, proactive engagement with stakeholder groups will be necessary to implement any of the recommended options listed above. Sacramento has an effective stakeholder group, the Sacramento PEV Collaborative, which meets monthly and discusses efforts, needs, and upcoming opportunities. During the Sacramento EV Blueprint project, the EV Blueprint team met with additional groups and identified two more stakeholder groups that will be essential to meeting the City's 75,000 ZEV goal; local business districts and workforce industries. In addition, engaging expertise from data scientists and similar disciplines will be key in effectively implementing and evaluating the success of EV initiatives.

CHAPTER 4:
Public Charging Prioritization Plan

Summary

While **Task 3** focused on new construction, **Task 4** sought to better understand and optimize existing public and workplace EV charging infrastructure, with specific analysis focused on opportunities for City-owned EVSE. The project team conducted an in-depth evaluation of current status and utilization and developed a plan to optimize and increase public access at key facilities, with a focus on service in disadvantaged communities. This task helped address gaps between existing EV access and the EV infrastructure needs identified in the geospatial analysis in **Task 2**. Public engagement in various tasks allowed for early discussion and vetting of findings and priority locations for charging.

Task 4.1: Evaluate Current Status and Utilization of Public and Workplace EVSE

Although most early EV adopters currently charge their vehicles at home, public charging is an important part of the EV ecosystem. The need and demand for public and workplace charging connectors is dynamic and based on many factors including user type, travel patterns, advancements in battery technology and more. These types of chargers can help relieve range anxiety, improve connectivity between and within regions, increase consumer awareness, and improve equity and accessibility if planned appropriately. Public and workplace charging infrastructure is essential to spur increased EV adoption, particularly for residents of multi-family dwelling units and commuters traveling long distances to work in city limits.

Sacramento has over 600 public and workplace charging connectors within city limits. While Sacramento has been a long-standing leader in electrification and has implemented a range of initiatives to deploy EV programs and infrastructure, there is opportunity for continued improvement. Most public charging locations are in parking garages and lots; the area's largest employers including SMUD, Kaiser, UC Davis, government buildings; and colleges. Much of the existing infrastructure is in downtown Sacramento. Gaps still exist in areas such as South Natomas, which has the largest amount of multifamily housing in Sacramento; the Pocket area, with low-density suburban homes and higher density multi-family units and few workplaces; and in Sacramento's disadvantaged communities. This pattern indicates that current public and workplace infrastructure supports mostly commuters, but not residents in general.

Multiple incentive programs are currently available to increase the amount of publicly available EVSE in Sacramento, notably CALeVIP with over $14MM available to projects within Sacramento County. Major investment is still needed to achieve the 2025 targets. Recent public-private partnerships, such as Electrify America's Sac-to-Zero program, and the EV curbside charging pilot with EVgo, help provide a strong foundation for future efforts and increase the amount of EVSE infrastructure.

Understanding use of public and workplace EVSE is extremely difficult because the data is not shared openly. To get a sense of general usage patterns, data for five City-owned, City-operated garages was analyzed (Capitol Garage, Memorial Garage, Tower Bridge Garage, Old Sacramento Garage, and the City Hall Garage). Additionally, it is important to note that there has been an increase in demand for the EV

parking program and all City garages currently have a waitlist for membership. This could be a sign of increased EV adoption and that other public or workplace EVSE programs are likely to experience an increase in demand as well; for example, ChargePoint's top 15 workplace charging customers saw a significant growth in EV drivers from the fall of 2017 through the fall of 2018 (an average of 60% growth).[6]

While the majority of EV drivers do most of their charging at home, public and workplace charging infrastructure is essential to spur increased EV adoption, particularly for drivers without access to reliable home charging, with low-range EVs, or for the many regional trips that will continue to originate or end in Sacramento. However, an over-emphasis on free charging can lead to excessive public charging use and congestion at chargers by incentivizing drivers to disregard viable home charging options, ultimately limiting access to EV drivers who need it. Charging fees for use of EVSE has been shown to increase availability of chargers at otherwise congested sites by decreasing unnecessary charging or idle time. For example, a 2013 study from UC Davis found that when workplace charging is free, people use the EVSE four times more than they need to.

Task 4.2: Conduct Stakeholder Interviews for Public and Workplace EVSE Needs and Opportunities

The project team convened nine stakeholder interviews to gather opinions and insights into public and workplace EVSE opportunities and constraints. The types of stakeholders interviewed represented:

- Workplaces in other regions advancing EV technology
- Community-based organizations
- Dense multifamily housing and no public charging or light rail service
- Low-income and disadvantage communities
- Geography-based stakeholders
- Need-based/workplace needs
- Fleet agencies
- Clean mobility providers
- Affordable housing providers

Specifically, the participants were from the following organizations:

- Breathe California
- California Department of Food and Agriculture, Division of Measurement Standards
- City of Citrus Heights
- EVgo
- Mutual Housing California
- North Natomas Transportation Management Association (JIBE)
- Sacramento House Redevelopment Agency
- Sacramento Metropolitan Air Quality Management District (SMAQMD)
- Sacramento Employment and Training Agency (SETA) Head Start

6 January 2019 ChargePoint Webinar: Should You Charge for EV Charging?

The purpose of the interviews was to obtain stakeholder feedback about current issues and opportunities for expanded access to public and workplace EVSE. The interviewees were also prompted to obtain recommendations for leveraging current government incentive programs to accelerate EV adoption and infrastructure development. The interviewees were contacted by email and phone to participate. Then phone interviews were scheduled in advance and lasted between 30 and 60 minutes. All participants were asked the same questions with specific prompts according to their representation, with customized questions depending on their expertise or experience. Some participants were also asked specific questions as part of their focus group participation.

Responses regarding challenges and opportunities for public and/or workplace charging varied, but a few general observations emerged:

- All interviewees were aware and working on advancing EVSE in the public and in workplaces through diverse means, whether through grant-funded programming or a fleet agency actively working to upgrade their vehicles. Efforts were being made and the awareness levels were high amongst all interviewees, including awareness of the City's EV efforts.
- Cost and affordability continue to be a challenge amongst the people whom interviewees serve and within their organizations' management, although in contradiction interviewees who help conduct outreach about incentive programs feel that people and organizations are not taking advantage of those programs.
- Participants identified locations like park-and-ride lots and large employers as opportunities, yet also expressed concerns about safety, cost and risk, and liability.
- Some interviewees offer free charging and have seen the benefits with increased use by offering this model. With new legislation coming in 2021, charging models will change and ideas for incentivizing charging hosts will become more difficult with more regulations determining what can and cannot be charged. Income-generated models for public charging were mentioned as an incentive, although some people disagreed that the potential to generate income would outweigh barriers such as startup costs for installing EVSE.

Task 4.3: Evaluate and Recommend EVSE Upgrades and Strategies to Optimize Public Charging Access

The goal of this report was to provide near-term guidance to optimize existing public and workplace EV charging infrastructure and establish a pipeline of EV infrastructure projects that will expand public charging access and increase service in disadvantaged communities. Opportunities for City-owned public charging locations were prioritized and evaluated as prototypes for future public and workplace charging. This report also included conceptual design prototypes for City-owned public charging facilities that are intended for fundable near-term projects, along with associated cost estimates for installing charging infrastructure.

The report considered multiple factors to prioritize recommendations for City-owned facilities, such as future growth capacity, location near disadvantaged communities, and EVSE rankings from the prioritization tool. Most EVSE in City-owned garages will be upgraded in 2019 and 2020 using CALeVIP funds, so the recommendations focused on other public City-owned locations such as libraries and community centers.

Table 5: Recommended Locations for Public Chargers

Community Centers, Libraries and Parks	Address	Potential EVSE
Del Paso Library	920 Grand Ave.	One Level 2 EVSE with two connectors
Hagginwood Community Center	3271 Marysville Blvd.	Two Level 2 EVSEs with two connectors
Oak Park Community Center	3425 Martin Luther King Jr. Blvd.	Two Level 2 EVSEs with two connectors
Valley Hi North Laguna Library	7400 Imagination Parkway	Two Level 2 EVSEs with two connectors
Samuel C. Pannell Community Center	2450 Meadowview Rd.	Up to three Level 2 EVSEs with two connectors; possible dual-use at City Solid Waste Division
Martin Luther King Jr. Library	7340 24th St. Bypass	Two Level 2 EVSEs with two connectors; possible mobility hub with solar & storage at vacant lot
South Natomas Community Center	2921 Truxel Rd.	Two Level 2 EVSEs with two connectors; possible alternate location at park under construction

Source: City of Sacramento

The team drafted conceptual site designs for five of the seven sites recommended above, which were included in **Task 3.6** as well.

The City of Sacramento intends to implement a fee for use of EVSE, which has been shown to encourage more efficient use and turnover and increase EVSE availability for people who really need it, including those without access to home charging. The fees would also cover program costs including electricity, operation, and maintenance. Interviews with ChargePoint, EVgo, and cities and counties in the Bay Area revealed a variety of pricing models used at workplaces and municipal garages. However, it should be noted that the Electric Fueling Systems regulation (National Institute of Standards and Technology Handbook 44) will preclude some of the various pricing structures that currently exist, such as flat monthly fees, hourly fees, energy-based fees, graduated pricing based on duration of charge, time of use pricing, initial connection fee, and overstay fees.

CHAPTER 5:
EV Toolkits

Summary

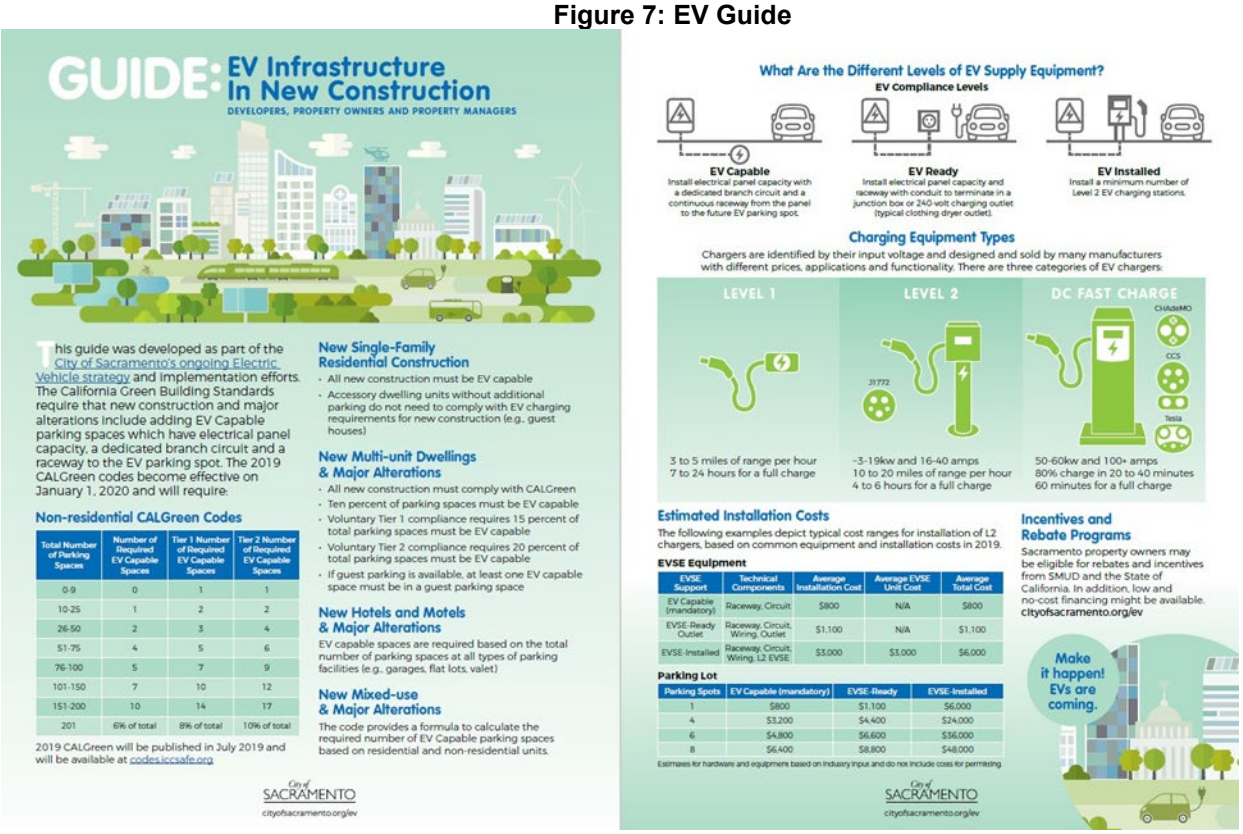
In this task, the team developed toolkits to foster both community and agency EV awareness. Priorities for this task were to lessen consumer barriers to EV adoption and identify a path for creating an economic EV ecosystem. The team prepared a package of EV informational resources designed to inform property owners and the general public on EVSE and EV options. The toolkit consists of graphic, user-friendly materials that summarize key resources and frequently asked questions from previous tasks and conversations. The materials included in the toolkit serve as a starting point for accessing more information for diverse EV audiences, with the primary intent of education and promotion. These resources also highlight partner efforts, summarizing regional programs and work to date. The final deliverables were adjusted based on stakeholder feedback and research. A revised approach was developed to increase the usefulness of the tools and be responsive to stakeholder engagement. The final deliverables included: (1) a poster for events; (2) a guide on EV infrastructure aimed at developers, property owners and property managers; (3) a FAQ for EVSE installation aimed at businesses, workplaces, shopping centers and apartments; (4) updated website content; and (5) other outreach materials that was developed as needed for events.

The second toolkit, EV Economic Pathways, outlined various strategies for the City to catalyze a ZEV workforce for advanced transportation employment opportunities, identify an operational structure for a potential ZEV service center, and develop a guide for agency efforts to strengthen the local ZEV workforce. Key issues included barriers entry for low-income and disadvantaged communities into the advanced transportation technology space.

Task 5.1 Prepare EV Toolkits

Example images of the EV Guide and EV FAQ sheet are on the following page in Figures 7 and 8. These tools will support the City in ongoing outreach. In addition, these documents will serve as educational resources the Community Development Department can use during engagement with developers and property owners.

Figure 7: EV Guide



GUIDE: EV Infrastructure In New Construction

DEVELOPERS, PROPERTY OWNERS AND PROPERTY MANAGERS

This guide was developed as part of the City of Sacramento's ongoing Electric Vehicle strategy and implementation efforts. The California Green Building Standards require that new construction and major alterations include adding EV Capable parking spaces which have electrical panel capacity, a dedicated branch circuit and a raceway to the EV parking spot. The 2019 CALGreen codes become effective on January 1, 2020 and will require:

Non-residential CALGreen Codes

Total Number of Parking Spaces	Number of Required EV Capable Spaces	Tier 1 Number of Required EV Capable Spaces	Tier 2 Number of Required EV Capable Spaces
0-9	0	1	1
10-25	1	2	2
26-50	2	3	4
51-75	4	5	6
76-100	5	7	9
101-150	7	10	12
151-200	10	14	17
201	6% of total	8% of total	10% of total

2019 CALGreen will be published in July 2019 and will be available at codes.iccsafe.org

New Single-Family Residential Construction

- All new construction must be EV capable
- Accessory dwelling units without additional parking do not need to comply with EV charging requirements for new construction (e.g., guest houses)

New Multi-unit Dwellings & Major Alterations

- All new construction must comply with CALGreen
- Ten percent of parking spaces must be EV capable
- Voluntary Tier 1 compliance requires 15 percent of total parking spaces must be EV capable
- Voluntary Tier 2 compliance requires 20 percent of total parking spaces must be EV capable
- If guest parking is available, at least one EV capable space must be in a guest parking space

New Hotels and Motels & Major Alterations

EV capable spaces are required based on the total number of parking spaces at all types of parking facilities (e.g., garages, flat lots, valet)

New Mixed-use & Major Alterations

The code provides a formula to calculate the required number of EV Capable parking spaces based on residential and non-residential units.

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What Are the Different Levels of EV Supply Equipment?

EV Compliance Levels

EV Capable
Install electrical panel capacity with a dedicated branch circuit and a continuous raceway from the panel to the future EV parking spot.

EV Ready
Install electrical panel capacity and raceway with conduit to terminate in a junction box or 240-volt charging outlet (typical clothing dryer outlet).

EV Installed
Install a minimum number of Level 2 EV charging stations.

Charging Equipment Types

Chargers are identified by their input voltage and designed and sold by many manufacturers with different prices, applications and functionality. There are three categories of EV chargers:

LEVEL 1	LEVEL 2	DC FAST CHARGE
3 to 5 miles of range per hour 7 to 24 hours for a full charge	~3-19kw and 16-40 amps 10 to 20 miles of range per hour 4 to 6 hours for a full charge	50-60kw and 100+ amps 80% charge in 20 to 40 minutes 60 minutes for a full charge

Estimated Installation Costs

The following examples depict typical cost ranges for installation of L2 chargers, based on common equipment and installation costs in 2019.

EVSE Equipment

EVSE Support	Technical Components	Average Installation Cost	Average EVSE Unit Cost	Average Total Cost
EV Capable (mandatory)	Raceway, Circuit	$800	N/A	$800
EVSE-Ready Outlet	Raceway, Circuit, Wiring, Outlet	$1,100	N/A	$1,100
EVSE-Installed	Raceway, Circuit, Wiring, L2 EVSE	$3,000	$3,000	$6,000

Parking Lot

Parking Spots	EV Capable (mandatory)	EVSE-Ready	EVSE-Installed
1	$800	$1,100	$6,000
4	$3,200	$4,400	$24,000
6	$4,800	$6,600	$36,000
8	$6,400	$8,800	$48,000

Estimates for hardware and equipment based on industry input and do not include costs for permitting.

Incentives and Rebate Programs

Sacramento property owners may be eligible for rebates and incentives from SMUD and the State of California. In addition, low and no-cost financing might be available.
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Make it happen! EVs are coming.

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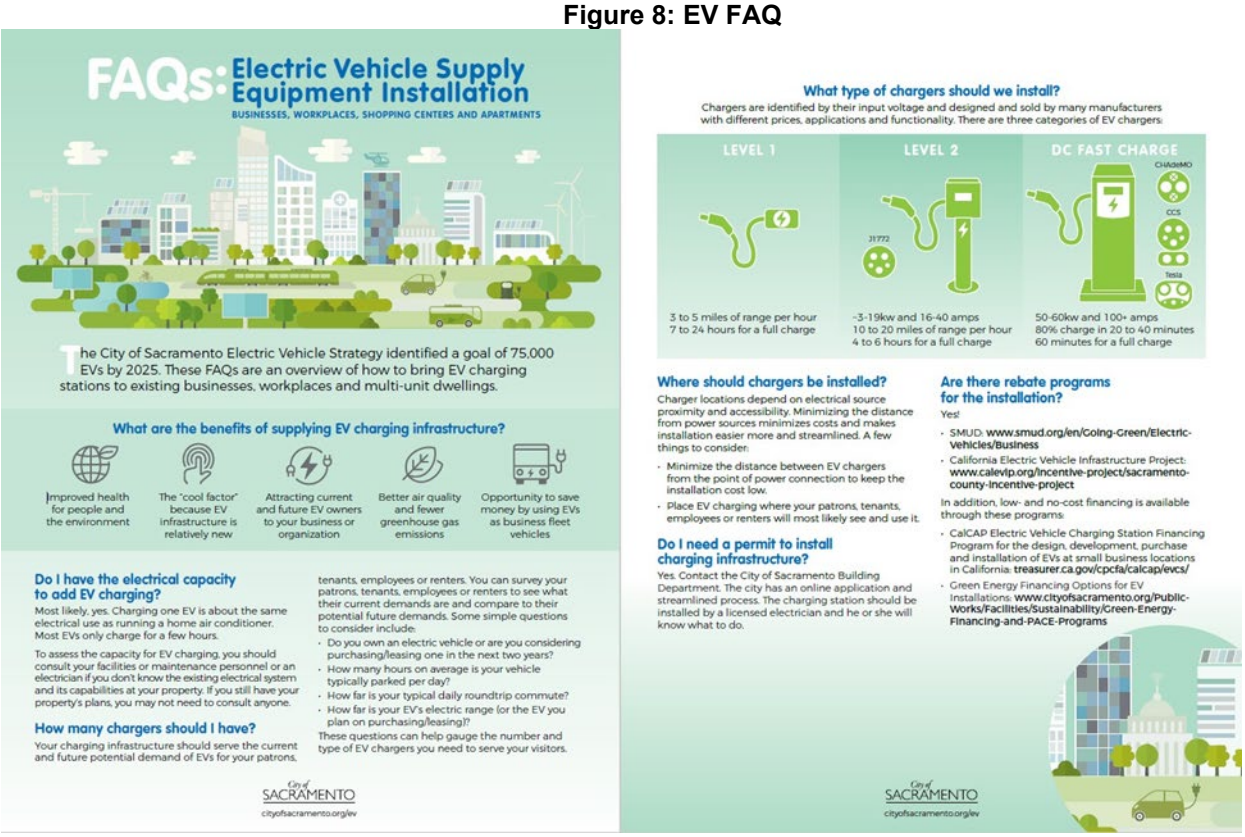
Source: City of Sacramento

Figure 8: EV FAQ



FAQs: Electric Vehicle Supply Equipment Installation

BUSINESSES, WORKPLACES, SHOPPING CENTERS AND APARTMENTS

The City of Sacramento Electric Vehicle Strategy identified a goal of 75,000 EVs by 2025. These FAQs are an overview of how to bring EV charging stations to existing businesses, workplaces and multi-unit dwellings.

What are the benefits of supplying EV charging infrastructure?

- Improved health for people and the environment
- The "cool factor" because EV infrastructure is relatively new
- Attracting current and future EV owners to your business or organization
- Better air quality and fewer greenhouse gas emissions
- Opportunity to save money by using EVs as business fleet vehicles

Do I have the electrical capacity to add EV charging?

Most likely, yes. Charging one EV is about the same electrical use as running a home air conditioner. Most EVs only charge for a few hours.

To assess the capacity for EV charging, you should consult your facilities or maintenance personnel or an electrician if you don't know the existing electrical system and its capabilities at your property. If you still have your property's plans, you may not need to consult anyone.

How many chargers should I have?

Your charging infrastructure should serve the current and future potential demand of EVs for your patrons, tenants, employees or renters. You can survey your patrons, tenants, employees or renters to see what their current demands are and compare to their potential future demands. Some simple questions to consider include:

- Do you own an electric vehicle or are you considering purchasing/leasing one in the next two years?
- How many hours on average is your vehicle typically parked per day?
- How far is your typical daily roundtrip commute?
- How far is your EV's electric range (or the EV you plan on purchasing/leasing)?

These questions can help gauge the number and type of EV chargers you need to serve your visitors.

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What type of chargers should we install?

Chargers are identified by their input voltage and designed and sold by many manufacturers with different prices, applications and functionality. There are three categories of EV chargers:

LEVEL 1	LEVEL 2	DC FAST CHARGE
3 to 5 miles of range per hour 7 to 24 hours for a full charge	~3-19kw and 16-40 amps 10 to 20 miles of range per hour 4 to 6 hours for a full charge	50-60kw and 100+ amps 80% charge in 20 to 40 minutes 60 minutes for a full charge

Where should chargers be installed?

Charger locations depend on electrical source proximity and accessibility. Minimizing the distance from power sources minimizes costs and makes installation easier more and streamlined. A few things to consider:

- Minimize the distance between EV chargers from the point of power connection to keep the installation cost low.
- Place EV charging where your patrons, tenants, employees or renters will most likely see and use it.

Do I need a permit to install charging infrastructure?

Yes. Contact the City of Sacramento Building Department. The city has an online application and streamlined process. The charging station should be installed by a licensed electrician and he or she will know what to do.

Are there rebate programs for the installation?

Yes!

- SMUD: www.smud.org/en/Going-Green/Electric-Vehicles/Business
- California Electric Vehicle Infrastructure Project: www.calevip.org/incentive-project/sacramento-county-incentive-project

In addition, low- and no-cost financing is available through these programs:

- CalCAP Electric Vehicle Charging Station Financing Program for the design, development, purchase and installation of EVs at small business locations in California: treasurer.ca.gov/cpcfa/calcap/evcs/
- Green Energy Financing Options for EV Installations: www.cityofsacramento.org/Public-Works/Facilities/Sustainability/Green-Energy-Financing-and-PACE-Programs

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cityofsacramento.org/ev

Source: City of Sacramento

Task 5.2: Develop EV Economic Pathways

The goal of this task was to develop a guide for agency efforts to strengthen the local ZEV workforce. The team evaluated the local economic context and opportunities for advanced transportation employment opportunities and developed recommended strategies.

Most ZEVs are leased from major automakers. Under the typical model, dealerships perform all maintenance, leased cars are typically returned before they need major servicing, and dealerships hire technicians that have completed automaker-specific training. Dealerships stated that ZEV servicing is different than traditional servicing for internal combustion engine vehicles – ZEV servicing is more like data analysis than automotive repair, and that auto mechanic classes offered at community colleges and trade schools neither equip students to work on ZEVs nor attract people who have an aptitude for data.

Fleet managers expect that their staff will eventually take on maintenance tasks related to electric vehicles (EVs), but do not anticipate offering training. Instead, they expect to hire people who have necessary certifications. At least one individual instructor teaches an EV certification course for experienced mechanics.

Journeyman electricians were identified as the largest employment gap in the next five years related to EV workforce needs. The International Brotherhood of Electrical Workers Local 340 estimates a current shortage of 1,500 people in the apprentice program. Apprenticeship, however, has significant barriers to entry.

All industries identified a need for people with customer service soft skills: from service writers at automotive repair to insurance estimators to agents answering phone calls about EV chargers or car-sharing, companies reported difficultly hiring qualified employees.

Specific steps that could help develop a ZEV-ready workforce include:

- Integrating ZEV servicing into computer classes at high school, community college, and adult education. Computer and technology classes are often presented as a pathway to a four-year degree and a desk job. Demonstrating the link between data analysis and cars could entice a new segment of people into EV service classes.
- Extending the City of Sacramento's Community Workforce Training Agreement (CWTA) to include apprentices for mobility-related projects to provide a pathway for residents of low-income and disadvantaged communities. CALeVIP recipients will be required to pay installers a prevailing wage and could create a pathway to using electrical contractors that participate in CWTA.
- Offering targeted tutoring, potentially through "bridging" classes or pre-apprenticeship programs—to help people pass reading comprehension and math tests required for apprenticeship programs
- Partnering with each council member to stage a customer service bootcamp followed by career fair with local business and e-mobility providers.
- Arranging for one or more train-the-trainer sessions to certify local instructors to teach the Automotive Career Development Center's (ACDC) EV certification course to experienced mechanics. Grow Sacramento Funds or Rapid Acceleration, Innovation, and Leadership (RAILS) grants could provide funding for a private company to lead this effort and purchase equipment for training.

Other opportunities include creation of service hubs, such as a ZEV service center. A ZEV service center could provide the equipment, training, and support needed for ZEV fleet expansion, workforce training, and ongoing ZEV fleet service and maintenance needs. Costs for establishing such a center could be high. Acquisition costs for property with appropriate zoning and square footage can range – examples surveyed for the report including a leasing option from $6,000 per month, or a property for sale at $675,000. Obtaining equipment, tools, a lift, business license, EVSE, and insurance is between

$50,000 and $60,000. Overhead (excluding lease) and supplies average $10,000 a month, plus salaries, employment taxes, and worker's compensation. Interviews completed for this task indicate that even a one-person shop needs to gross about $200,000 a year to break even.

The service center operators interviewed for this report stated that a ZEV-only service center (or a center that services both hybrids and ZEVs) is not financially viable at this time. Many interviewees stated that most people lease ZEVs and the dealerships service the cars, but they also pointed out that ZEVs don't need oil changes, tune-ups, and smog checks that are the financial backbone for most service centers.

CHAPTER 6:
Advanced EV Mobility Opportunities

Summary

This task allowed for a comprehensive review of EV mobility findings and development of recommendations based on Sacramento's early electrification initiatives. Findings will help the City and partners to identify sustainable business models and partnership approaches to increase service and access, learning from pilots to date in Sacramento and other regions. Additionally, this task examined various models for a holistic e-mobility demonstration hub, with recommendations that the City can use to develop a proposal for future funding requests in collaboration with partners such as the County of Sacramento, SMUD, SACOG, and the Sacramento Metropolitan SMAQMD.

Task 6.1: Evaluate EV Mobility Pilots

The goal of this task was to facilitate a critical evaluation of early EV pilots in Sacramento and new initiatives currently under development, with input from key stakeholders. The team conducted an inventory of EV mobility projects and prepared an interview framework that identified the list of pilots to evaluate, interviewees, and interview questions. The task helped identify opportunities to increase the scale and success of work to date, with a focus on increasing service to disadvantaged communities. The EV mobility pilots evaluated and/or partners engaged included:

- Our Community CarShare
- Zipcar
- Gig Car Share
- Envoy
- EVgo – Southside Park curbside high-power charger
- On-Demand/micro-transit, including the South Sacramento SmaRT Ride: SacRT
- JUMP Bike Share

Task 6.2: Create E-Mobility Hub Recommendations

The purpose of this task was to support development of the Sacramento Plug-In Electric Vehicle Collaborative's "e-mobility hub" concept and provide background information and assumptions to develop a concept for an e-mobility hub pilot for **Task 6.3**.

Mobility hubs are centers of connectivity at which multiple modes of travel converge. The concept is to provide an integrated suite of mobility services, with options such as transit, car share, bike share, wayfinding and urban design enhancements and technologies that include dynamic parking management strategies, real-time traveler information, and real-time ridesharing. Mobility hubs may include pick-up/drop-off zones for ride-hailing and "kiss-and-ride," freight delivery hubs and connections to bike and pedestrian routes.

An e-mobility hub is the concept of advancing the mobility hub one step further by adding the infrastructure and support services to enable every vehicle to be electric instead of running on petroleum. This concept includes provision of charging stations for a variety of vehicles, potentially

energy storage, and amenities that can serve all populations. Many agencies and organizations in the Sacramento region continue to explore options for e-mobility hubs.

The team evaluated relevant examples of mobility hubs and concepts from Seattle, Los Angeles, San Diego, and Minneapolis/St. Paul that combined multiple services, with attention to issues such as: upfront capital investments, operational structure and costs, site design, business model and/or level of public agency involvement, types of awareness and education activities provided on site, and integration of on-site solar photovoltaics or energy storage technologies. Options for e-mobility hub program structure were outlined, with an emphasis on close coordination with regional partners and Sacramento as a lead.

Deployment of e-mobility hubs should seek to optimize public benefit, and site projects along important transportation corridors that serve a variety of travel modes, preferably improving access to a concentration of services such as employment, housing, shopping, education and/or recreation. The team used the information in this task to create siting criteria for an e-mobility hub in Sacramento and evaluated potential locations against the criteria to develop a more comprehensive view of options that various sites could offer. Locations considered in the process were identified based on the outcomes from this project, including using the EVSE Priority Siting Tool; the model for sustainable car-share communities; interviews with stakeholders, developers, and community-based organizations; and public input from mapping exercises at the Sacramento PEV Collaborative and community events and workshops. It's likely that other candidate sites exist and will be identified as this concept progresses. **Table 6** summarizes the sites against the criteria (further detail can be found in the report). It is important to note that sites included in this assessment do not account for ownership or operational control; these properties are generally owned by other agencies or owners. The list is provided for discussion and brainstorming purposes, and does not indicate a project commitment. The City will continue to evaluate sites and identify priorities based on ongoing stakeholder engagement, partnerships, and funding.

Table 6: Examples of Potential Locations for E-Mobility Hubs and Evaluation Criteria*

		Criteria							
		Mode Transfer	Transit Service	Active Transportation Infrastructure	Proximity to Public Services	Socioeconomic Diversity	Adequate land	Electrical Infrastructure	Redevelopment
Potential sites	Franklin Blvd. Business District		X	X	X	X		?	X
	Township 9 LRT Station	X	X				X	?	X
	1349 Florin Road	X			X	X		?	
	University Transit Village	X	X	X	X	X		?	X
	Arena Reuse	X			X	X	X	?	X
	Northgate Blvd.	X		X	X	X		?	X
	Delta Shores	X			X		X	?	
	May and Grand Avenues	X	X	X	X	X		?	
	Cal Expo	X			X		X	?	X

Source: City of Sacramento. *Note: sites are identified for illustrative and discussion purposes only. Table includes sites not operated or controlled by the City.

Task 6.3: Identify Advanced EV Mobility Opportunities

Task 6.3 synthesized lessons from **Tasks 6.1** and **6.2**. This task provided summaries of interviews with e-mobility operators and research of successful e-mobility programs including carshare, EV charging, and on-demand transit. The evaluation included consideration of available program outcomes and key service indicators, along with analysis of business and service models.

While **Task 6.2** analyzed concepts and plans of other example mobility hub frameworks and expanded on those concepts to recommend an e-mobility hub prototype, this task included an additional focus on ensuring that all vehicle transportation be electric. However, the emphasis should remain on active transportation and shared rides, including transit. Four key principles to consider when designing and siting an e-mobility hub include:

1. **Active transportation first:** Enable people to walk or bike for five minutes on protected, well-lit lanes. People arriving at the hub by bike need secure storage. Include a charging dock for scooters and e-bikes so fully charged "micromobility" is ready to go when travelers arrive.
2. **Connect people to affordable and clean shared rides:** Prioritize transit connections in site design and layout with adequate loading spaces and quick connections to light rail and/or buses. Use distinctive, illuminated shelters with signage for pick-up and drop-off facilities for ODT and carpools. Include dedicated DC fast charging for drivers so that ride-hailing and on-demand transit vehicles can quickly charge on site or very close by between passengers or when waiting for transit to arrive.
3. **Electric cars where transit doesn't go:** Ensure adequate parking and use parking apps so that long-distance commuters can reserve spots in advance. Electric car-share vehicles are on site and fully charge. Equip parking lots with Level 2 charging—some dedicated to car-share vehicles and some for commuter cars—and Level 1 outlets so long-distance drivers can plug in continuing the commute on transit.
4. **Sustainable design:** Activate the hub with attractive design, art, and services that can encourage people to visit nearby business and community gathering spots. Provide free and fast Wi-Fi and plugs for charging cell phones. Enable travelers to order a shared ride or check out shared vehicles from a kiosk or from attendant or kiosk at the hub. Install electronic reader boards with real-time transit travel information that can be read from a distance. Incorporate solar energy and energy storage where appropriate to reduce grid demand. Add e-commerce lockers and a dedicated cargo delivery space so that people can pick up packages, groceries, or other items at the e-mobility hub.

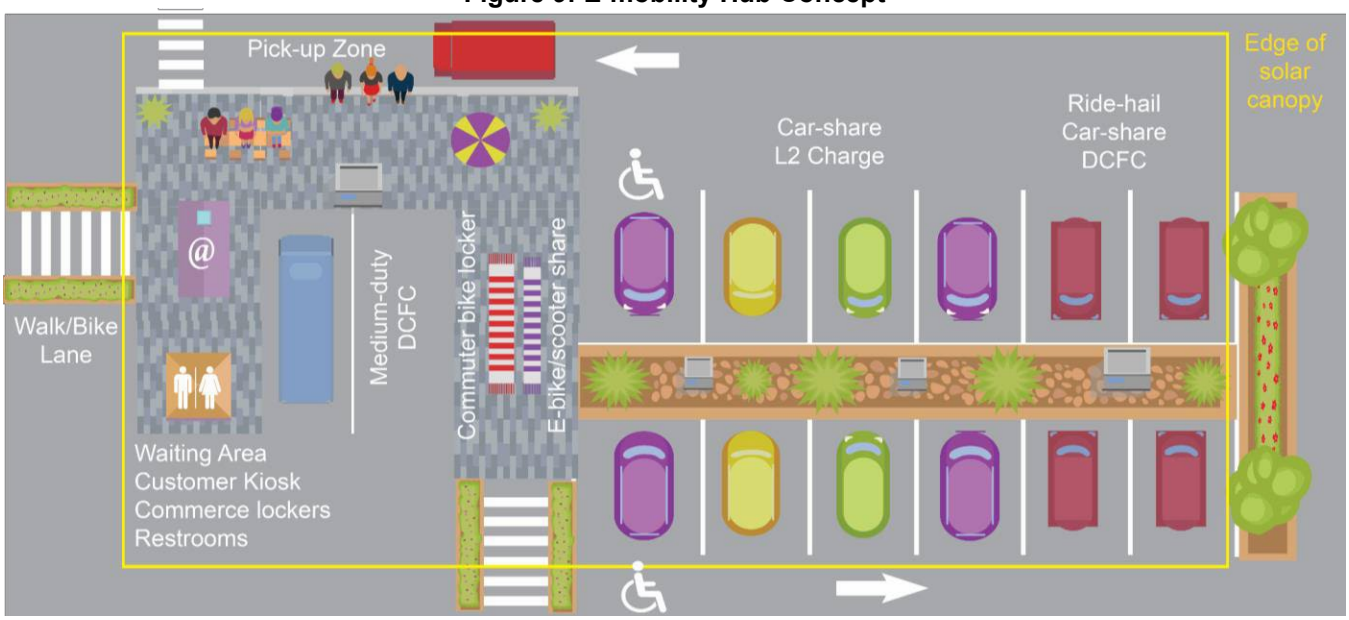
Ideally, e-mobility hubs will be located where multiple mobility modes already converge. Mobility hubs might also include charging stations for transit buses, but hubs could be sited at light rail stations and travelers will use other modes of transit to quickly reach their destinations. The team proposed a modular concept that can be at or near any high-capacity transit station and is intended to fit within a standard park-and-ride lot. **Figure 9** demonstrates the scalable e-mobility concept that can be deployed together or as individual elements.

The team's e-mobility concept envisions re-configuring surface parking into a flexible, modular design prototype that can be scaled up or down depending on available space, mobility demand, and electrical capacity. Optionally, some elements could be adjacent to the transit stop—across the street or at a nearby community center.

As the anticipated demand for shared e-mobility services continues to grow, facilities can be expanded and replicated at other transit locations to provide a regional multi-modal e-mobility network. The modular approach also future proofs the regional transit system as shared mobility becomes more convenient and economical than private vehicle ownership. For example, commuter parking spaces can gradually be replaced with docks for shared vehicles, a larger drop-off zone, or additional light rail tracks. The recommended Sacramento e-mobility hub concept includes features such as:

- Transit
- Microtransit (On-demand transit)
- Ride hailing and car sharing
- Micromobility
- Commerce
- Amenities
- E-features
- E-resources and information

Figure 9: E-mobility Hub Concept



Source: City of Sacramento

Because local government support is essential to ensure the hub serves social and environmental goals, the City could provide program management or management support for hub development, but not lead actual day-to-day operations. A third-party non-profit or community-based organization could manage daily operations. However, the right agency to operate the facility may depend on the funding sources, property ownership, or other nuances of any project. For example, the City could provide overall program oversight, including the following. These roles could also be filled by another agency, or implemented in partnership:

- Facilitate necessary conversations between project partners, stakeholders, and community stakeholders to guide project implementation.
- Work with the private industry partners to communicate and enforce City objectives, such as an emphasis on reducing vehicle likes traveled.

- Coordinate project partner meetings which to occur quarterly (at a minimum) and serve as the line of communication between the City and other regional partners.
- Hold the funding agreement with potential third-party funders and execute other contracting mechanisms with project partners and additional partners as appropriate but not own or have any legal interest in the equipment installed through this agreement.
- Coordinate with other departments that may contribute to the program like Transportation, Parking, Engineering and Facilities as well as the Department of Community Development including Planning and Building, and Information Technology Department.

Based on public records of similar projects' initial costs, the estimated startup costs for this concept range from $2.7MM - $3.5MM. These costs do not include operational costs for the first two years, due to the absence of available data.

CHAPTER 7:
Community Engagement

Summary

This task summarizes project tasks completed for the direct engagement of community leaders and residents on issues of EV awareness, adoption, workforce development and other topics related to the overall EV Blueprint project.

Task 7.1: Develop and Implement an EV Engagement Program

The goal of this task was to create and launch a community-wide EV engagement program to support implementation of Sacramento's EV Blueprint, relying on various approaches and types of events. The team developed an outreach strategy, outreach materials, and a summary of public outreach and community feedback to inform project recommendations.

The team participated in over 15 events from April to June 2019 in the City of Sacramento to increase EV engagement and identify barriers and opportunities to EV adoption. The events ranged from presentations to pop up booths or working sessions. To maximize participation, the project team attempted to show up at existing events, where community members were already present. Each event included complimentary materials such as posters, a survey in both online and a poster/dot voting format, curriculum, PowerPoints, interactive activities, and fact sheets. Events aimed to reach out to diverse community groups, residents, and neighborhoods. City staff sought to engage representatives and leaders of disadvantaged communities, such as key representatives from local community-based organizations serving those communities. While meetings were held in a variety of locations, the project team focused on attending existing events where communities were present , in order to remove barriers to listening and engagement. A key objective for these events was to identify perception, opportunities, and issues for EV adoption in low-income communities (LIC) and disadvantaged communities (DAC) in particular.

Table 7: List of Events

Date	Event/Group	District	Audience or Primary Target
4/4/2019	Sneak Preview: 2019 Title 24 Highlights	District 3, Citywide audience (event hosted at SMUD)	Building industry
4/17/2019	Clean Cities meeting, Lion Experience Center	City-wide	Fleet managers
4/19/2019	Drive Electric Earth Day at Kaiser South	District 8	Community, employees
4/22/2019	General Plan Workshop at Hagginwood Community Center	District 3	Community
4/25/2019	General Plan Workshop at Pannell Community Center	District 5	Community
4/28/2019	ECOS Earth Day at Southside Park	District 4 City-wide audience	Community, visitors
4/29/2019	General Plan Workshop at Oak Park Community Center	District 5	Community
4/30/2019	Joint Property Business Improvement District (PBID) meeting	City-wide	Businesses and property owners
5/7/2019	Pocket/Greenhaven Community Association Working Session	District 7	Community
5/8/2019	General Plan Update Special Visioning Workshop for Planning Academy Alumni	City-wide audience	Community
5/15/2019	Northern California Alt Car Expo	City-wide audience, many people who work downtown	All
5/30/2018	Let's Move! Community Event (Envision Broadway + Vision Zero Broadway/Stockton + EV Blueprint)	District 5	Community
6/8/2019	Sac to Zero Launch Event	District 4 City-wide audience	Community
6/20/2019	Sacramento Food Bank and Family Services Network Event	City-wide	Community and Service Providers

Source: City of Sacramento

Summaries of each event can be found in the Task 7.1 memo, but highlights of lessons learned are listed below:

- When speaking with industry and developers, most people thought the EV Ready option as a mandatory local code was reasonable.
- Most attendees at General Plan workshops were:
  - Aware of EVs, but do not own one
  - Unsure of whether an EV will save them money or if it's a safe transportation mode
    - Even EV advocates don't have a simple answer about how much is costs to charge an EV compared to filling a tank with gasoline.
  - Charging time was also an area of unknown for most of the attendees at this workshop
- Mapping activities were often limited because most attendees were not from the neighborhood and could not draw their routes on map.
- There is a need for community trainings on EV use and technology.
- Some of the biggest concerns for EV adoption were centered around price of initial purchase and investment, including buying an EV and installing a home charger.

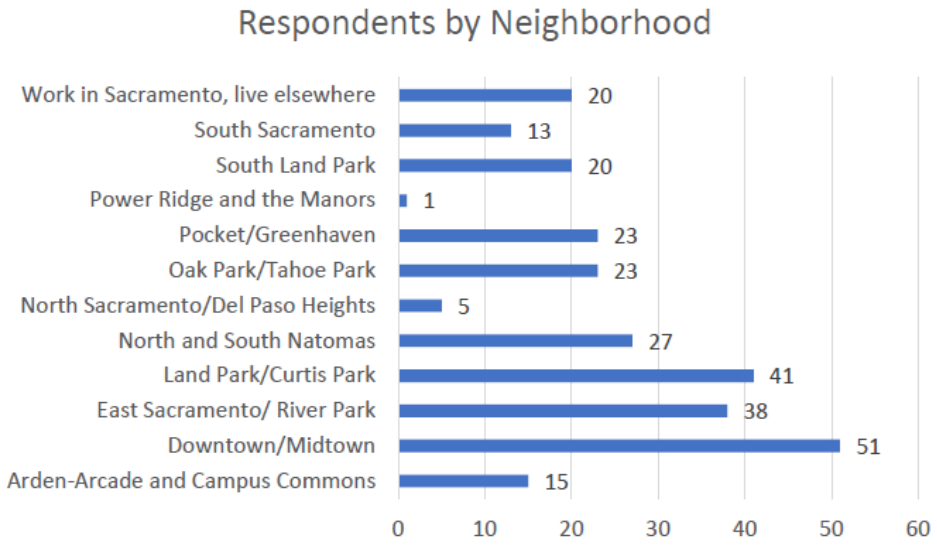
- For many, a personal car is the only option for getting to and from work in a timely fashion, and a lack of charging at the destination is a significant barrier to EV adoption.
- Messaging can be multifaceted, from many stakeholders and can be confusing: Property Business Improvement Districts (PBIDs) wanted a simple fact sheet to communicate more clearly with the businesses in their districts.
- Some communities expressed a lack of trust for car share or bike share apps since they have tracking capabilities; this was raised as a potential concern by communities of color in particular.
- There is a lack of awareness of the broad range of makes and models that offer EVs; almost all participants that played "Spot the EV" were surprised to learn that all 20 cars were EVs.
- Overall attendees seemed excited about the idea of a mobility hub and its potential long-term impacts on the community, both environmental and financial. Some expressed a need for an attendant or kiosk for customer support and education.

The team also developed an online survey to identify transportation patterns and barriers and opportunities for EVs throughout the City of Sacramento. The survey was posted on the www.CityofSacramento.org/EV website and was publicized through City outlets and EV Blueprint Strategy events throughout the duration of the project.

307 survey responses were returned, which is not statistically valid for the City's population size (a population of more than 500,000 people). Respondents that opted to participate in the survey may have a predisposition about the topic. Of the 307 responses, 277 are valid as people who live and/or work in Sacramento. Several responses were excluded from the analysis, including two responses because they were test answers, two responses because respondents took the survey to express an opinion about off-topic matters, and additional responses that were deleted because they were from people who live out of state.

Respondents were rather equally split between men and women and covered a wide geographic distribution throughout the City, as shown in **Figure 10** below.

Figure 10: Online Survey Respondents by Neighborhood



Source: City of Sacramento

Select findings are highlighted below:

- Consistent with input from outreach events, people drive more miles on a daily rate than statistics tell us. Data from the 2015 American Community Survey indicates that 8% of Sacramento residents drive 25 to 50 miles from work census block to home census block.
- When correlated with feedback from events and workshops, the lack of understanding about the cost to operate an EV is a barrier. The EV industry can't make an apples-to-apples comparison about the cost to charge a car and the cost-per-gallon of gasoline because electricity prices vary on the time of day, the place you plug in, the pay-per-charge scheme of the EVSE provider, and the level of charging.
- Another barrier is the price of the car, which is well-known and understood. For many people, cost is not specific to buying an electric car, but to buying a car at all (electric or gasoline-powered).
- Car-sharing is a relatively new concept so it's not surprising that respondents still need more information about how the EV car share programs work in general. Results of this part of the survey may have been influenced by the presence of GIG and Envoy at one outreach event. One consideration is that the people with access to bike sharing were more aware about car sharing, and a good first step may be to introduce electric bike sharing to areas such as the Pocket and South Land Park neighborhoods.

Task 7.2: EV Mobility and Opportunities Curriculum

The goal of this task was to create new educational materials on EVs and EV mobility programs targeted to the issues and needs of disadvantaged communities. The materials were used at various outreach events and will serve as a helpful communication tool for the City and its partners in the future. The curriculum compiled multiple existing resources into a comprehensive overview. These products include information on the benefits of EVs to combat pollution and climate change, provides information about EVs, incentives available, ZEV transit, charging infrastructure and options, and carsharing. It is all packaged as a four-page "Clean Air Gazette" booklet in a friendly, approachable format. The products even include a "test your knowledge" section at the end. Figure 11 shows the cover from a children's activity created for this task, the Clean Air Gazette.

Figure 11: Cover Page of the EV Curriculum

City of SACRAMENTO

Clean Air Gazette

VOL. 1 Issue 1 | City of Sacramento | Spring 2019

ELECTRIC VEHICLES COMBAT POLLUTION

AIR POLLUTION EFFECTS our economy and quality of life. Although Sacramento has significantly reduced air pollution levels, many residents breathe unhealthy levels of air pollutants—PM, NOx, and VOCs—during some part of the year. The Sacramento valley is like a bowl; during the summer, strong winds clamp a lid on the bowl trapping pollution and building ground-up ozone. In the winter, low pressure systems move in and create a similar effect.

"Ozone pollution is a corrosive gas," said Bonnie Holmes-Gen, director for air quality and climate change with the American Lung Association in California. "It actually causes burns on lung tissue, like a bad sunburn ... It can cause long-term health problems. It can worsen asthma symptoms and contributes to heart attacks and early death."

Greenhouse gases are also air pollutants. CO_2 released from transportation and energy production are causing global warming. Small changes in the average temperature of the planet can translate to large and potentially dangerous shifts in climate and weather, which will impact Sacramento.

Although these air pollution villains come from many sources, transportation is a leading cause of pollution and greenhouse gas emissions.

Sac To Zero is one City of Sacramento combating the air pollution villains with electric cars.

Electric Cars 101

"EV" IS A GENERAL TERM for any car, truck or bus that runs on battery power and is recharged with electricity. EVs use electric energy to turn a motor that propels the car. EVs do not create pollution from the tailpipe and are called "zero emission vehicles."

Most EVs travel 100 miles or more on a full charge and have a smooth, silent operation. A variety of cars are already on the market and more are coming. SMUD makes it easy to shop for EVs at smud.zappyride.com.

Charging an EV is as simple as plugging in. Each car has its own cord and will slowly charge from a standard outlet-about three miles of range for every hour plugged in. Car charging equipment have cords that connect to the car and charge much faster; up to a full charge in an hour!

Sac To Zero has four initiatives to increase EVs in Sacramento: Own, Share, Ride and Charge.

Source: City of Sacramento

APPENDIX A:
List of Abbreviations

ACS	American Community Survey
CALeVIP	California Electric Vehicle Infrastructure Project
CALGreen	California Green Building Standards Code
CBSC	California Building Standards Commission
CEC	California Energy Commission
CVRP	Clean Vehicle Rebate Program
DAC	Disadvantaged community/communities
DCFC	Direct current fast charger
DMV	Department of Motor Vehicles
EV	Electric vehicle
EVSE	Electric vehicle supply equipment ("chargers")
FCEV	Fuel-cell electric vehicle
ICCT	International Council on Clean Transportation
L1	Level 1 EVSE: charger at 110-120 volts, 4-6 miles of range per hour of charge
L2	Level 2 EVSE: charger at 208-240 volts, 10-20 miles of range per hour of charge
PBID	Property Business Improvement District
PEV	Plug-in Electric Vehicle
PHEV	Plug-in hybrid electric vehicle
RFP	Request for proposals
SACOG	Sacramento Area Council of Governments
SacRT	Sacramento Regional Transit
SMAQMD	Sacramento Metropolitan Air Quality Management District
SMUD	Sacramento Municipal Utility District
ZEV	Zero-emission vehicle

Attachment 2: Sacramento Electric Vehicle Blueprint – Task 3.6 Community EV Planning Blueprint

Sacramento EV Blueprint

Task 3.6:
Community EV Planning Blueprint

ARV-17-042

Prepared for the City of Sacramento by Frontier Energy and DKS Associates

Contents

Task 3.6: Community EV Planning Blueprint

The goal of this task to prepare a blueprint report summarizing Sacramento's approach to advance EVSE in new construction. This report also identifies the contribution of future EVSE in new construction to achieve the goal of 75,000 zero emission vehicles by 2025.

Issues, Constraints, Opportunities, and Costs

The Task 3.1 report, *Constraints and Opportunities to Accelerate Electric Vehicle Supply Equipment in New Construction*, describes the California Green Building Standards (CALGreen). Sections of the code describe mandatory and voluntary standards for future installation of electric vehicle charging in attached garages and parking spaces. The mandatory provision is referred to as "EV Capable." Local ordinances that require greater degrees of readiness refer to EV Ready and EV Installed. Figure 1 shows the difference between the terms.

Figure 1: Degrees of EV support in state code and local building ordinances

To advance EV infrastructure, the team identified opportunities to use City codes to encourage more EV charging to support reaching the goal of 75,000 EVs by 2025. These opportunities are based on technical analysis, cost-effectiveness, and feedback and vetting with stakeholders, Planning Commissioners, and City staff:

1. Develop a local ordinance (building code) to make EV Ready mandatory (installation of a 240-volt outlet and supporting electric supply). Initial cost estimates confirmed through stakeholder input estimate that EV Ready will cost about $1,100 per installation, an 11% increase from the estimated $800 for EV Capable.[1]
2. Revise existing and enact new City codes that require and incentivize EV support in parking lots, separate from building construction.
3. Revise existing City codes to incentivize EV car-sharing as projects that meet requirements for reducing vehicle miles traveled (VMT), or to require EV spaces when projects exceed parking maximums.

[1] California Air Resources Board staff estimate that the cost to install a raceway with an adequate panel capacity is approximately $800 per EV charging. A 2016 City of Oakland cost effectiveness report estimated total cost of an EV-ready space at $1,300. A 2016 City and County of San Francisco report estimated $900. The average of the two values is $1,100.

Each code revision or adoption requires stakeholder engagement and public comment, and then must proceed through the City's internal processes to determine approach, and establish local ordinances and documentation, if pursued.

Building Code

The 2019 California Green Building Code (CALGreen)[2] will be published in July 2019 and go in effect on January 2020. Specific to EV charging, the new code cycle requires all new construction and major alterations[3] as follows:

- Single-family residences, including townhomes and duplexes, be EV Capable
- Non-residential construction has 6% of parking spaces EV Capable
- Multiunit dwelling (MUD) construction has 10% of parking spaces EV Capable

The EV Blueprint project identified the process for Sacramento to follow to create a local ordinance that requires all new construction be EV Ready (circuit breaker, wires, and a 240-volt outlet.) This will ensure that new construction is ready for a resident or tenant to plug in a car without undue cost burden to the real estate developer. Stakeholder feedback at meetings and through focus groups indicated that developers and property owners would not oppose this local ordinance but cautioned that EV Ready would be one of many small construction-related cost increases. After a City public process, if passed, the ordinance would have to be filed with the California State Buildings Standards Commission, a process detailed in Task 3.4, *EV Readiness Guidelines*.

City Code

The team identified opportunities in City codes to increase EV charging locations—and potentially EV car-sharing locations—independent of building construction and alteration by focusing on parking and parking lots. Two potential code revisions enable the property owner or developer to reduce the number of required parking spots. WGI, a construction firm that specializes in parking structures, estimates that surface parking costs $5,000-$10,000 per space to construct, excluding the cost of land.[4] If a $6,000-to-$8,000 investment in a Level 2 electric vehicle service equipment (EVSE) can enable a developer to reduce four parking space to two, the cost saving could be an attractive investment. Additionally, fewer parking spaces can help meet the City's goal of reducing vehicle miles traveled. Opportunities in City code are:

1. Revise the existing City code "Transportation management plan measure"[5] to specify that a greater degree of EV charging support than required in City building code or implementation of EV car-sharing are acceptable measures to reduce the minimum number of parking spots. A developer that voluntarily complies with EV Installed or hosts an onsite EV car sharing hub can reduce the minimum number of parking spaces. Cost savings from construction and ongoing maintenance of parking spaces could pay for EVSE and increase

[2] http://www.hcd.ca.gov/building-standards/calgreen/docs/2018CALGreen-LegReport.PDF
[3] Code defines major alteration as a permit value of $200,000 or 1,000 square feet
[4] https://wginc.com/wp-content/uploads/2018/07/Parking-Construction-Cost-Article-17x11-8.5x11-Pages.pdf
[5] https://www.qcode.us/codes/sacramento/view.php?topic=17-vii-17_700-17_700_070

the availability of public charging, particularly in low-income and disadvantaged communities.

2. Revise existing City code "Development standards for off-street parking facilities"[6] to describe the location, size, and signage required for EV spaces in parking lots and structures to create a common understanding for designers, developers, contractors, and City staff to ensure that EV spaces are included in parking facilities in a manner consistent with building codes. This code has no associated cost and creates common understanding about EV parking spaces.
3. Add a new section to "Development standards for off-street parking facilities" to require that when developers install new light poles, solar canopies and carports, security gates, booths, and other structures that require electricity adjacent to parking spots they must include EV charging support.
4. Revise existing City code "Parking requirements of land use type and parking district" [7] to require EV support consistent with the building code requirement in stand-alone parking lots and parking garages. Surface parking and parking structures are often exempt from CALGreen code.[8]
5. Revise existing City code "Alternatives to standard parking requirements; other modifications"[9] (called the administrative parking permit) to enable developers to install above-code EVSE to deviate from minimum parking requirements.
6. Revise City Code "Waiver of minimum and maximum parking requirements"[10] to require that any additional parking spaces above the maximum vehicle requirement will be constructed as EV installed parking spaces.
7. Create a new code based on existing City code "Tree shading requirements for parking lots"[11] that will require compliance with City code for EVs during expansion of surface parking lots. Like the Tree shading code, language will be specific about the definition of expansion and include exceptions.

On June 13, 2019, City staff presented these options at the Planning and Design Commission meeting.[12] After a presentation, questions from the commissioners, and comments from two members of the public, the Commission recommended that staff move forward with the formal adoption process for all codes.

[6] https://www.qcode.us/codes/sacramento/view.php?topic=17-vi-17_608-17_608_040
[7] https://www.qcode.us/codes/sacramento/view.php?topic=17-vi-17_608-17_608_030
[8] Parking lots are exempt from CALGreen standards because they are not buildings. Parking garages are considered S-2 occupancies (storage) and have several exemptions from CALGreen.
[9] https://www.qcode.us/codes/sacramento/view.php?topic=17-vi-17_608-17_608_060
[10] http://www.qcode.us/codes/sacramento/view.php?topic=17-vi-17_608-17_608_070&fram
[11] https://www.qcode.us/codes/sacramento/view.php?topic=17-vi-17_612-17_612_040
[12] http://sacramento.granicus.com/GeneratedAgendaViewer.php?view_id=34&clip_id=4421

2040 General Plan

During this project, Sacramento started the update to its General Plan. The team identified two opportunities to expand wording in the General Plan's Mobility Element. [13]

1. Expand mobility to include microtransit and car sharing, and include Level 2 and DC fast charging hubs and hydrogen stations that can support transit, car-share and mobility hubs.
2. Distinguish charging hubs and hydrogen stations in the Parking section as methods of reducing greenhouse gas emissions.

In 2021, electricity will be regulated as a fuel[14] and, as such, zoning that applies to fuel stations could apply to charging locations. The City of Sacramento is working with State and County agencies to stay informed as the proposed regulation makes its way through the comment and implementation periods.

Citywide EV Forecasts, Targets for New Construction, and Gaps

Task 2.1, *EV Data and Forecasts*, looked at many factors to estimate the population of vehicles in general and at zero emission vehicles (ZEVs) as of January 1, 2019. Table 1 shows the calculations used to arrive at the baseline number of 4,772 total ZEVs and 2,468 battery electric vehicles (EVs) in Sacramento zip codes. Fuel cell electric vehicles are FCEVs and plug-in hybrids are PHEVs.

Table 1: Estimated baseline of all ZEVs as of 1/1/19

	EV	FCEV	PHEV	Total
DMV 1/1/18 registrations[15]	1,887	79	1,751	3,717
CVRP rebates 1/1/18-9/30/18[16]	290	26	219	535
Additional 30% ZEVs that did not apply for rebate[17]	87	8	66	161
Estimated ZEV registrations 10/1/18-12/31/18	126	11	95	232
Total estimated vehicles in Sacramento on January 1, 2019	**2,390**	**2,131**	**124**	**4,644**

According data from the Alternative Fuel Data Center and PlugShare,[18] Sacramento had 110 public and workplace charging locations that were open and under construction in January 2019 with 612 connectors, as listed in Table 2. This doesn't include EVSE that were in planning and permitting stages.

[13] http://www.cityofsacramento.org/~/media/Corporate/Files/ParksandRec/NS/content/Public%20Review%20Draft%202035%20General%20Plan%20full%20DocumentReducedA%2081414.pdf Page 2-99
[14] https://www.cdfa.ca.gov/dms/regulations.html
[15] Includes light-duty, heavy-duty, commercial, and exempt vehicles. https://www.dmv.ca.gov/portal/wcm/connect/c24637c9-5faf-4fe2-9375-9b5221a2ef4a/motorvehiclefueltypes_city.pdf?MOD=AJPERES&CVID
[16] https://cleanvehiclerebate.org/eng/rebate-statistics
[17] Based on conversations with SMUD, Center for Sustainable Energy, and UC Davis
[18] https://www.plugshare.com/

Table 2: Public charging available and under construction

Total Charging Connections	612
Level 1 (wall outlet—full charge in 8+ hours)	72
Level 2 (full charge in 4-6 hours)	454
DC Fast Charging (full charge in less than an hour)	39
Tesla-only (uses a specific connector)	47

Task 2.1 also used available data to estimate the number of new light-duty vehicles, which included cars, pick-up trucks, SUVs, and vans in Sacramento zip codes and estimated that in 2017:

- 26,600 new light-duty vehicles were registered in Sacramento
- 11,000 used light-duty vehicles were purchased from a dealership and registered in Sacramento

Statewide, new light-duty vehicle sales have been consistent at about 2 million a year since 2015 and expected to be 2 million again in 2019.[19]

Based on calculations in the Task 2.1 report, Table 3 illustrates the percentage of ZEVs as new car registrations needed to reach 75,000 ZEVs by 2025. *These numbers are to help understand how quickly sales must ramp up and not meant to be used as sales projections, forecasts, or estimates.*

Table 3: Illustration of percentage of new vehicle sales needed to reach ZEV target

Date	Registered ZEVs	Total Vehicles	Assumed new ZEV registrations	Assumed new ZEV registrations	Percentage of new vehicle registrations
1/1/2018	3,717[1]	591,134[1]	26,000[3]	0.63%	3%
1/1/2019	4,644[2]	617,134	26,000	0.75%	4%
1/1/2020	8,000	643,134	26,000	1.24%	15%
1/1/2021	12,000	669,134	26,000	1.79%	23%
1/1/2022	18,000	695,134	26,000	2.59%	35%
1/1/2023	27,000	721,134	26,000	3.74%	42%
1/1/2024	38,000	747,134	26,000	5.09%	65%
1/1/2025	55,000	773,134	26,000	7.11%	77%
1/1/2026	75,000	799,134		9.39%	
Cumulative new ZEV registrations			**208,000**		

1) From DMV data on 1/1/18 2) From estimates in this memo
3) Doesn't include new trucks, buses, or medium-duty vehicles that are included with DMV data

It is important to note that conversations with Sacramento area new car dealers, SMUD staff, and other stakeholders indicated that Sacramento residents do not turn over their vehicles as quickly as other residents in the state and 26,000 new registrations a year may be ambitious.

[19] https://www.cncda.org/wp-content/uploads/Cal-Covering-4Q-18.pdf

Task 2.4, *EV Infrastructure Deployment Plan*, projected the need for additional charging infrastructure. To support 75,000 light-duty EVs, in addition to existing charging connectors, it is estimated that Sacramento needs:

- 738 Workplace Level 2 connectors
- 398 Public Level 2 connectors
- 399 DC fast charging connectors
- 6,600 multifamily dwelling connectors
- 53,664 Level 1 or Level 2 connectors at single-family residences

From planning data provided by the City of Sacramento Community Development Department, the number of EV spaces from new construction planned as of January 2019 is shown in Table 4.

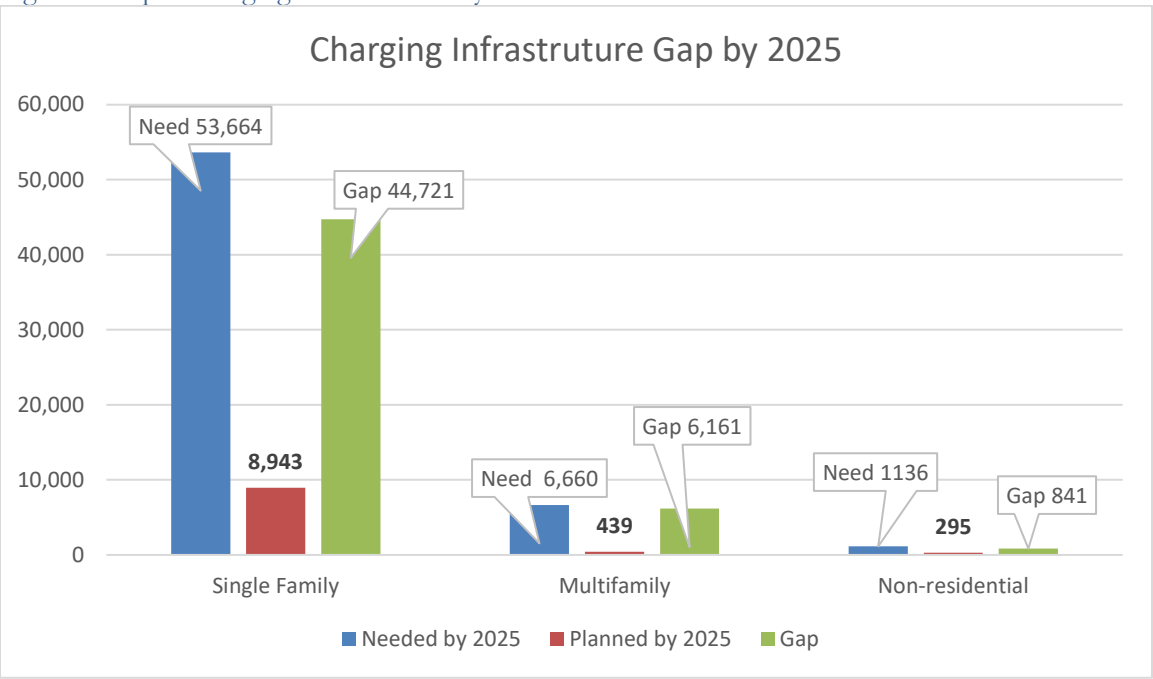
Table 4: Number of new EV spaces from planned development

Structure	# EV Spots added by 2021	# EV Spots added 2022-2024	# EV Spots added 2025-2029	# EV Spots added 2030 and after	Total
Single Family	3,660	3,621	1,662	None listed	8,943
Multifamily	331	81	23	0	439
Non-residential	200	63	0	32	295
Grand total	4,191	3,765	1,685	32	9,667

It's important to note that the CALGreen code requires EV Capable spaces. A more-stringent local ordinance will ensure that each of these nearly 10,000 parking spots is ready to charge a car.

New building projects will always enter the planning and building cycle and will increase the number of EV spaced in 2022 and beyond, and builders may add more EV connectors in later years, However, between now and 2025 reliance on building codes alone will not result in enough locations for charging, as shown in Figure 2.

Figure 2: Gap in charging infrastructure by 2025



Incentives from SMUD, the Air Resources Board's California Electric Vehicle Infrastructure Program (CALeVIP),[20] Electrify America[21] and other potential funders may provide dozens of charging locations but will not fill the gap.

How Codes Help Fill the Gap

By requiring EV charging as a function of parking instead of building, the City could add thousands of EV parking spots at existing multifamily dwellings, workplaces, and parking lots over 10 years. When a parking lot undergoes a major expansion (not simply repaving or restriping) or adds an accessory structure that requires electric service (e.g., solar canopy, freestanding light poles), it could be required comply with building code requirements for EV charging as part of the renovation. For example, if the building code requires EV Ready (panel capacity and a 240-volt plug), then City code could require the same degree of support in a parking lot. The following three scenarios are examples of how City codes might apply to parking lots.

Example Scenario 1

If the parking lot in Figure 3 added solar canopies to generate electricity and shade or expanded parking into the vacant lot, City code could require EV Ready outlets be added at the same time. The property owner could choose to upgrade to Level 2 of DC fast chargers that could collect a fee for charging vehicles. The availability of vehicle charging may encourage one or more tenants to purchase EV fleet vehicles that could charge overnight, encourage hotel guests to rent EVs or use EV car-share vehicles, or encourage taxi and ride-hailing drivers to use EVs.

[20] https://calevip.org/
[21] https://sactozero.com/

Figure 3: Gateway Center in Natomas with nine office buildings, two hotels, and one vacant property. Zero EV charging.

Example Scenario 2

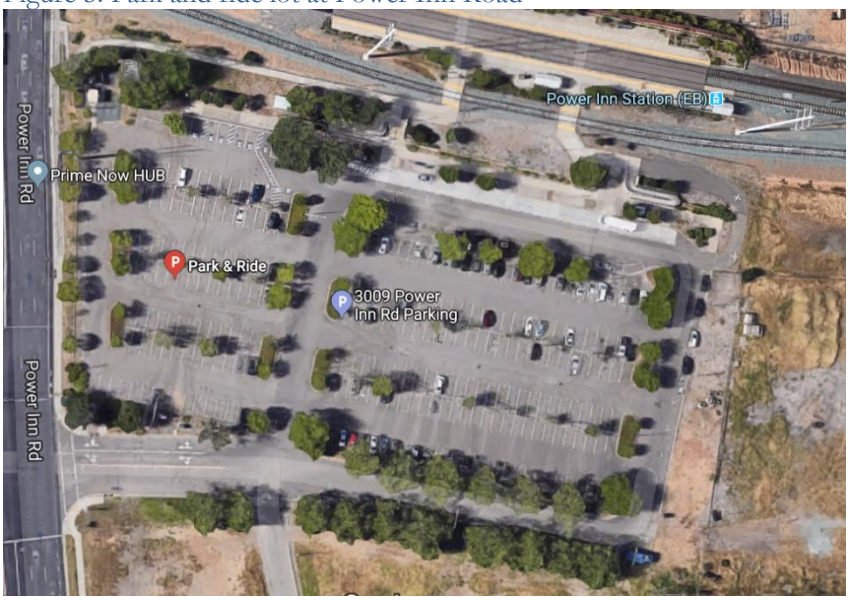
Figure 4 is an aerial view of a development site near Sacramento's old arena as submitted to the Planning Commission in 2017. It shows one of the eight hotels proposed to be built around the old arena, labeled Sleep Train Arena in the picture. City codes currently allow the developer to build fewer parking spaces than required by employing one or more methods of reducing transportation-related greenhouse gas measures. Revised City code could specify that Level 2 charging infrastructure (EV Installed) and/or EV car sharing are allowable measures that could to reduce parking spots by up to 35%. Code can additionally require that EV charging and car sharing be available to all employees, tenants, guests, or the public. Including this measure could reduce overall VMT and create a profitable business model for a car-share operator that could encourage more cars at additional locations in the community.

Figure 4: One of eight hotels being planned for Arena reuse area

Example Scenario 3

Figure 4 is a Google map view of the Park & Ride lot on Power Inn Road. Parking lots that are not attached to a building are exempt from building code requirements. By identifying surface parking lots and parking structures in City code, new lots can be required to have the same EV charging support as the building code requires. Parking lot operators may choose to install pay-per-use chargers that could generate revenue.

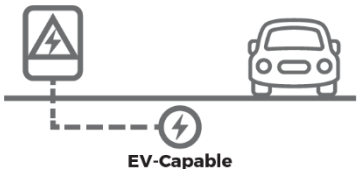
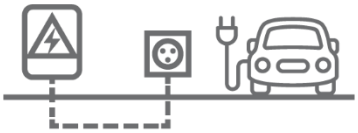
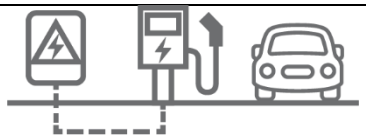
Figure 5: Park and ride lot at Power Inn Road



Cost-Benefit Findings

Task 3.2, *EV Infrastructure Cost-Effectiveness Study for Sacramento*, estimated the cost of complying with degrees of EV support during new construction. Table 5 shows the mean cost per parking space for each degree of EV support independent of the type and size of the building.

Table 5: Estimated costs of degrees of EV support per EV charging space

EVSE Support	Technical Components	Average Installation Cost	Average EVSE Unit Cost	Average Total Cost	Percentage Increase Over Mandatory
EV Capable[22] (mandatory in State building code)	 Raceway, Circuit	$800	N/A	$800	NA
EV Ready[23] (240-volt plug)	 Raceway, Circuit, Wiring, Outlet	$1,100	N/A	$1,100	11%
EV Installed[24] (non-networked, pedestal mounted Level 2 EVSE)	 Raceway, Circuit, Wiring, L2 EVSE	$3,000	$3,000	$6,000	60%

The cost benefit is realized by the resident/tenant who avoids a future cost of installing wiring and hardware for EV Ready or EV Installed, and by the City of Sacramento from reduced greenhouse gas emissions and air pollutants. The Task 3.2 report shows that an EV Ready parking space will cost about $1,100 when installed during construction. Findings from Bay Area cities show that the same level of compliance in a retrofit can cost $2,370 to $3,750 per parking space.[25]

[22] California Air Resources Board staff estimate that the cost to install a raceway with an adequate panel capacity is approximately $800 per EV charging.
[23] A 2016 City of Oakland cost effectiveness report estimated total cost of an EV-ready space at $1,300. A 2016 City and County of San Francisco report estimated $900. The average of the two values is $1,100.
[24] From 2015 U.S. Department of Energy https://afdc.energy.gov/files/u/publication/evse_cost_report_2015.pdf
[25] The range considers the potential for breaking concrete to run electrical wiring through an existing wall and the length of conduit. Costs do not include additional upgrades to an electrical panel.

During an outreach event with electrical contractors, the group stated that should a parking space be EV Capable, the cost of bringing an electrician back to the site to later install the breaker, wires, and 240-volt outlet would likely cost $1,100—the same cost as installing EV-Ready during construction.

The Task 3.2 report also evaluated the cost effectiveness of installing additional solar panels to offset the energy use of charging a vehicle at multifamily and non-residential buildings. The 2019 Energy Code (Title 24 Part 6) of the California State Building Codes[26] will require additional energy efficiency measures and solar panels on all new construction. If the City of Sacramento proposes a local ordinance that requires photovoltaics (PV) in above State code requirement, the City must demonstrate to the California Energy Commission that energy savings will offset the cost of additional PV. Using CAL-ERES for energy modeling it was determined that additional PV at multifamily dwellings and non-residential construction only to offset light-duty EV charging would not meet the Energy Commission's cost-effectiveness requirements.[27]

In 2021 electricity will be regulated as a fuel and every EVSE that sells fuel will pay an annual fee to the County of Sacramento to cover the cost of testing. The Interim Agricultural Commissioner/Sealer at the County of Sacramento stated in an email that the County is considering a cost of $120 per EVSE annually. It will be important to calculate the $120 into operating and maintenance costs for all Level 2 and DC fast charging stations that accept payment.

Stakeholder Recommendations and Key Issues

Initial conversations with developers, property owners, low-income housing providers, and other construction-industry representatives indicate that they are amenable to the City of Sacramento requiring EV Ready (a 240-volt outlet) and that $1,100 per parking space is a valid mean dollar amount. The cautioned, however, that this $300 increase[28] is one of several proposed fee increases and to pay attention to the bottom line of combined fee increases. The City is currently working with Economic & Planning Systems, Inc. (EPS) to assess the feasibility of new community impact fees that every developer pays for water, sewer, parks, transportation, flood protection, and other services.

Members of the community expressed verbally and in writing that they support the City requiring greater numbers of EV parking spaces and made two suggestions:

- The City require that 20% of parking spaces at multifamily be made EV Ready instead of 10% of spaces because it will make charging available to more residents. (The 2019 CALGreen code requires that 10% of parking spaces at multifamily be EV Capable; 20% is the Tier 2 voluntary level.)
- Instead of requiring 10% of parking spaces be EV Ready, include a 120-volt outlet in every parking space. The theory is that the amount of energy needed for one 240-volt outlet could support six 120-volt outlets for the same cost. Because cars are parked for eight hours or more, the slow charge could replenish the range for most drivers.

[26] Effective January 1, 2020
[27] Task 3.2 did not include energy analysis and modeling for single-family homes.
[28] The incremental dollar amount between mandatory compliance (EV Capable) and EV Ready

Conversations with developers, the business community, and housing operators indicated that they would not support requiring 20% of parking spaces to be EV Capable or EV Ready. The expressed that it could put property mangers in the position of having too many dedicated parking spaces for several years and, therefore, not enough parking for other tenants. Developers stated that they would not support two measures that surpassed the state standard.

Property managers and the business community worried that putting 120-volt outlets in parking lots could both create an attractive nuisance and cause electricity bills to increase. A 240-volt outlet on a dedicated breaker can be submetered, but 120-volt outlets cannot. Tenants, guests, and passers-by could use 120-volt outlets for everything that needs electricity, from a cell phone to running household appliances.

Specific feedback from Sacramento Housing and Redevelopment Agency and Mutual Housing were that 240-volt outlets were affordable now and could later be upgraded to Level 2 chargers as need for EV charging increases over time.

Analysis and Recommended Approach to Advance EVSE

Building and city codes are tools that cities can use to require EV infrastructure, but the Sacramento EV Blueprint demonstrates that new construction cannot meet the need for charging infrastructure. To encourage more infrastructure, EV charging needs an attractive business case.

Many of the costs of EV infrastructure are outside of the control of a City. For example, electricity demand charges can make up as much as 90 percent of the monthly bill of operational public DC fast chargers, driving the cost of delivered electricity as high as $1.96 per kilowatt-hour—about seven times the cost of gasoline.[29] Utilities, including SMUD, work with EVSE providers and regulators on strategies that can reduce electricity costs, and the Air Resources Board recently added new crediting mechanism to the Low Carbon Fuel Standard to issue credits for ZEV infrastructure on a calculation of capacity, less the actual fuel dispensed.[30] Station operators can sell the credits which creates an income stream to offset operational costs. All of this is outside the purview of the City.

The State of California, Sacramento Metro Air Quality Management District, Sacramento Area Council of Governments, and SMUD all have incentive programs for public charging stations to reduce the capital costs of Level 2 and/or DC Fast Charging. In early 2019, the Air Resources Board launched the California Electric Vehicle Incentive Program (CALeVIP) in Sacramento to further encourage public charging infrastructure. This, too, is outside of the City's control, although City staff actively contribute as engaged stakeholders and plan to use this funding to upgrade many of the EVSE in City parking garages.

The City of Sacramento can play a role in reducing costs and developing a business case. During the Sacramento EV Blueprint project, the City identified five approaches that may reduce costs of installing EV infrastructure.

1. *Job training*

Interviews throughout the project identified a crucial need for more electricians. Several factors from a decade of de-emphasizing trades as a career path in high school to a construction boom related to wildfire reconstruction resulted in a shortage of electricians and a steep rise in wages. One Sacramento-area developer stated that two years ago he paid second-year apprentices about $20 an hour; currently he pays between $45 and $60 an hour. The International Brotherhood of Electric Workers (IBEW) Local 340 represents the Sacramento area and reported that it needs about additional 1,500 people in the apprenticeship pipeline. As detailed in Task 5.2, *EV Economic Pathways*, the City of Sacramento can collaborate with its partners to help prepare people to become electrician apprentices, which will reduce EVSE costs and provide residents with well-paying jobs.

[29] https://rmi.org/press-release/press-release-rmi-evgo-report-reveals-utility-rate-structures-support-fast-charging-growth/
[30] https://www.arb.ca.gov/fuels/lcfs/guidance/fci_userguide.pdf

2. Hotels and car-sharing

In 2016, Visit Sacramento[31] reported more than 200,000 hotel room nights and 400 meetings, conventions and sporting events. In 2019, Sacramento will begin expansion of the Convention Center and Mayor Darrell Steinberg announced a major revitalization of the Old Sacramento waterfront, one of the city's top tourist destinations. These projects, and others, will attract more visitors to our city and present an opportunity to reduce the number of gas-powered vehicles that visitors drive. Working with Visit Sacramento, the Sacramento Metro Chamber of Commerce, City of Sacramento Economic Development, and the property-based improvement districts (PBID), the City can facilitate relationships that could place EV car-sharing programs at area hotels and tourist attractions. Because visitors often use rental cars, taxis, or ride-hailing, they already expect to pay for local transportation. Shifting that transportation to a shared EV can increase the number of EVs in Sacramento, increase EVSE usage, build a profit model for car-share providers, and reduce the number of cars on Sacramento streets.

3. EVSE at City Facilities

Task 4.3: *Evaluate and Recommend EVSE Upgrades and Strategies to Optimize Public Charging Access* proposed five projects at City-owned facilities that can increase access to charging for residents that live nearby. To identify the five properties, the project team developed the EVSE Priority Siting Tool, an Excel model that combines land-use information with SACOG travel data. The team used the tool to narrow down a long list of City properties to those in low-income or disadvantaged communities, were somewhat isolated from transit stops, and were within safe walking distance of multifamily communities, retail, community services, and/or education.

Recommended opportunity locations and configurations are in Table 6.

Table 6: Recommended locations to add EVSE at City-owned properties

Community Centers, Libraries and Parks	Address	Potential EVSE
Hagginwood Community Center	3271 Marysville Blvd.	Two Level 2 EVSEs with two connectors
Oak Park Community Center	3425 Martin Luther King Jr. Blvd.	Two Level 2 EVSEs with two connectors
Samuel C. Pannell Community Center	2450 Meadowview Rd.	Three Level 2 EVSEs with two connectors
Martin Luther King Jr. Library	7340 24th St. Bypass	Two Level 2 EVSEs with two connectors
Oakbrook Park (under construction)	3341 Soda Way	One curbside Level 2 EVSEs with two connectors

Concept drawings and cost estimates for the five locations are at the end of this report.

[31] https://www.visitsacramento.com/articles/post/new-tourism-figures-shows-industrys-impact-in-sacramento/

4. E-Mobility Hubs

Mobility hubs are centers of connectivity where multiple modes of travel converge. They provide an integrated suite of mobility modes—safe walking and biking, transit connections, and cars; amenities like lockers, wayfinding, and enjoyable waiting areas; and technologies like dynamic parking management strategies, real-time traveler information, and real-time ridesharing. Mobility hubs can also depots for ride hailing, package delivery, and "kiss-and-ride" drop-off/pick-up zones.

Many cities are talking about and planning for mobility hubs, but Sacramento is taking a different approach with an e-mobility hub. As described in *Task 6.3: E-Mobility Opportunities*, an e-mobility hub includes charging infrastructure that supports zero-emission transportation. The flexible design is ideal for park-and-ride lots at Sacramento's light rail stations and can include reserved DC Fast Charging for working drivers—ride-hailing, package delivery, microtransit shuttles, and super commuters—and Level 2 charging for ride chaining (people who drive to the park and ride for one leg of the trip, and then take transit for the next leg). It also includes reserved Level 2 charging for ride-share cars and low-speed charging for electric bikes and scooters. On June 20, 2019, the EV Blueprint team led a short focus group with about 40 leaders of regional community-based organizations (CBOs) to solicit input on how this concept would work for the people they serve. All present could see how this concept could work: a client takes light rail to the e-mobility hub, then uses a transit card at a kiosk (or with an attendant) to check out an e-bike, call an on-demand shuttle, or rent an EV for the next leg of the trip. Representatives from three job training programs said that their clients are often late to or absent from classes because they miss a bus connection or can't get a ride. Representatives from two community health service organizations immediately focused on the ability to connect people with food, even suggesting that a farmer's market or lockers where the Sacramento Food Bank could leave deliveries could expand the hub's utility. Other organizations talked about making the hub come alive with art, music, and a garden. They suggested that the hub have an attendant that could help people use vehicles, caution drivers to watch for bicyclists, and loan items like car seats and tools for bike repair.

The concept drawing and cost estimate for the e-mobility hub are included at the end of this report.

5. Disadvantaged Communities

Greenlining Institute's Electric Vehicles for All Equity Toolkit[32] recommends focusing EV projects on identified community needs. The EV Blueprint team met one-on-one and in groups with several community-based organizations (CBOs) and identified opportunities for CBOs to prepare for an upcoming ARB voucher program. The Clean Mobility Voucher Program will be available to CBOs to establish and operate mobility projects that can include transit, bikes, and cars to address specific needs of a low-income or disadvantaged community. Sacramento can support potential project by leveraging local experience with clean mobility programs and workforce development efforts.

The City will also coordinate with the Electrify America-funded Sac to Zero programs to understand how the charging, car-share, and microtransit pilot programs address community needs. The City

[32] http://greenlining.org/publications-resources/electric-vehicles-for-all/#tab4-section1

will continue to coordinate with project stakeholders to understand actions the City might take to sustain the programs when private funding or public grants end.

Coordination Among Groups

Sacramento has an effective stakeholder group, the Sacramento PEV Collaborative, that meets monthly and discusses efforts, needs, and upcoming opportunities. During the Sacramento EV Blueprint project, the EV Blueprint team met with additional groups and identified two that are essential to meeting the City's 75,000 ZEV goal.

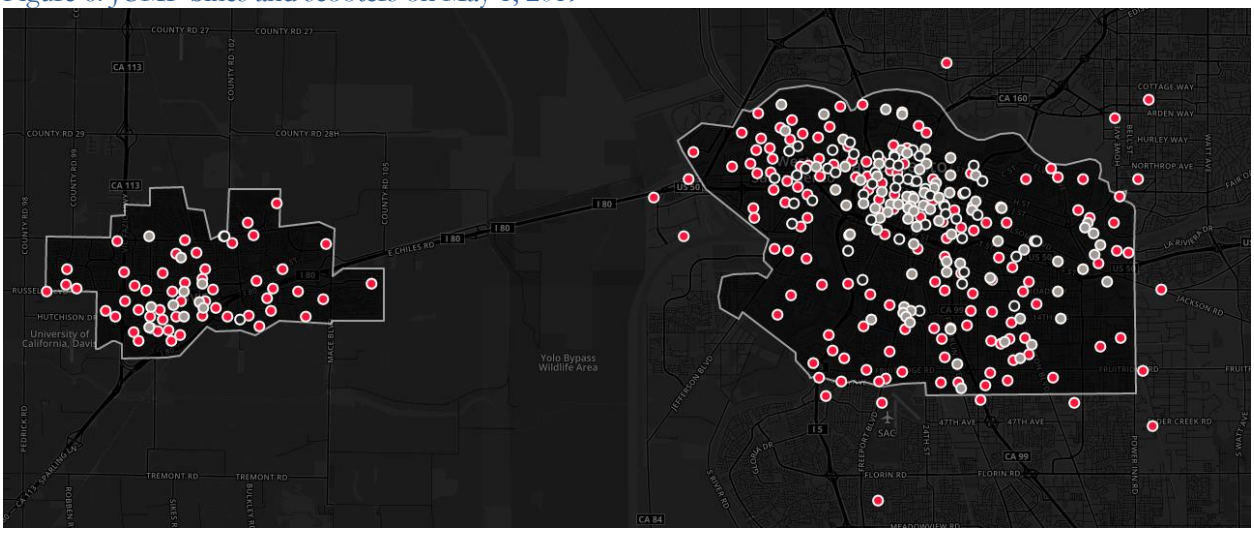
1. Business Districts

Property-based improvement districts (PBIDs) are public/private sector partnerships that perform a variety of services to improve the images of their cities and promote individual business districts. PBIDs are formed by the City and property owners who fund the district by a special assessment on their properties. The owners then form a board to direct how the funds are spent in the district. Sacramento has 11 PBIDs, each with an executive director and some with paid staff. PBID executive directors reported that they receive multiple requests from companies seeking partners for car- and/or bike-share hubs, locations for charging stations, and partners for other innovative programs. Closer collaboration with the City can better prepare the executive directors to respond to opportunities that can result in more charging infrastructure.

2. Data Scientists

Data science is an emerging opportunity the public and private sector. For example, greater Sacramento is home to the largest deployment of JUMP bikes and scooters, a shared mobility service. Figure 6 shows the home zones in Davis, West Sacramento and Sacramento outlined in white. Red dots are available bikes and scooters; grey dots are locations of bike racks. The dark area between the cities is a wildlife refuge. JUMP travelers can ride the vehicles between cities. Travelers must use the JUMP/Uber app to check out a bike or scooter. The app transmits the phone's location and speed, which data scientists analyze to understand travel behavior.

Figure 6: JUMP bikes and scooters on May 1, 2019



Smartphones track movement—the places a user visits, how many times they've been there, and the days and time of day they were there. Companies buy that data to target advertising, enable GPS-based services, and enable Internet of Things (IoT) devices like smart locks and thermostats. Transportation apps on a phone, including those that let you board a plane or bus, also track the phone's speed of travel. Transit agencies and urban planners are often customers for the analyzed data.

In Task 4.1, *Current Status and Utilization of Public and Workplace EVSE*, the City summarized the usage data of 22 City-owned networked Level 2 EVSE connectors and 15 non-networked Level 2 and Level 1 connectors at five downtown Sacramento parking garages. The data from the networked connectors included the number of charging sessions, unique vehicles, and charging session length. Data from the non-networked connectors showed only energy use. Movement data from a transportation app might provide additional insight into charging use, including drivers that wanted to charge when the connector was in use, session information from non-networked connectors, and periods that connectors were unused.

By engaging with tech incubators, universities, and information innovators, the City can better understand new opportunities to collect and use data, potentially create new job classifications within the City, encourage innovation at tech start-ups, and stimulate new degree programs in data science at local universities.

Summary of Code Revisions or Other Mechanisms to Achieve City Goals

1. Begin the process for adopting a local ordinance that requires EV Ready as mandatory in single-family residential, multifamily, mixed-use, and non-residential new construction and major alterations in 2020.
2. Revise the "Transportation management plan measures" (City code 17.700.070) to specify that above-code EV charging and EV car share programs are acceptable measures.
3. Revise "Development standards for off-street parking facilities" (City code 17.608.040) to describe the location, size, and signage required for EV spaces in parking lots and structures.
4. Add a new section to "Development standards" that requires EV support in new parking structures that require electricity.
5. Revise the "Parking requirements of land use type and parking district" (City code 17.608.030) to require EV support consistent with the building code in stand-alone parking lots and structures.
6. Revise "Alternatives to standard parking requirements; other modifications" (City code 17.608.060) to enable developers to install above-code EVSE to deviate from minimum parking requirements.
7. Revise "Waiver of minimum and maximum parking requirements" to require that parking spaces above the maximum be constructed as EV installed.
8. Create a new code using Tree shading requirements for parking lots (City code 17.612.040) as a guideline that will require minimum EVSE compliance for parking lot construction projects.
9. Coordinate with businesses and educators to develop a business case for EVs by increasing the workforce and supporting synergetic projects for car-sharing.
10. Support and/or seek funding for an e-mobility hub pilot, ideally in partnership with other agencies and local groups, for a project at a park-and-ride lot in a low-income/disadvantaged community. Consider leveraging funding from the upcoming Clean Mobility Voucher project and grants from SACOG.
11. Identify opportunities for increased insight from data collection and analysis.

Attachment of code revisions, or other recommended revisions and materials to support the permitting framework

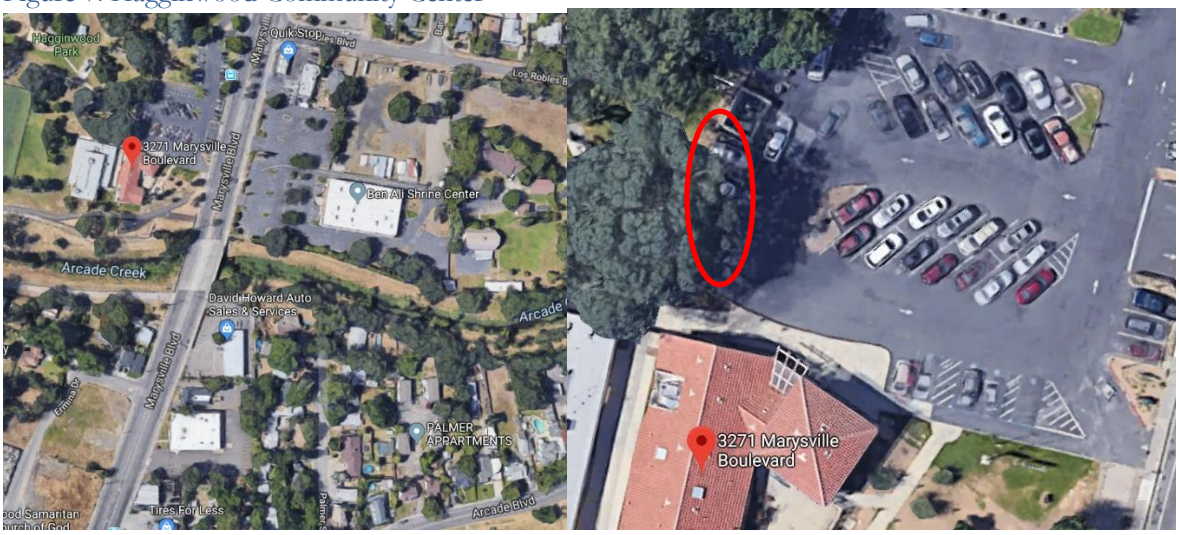
Refer to the Task 3.4 report, *Guidelines for EV Readiness,* for recommended code revisions that City staff will seek to implement following grant completion. These recommended options for code revisions are summarized above, in the preceding section.

Project Recommendation: EVSE in Public Lots

Task 4.3: *Strategies to Optimize Public Charging Access* identified five City-owned properties that could potentially have Level 2 charging stations added to increase access to charging in low-income and disadvantaged communities. The EV Blueprint team created a model, the EVSE Priority Siting Tool, that uses 20 factors to score each census tract for its opportunity to increase public-serving EVSE. To identify potential locations this task, the tool was used to weight tracts with City-owned properties in close proximity to rental housing in low-income communities. It identified 12 libaries and parks, which were then further distilled based on reasonable walking distance (1/8 mile) to homes or services, the availability of parking, and reasonable safety for a person to walk elsewhere after plugging in their car (e.g., lights, sidewalks, the amount of high-speed car traffic). The resulting five locations are below:

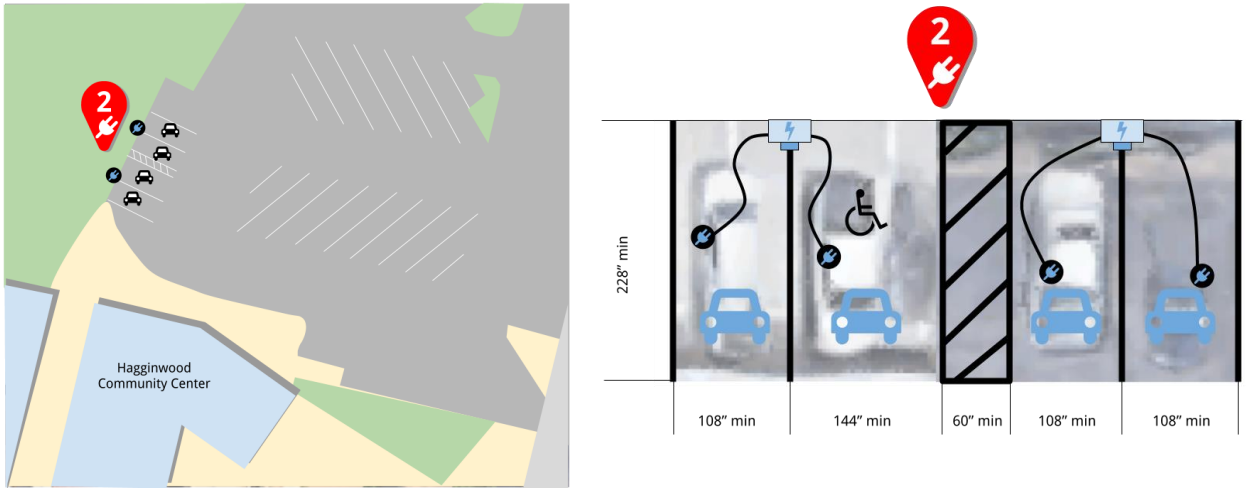
Hagginwood Community Center (Figure 7)**Error! Reference source not found.** is the Hagginwood Community Center and surrounding neighborhood that includes apartments, businesses, and the Ben Ali Shrine Center. It can support two pedestal mounted Level 2 EVSE, each with two connectors, in the area circled in red. The section of the parking lot is well light and close to the community center's front door. The building will not require electrical upgrades for the EVSE. Configuration of the parking spaces is conceptual drawings of the EVSE configuration.

Figure 7: Hagginwood Community Center



The section of the parking lot is well light and close to the community center's front door. The building will not require electrical upgrades for the EVSE. Configuration of the parking spaces follows recommendations in the upcoming *Electric Vehicle Charging Station Permitting Guidebook* from the Governor's Office of Business and Economic Development (GO-Biz.)

Figure 8: Hagginwood Conceptual Drawing

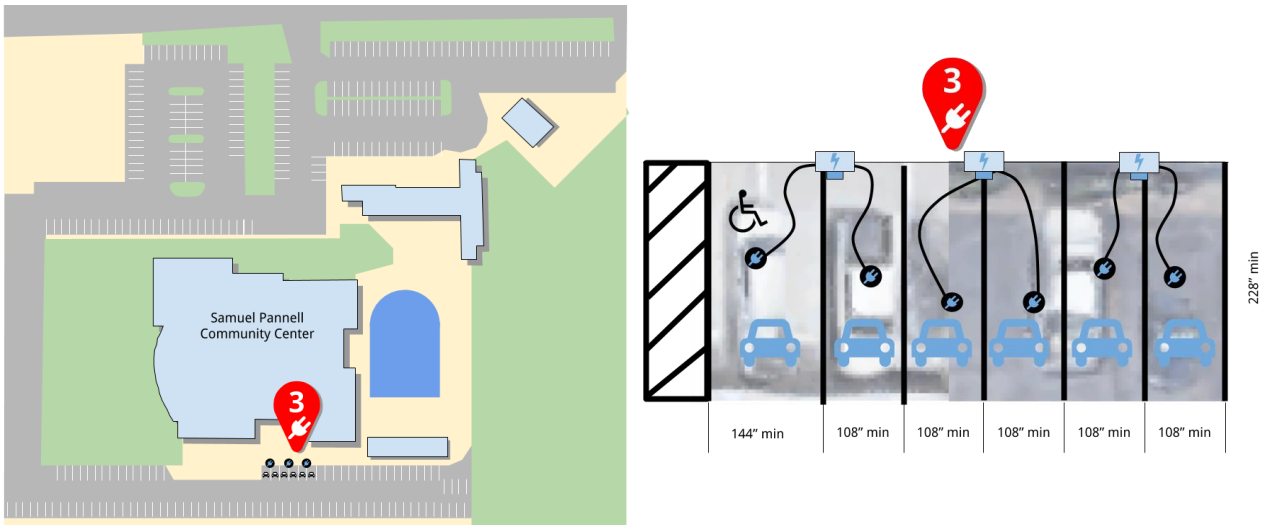


Samuel Parnell Community Center (Figure 8) is a large complex in a residential area with apartments and older single-family homes. A rear parking lot, circled in the picture, is directly adjacent to the building and could potentially support up to four Level 2 EVSE. Figure 10 is conceptual drawings of the EVSE configuration.

Figure 9: Sam Parnell Community Center

The section of the lot is at the rear of the building and already has van-accessible parking spots. It does not have free-standing lighting and it is advisable to add motion-sensitive spot lights mounted on the building. It currently has 20 parking spaces and a no-parking area for delivery truck unloading. To make use of the existing ADA spaces, it's advisable to move the delivery zone.

Figure 10: Parnell Conceptual Drawing



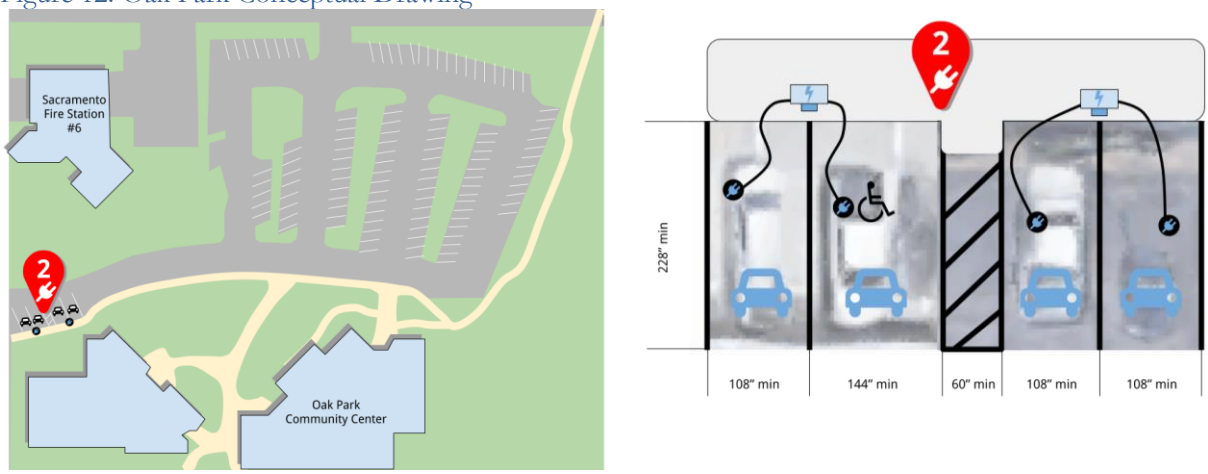
Oak Park Community Center (Figure 11Figure 10) also includes a fire station, childcare center and social services. The surrounding community includes homes, restaurants, and an elementary school. The four parking spots closest to the entrance (circled in red) could support two Level 2 EVSE and has enough space to reconfigure the striping for a van-accessible parking space. This is also a potential location for an e-mobility hub that includes bikes and car sharing, potentially in coordination with the Father Kenny K-8 School. Figure 12 is conceptual drawings of the EVSE configuration.

Figure 11: Oak Park Community Center

The section of the lot is immediately inside the center's driveway and has free-standing lighting. A sidewalk leads from this parking section to the building's front door. High visibility from the street may help deter theft of vehicles left overnight. The section currently has five parking spaces that will be reconfigured to four to follow recommendations in the upcoming *Electric Vehicle Charging Station Permitting Guidebook*. Because the parking spaces are adjacent to the driveway, the EVSE will need to

be curb mounted which requires widening the sidewalk. A ramp from the ADA parking space to the sidewalk will also need to be added.

Figure 12: Oak Park Conceptual Drawing



Oakbrook Park (Figure 13Figure 10) is a recommended alternative location to the South Natomas Community Center. The park is directly adjacent to existing multifamily dwellings and is currently under construction. One pedestal-mounted Level 2 EVSE with two connectors can be added to the drop-off area on San Juan Road without impacting traffic. This section already has wide sidewalk, is well-lighted and has room for four cars to park.

Figure 13: Oakbrook Park

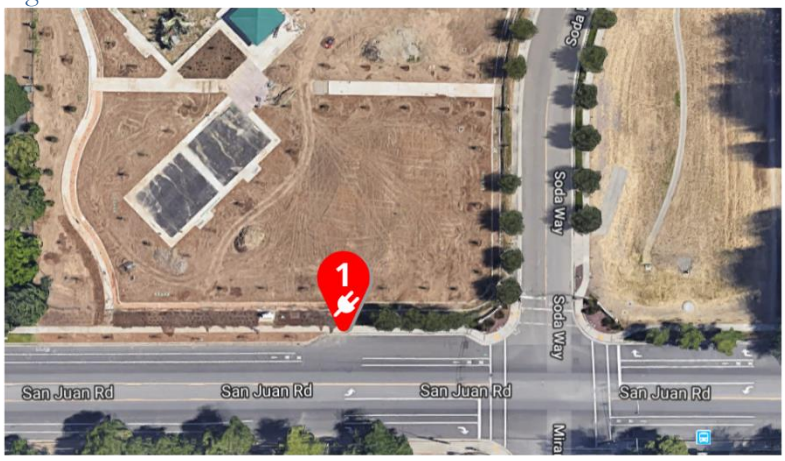
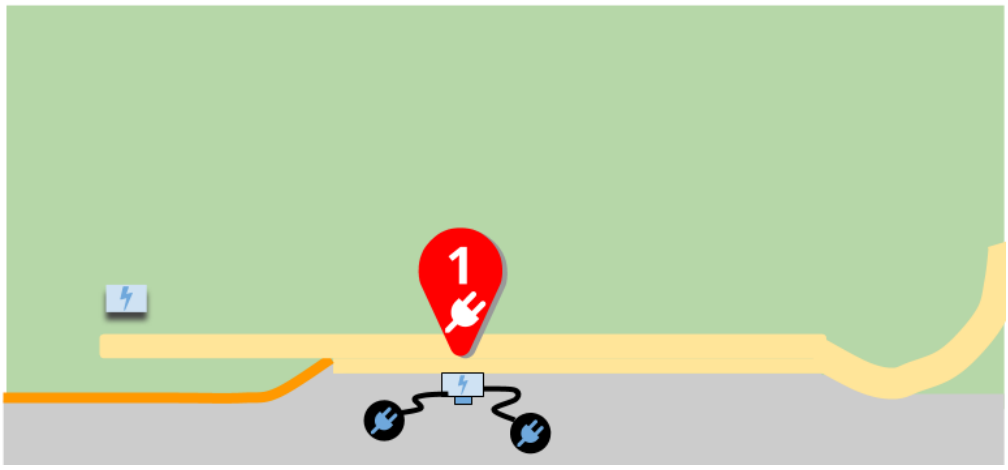


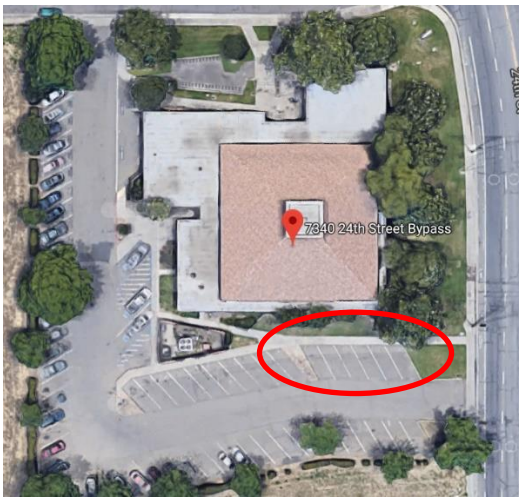
Figure 14 shows a potential schematic for adding one pedestal-mounted EVSE at the curb. If necessary to maintain ADA access of the sidewalk, the EVSE could be mounted on a small curb extension in the right of way or the sidewalk slightly widened around the EVSE.

Figure 14: Oakbrook Park Schematic



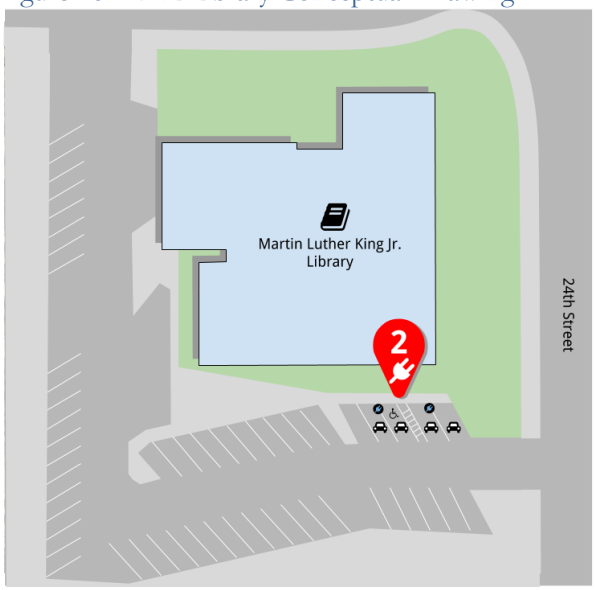
The Martin Luther King, Jr. Library (Figure 15Figure 10) is across the street from an apartment building and an easy walk to more residential. The circled area of the parking lot is likely to be closest to electrical supply, has room for an ADA-accessible charging space, has free-standing lighting, and is visible from the street, which may help deter theft of vehicles left overnight. Figure 16 is conceptual drawings of the EVSE configuration.

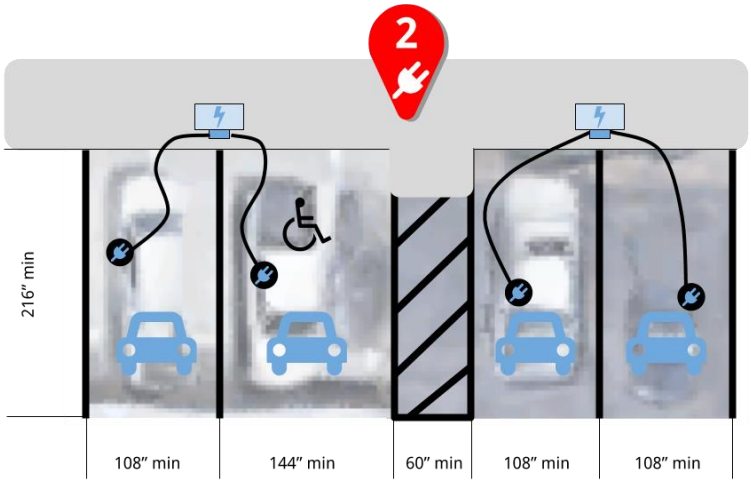
Figure 15: MLK Library



The section of the lot is immediately inside the center's driveway. The section currently has five parking spaces that will be reconfigured to four to follow recommendations in the upcoming *Electric Vehicle Charging Station Permitting Guidebook*. Because the parking spaces are adjacent to the driveway, the EVSE will need to be curb mounted which requires widening the sidewalk. A ramp from the ADA parking space to the sidewalk will also need to be added.

Figure 16: MKL Library Conceptual Drawing





Estimated Project Budgets

Table 7 is the consolidated estimates for purchasing and installing equipment and estimates for other costs associated with EVSE, like parking lot improvements, EV Only signs, and City labor. Assumptions do not include upgrades to the building electrical supply, permits, or other improvements that might be triggered by adding EVSE. The City may be able to leverage economies of scale by installing multiple projects at one time.

Table 7: Costs for adding EVSE at five City properties

Location	Total Cost
Hagginwood	$22,686
Parnell	$29,071
Oak Park	$24,142
Oakbrook Park	$15,355
MLK Library	$24,180
Total for five locations	**$115,434**

The team also considered a budget for placing a free-standing EV ARC at one facility, most likely the Parnell Community Center. The EV ARC is an all-in-one unit that includes a solar canopy, energy storage, and charging for cars and bikes. It doesn't require construction or ground-disturbance and can be quickly installed and set-up without permitting. More expensive than an EVSE, the EV ARC can be quickly deployed and relocated, and can provide back-up power in an emergency.

At the Pannell Center, the EV ARC could be placed in the current ADA space and the adjacent space. The other spaces could host a bike/scooter sharing hub without reconfiguring the parking lot, running electricity from the building, or disturbing the neighbors with construction. Table 8 is an estimate for the EV ARC with two networked Level 2 connectors.

Table 8: Parnell Community Center alternative estimate

Item	Total Cost	Note
EV ARC base	$57,500	Includes minimum level of energy storage
ChargePoint networked EVSE with two connectors	$6,949	Includes lights and EV Charging signs
Network fees	$540	$540 per year; one year paid in advance
E-bike charging hub	$8,700	Can charge 12 bikes/scooters
Total	**$73,689**	

Project Recommendation: E-Mobility Hub

Task 6.2, *E-Mobility Hub Recommendations,* analyzed concepts and plans of other regions' mobility hubs and expanded on those concepts to create an e-mobility hub. Sacramento's intention is to take the mobility hub principle a step further by encouraging all transportation to be electric. However, the emphasis should remain on active transportation and shared rides, including transit. Figure 17 shows an example of transportation modes that a traveler would ideally use to get to or from light rail or an electric bus.

Figure 17: E-mobility hub travel

The concept e-mobility hub envisions re-configuring surface parking at a light rail stop into a flexible, modular design prototype that can be scaled up or down depending on available space, mobility demand, and electrical capacity. Optionally, some elements could be adjacent to a transit stop—across the street or at a nearby community center.

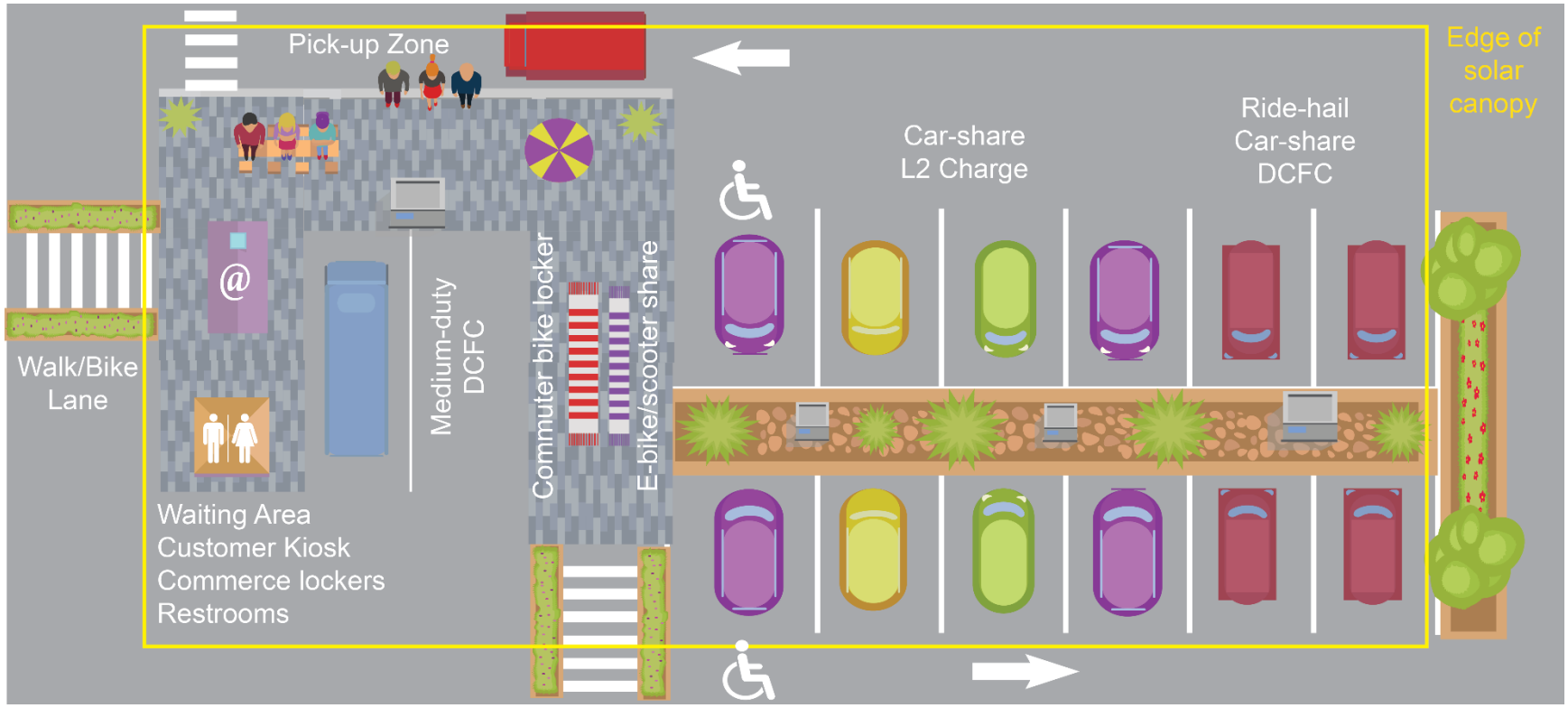
The modular approach also future proofs the regional transit system as share mobility becomes more convenient and economical than private vehicle ownership. For example, commuter parking spaces can gradually be replaced with docks for shared vehicles, a larger drop-off zone, or additional light rail tracks.

The layout of the e-mobility hub concept is intended to fit within a standard park-and-ride lot, which allows the e-mobility hub to be scaled up or down without impacting the design or operation of the lot.

Figure 18 is a concept drawing that fits within a row of parking stalls that is two parking spaces deep (36-40 feet) by approximately 20-25 parking spaces wide (170-215 feet). It assumes that this row would the closest to the light rail station. Some of the existing parking spaces would be transformed into a structure with public amenities concentrated at one end of the site. The other end would for parking and charging car-share and ride-hailing EVs. The concept shows 12 spaces for shared-ride passenger cars and leaves two spaces for medium-duty vehicle charging.

To expand in the future as transportation becomes more dependent on shared EV mobility, the e-mobility hubs should be within the longest rows of parking at the transit center. This enables adding more chargers and/or expanding the active transportation portions as housing and commerce grow closer to the hub.

Figure 18: E-Mobility Hub Conceptual Drawing



This drawing shows two car-share spaces that are ADA accessible. Once charger in the center aisle can serve four vehicles. Parking at 90 degrees instead of 45 degrees makes the EVSEs accessible to a wider variety of vehicles. Plants in the center of the row ensure this is not interpreted as a walkway to the amenity area. The bike lockers and shared ridables (scooters and bikes) are placed together so that one power source can charge personal and shared bikes/scooters. The protected bike lane in this configuration enables people to safely cross the area where shared cars are pulling in and out.

The purple-and-yellow circle represents the customer service kiosk. This could be an attended station, a self-service kiosk, or a convenience store or coffee shop. A mobile office staffed by a person in an electric van could serve as an attendant who moves from hub to hub. A delivery van can pull into the medium-duty charger and quickly charge while unloading goods into the e-commerce lockers (marked with @ in the drawing). This can reduce VMT from the van and the person who might otherwise drive to a store, food bank, or library.

Anticipated Costs

Table 9 is an estimate of the initial start-up costs based on public records of similar projects' initial costs. These do not include operational costs for the first two years because data isn't currently available.

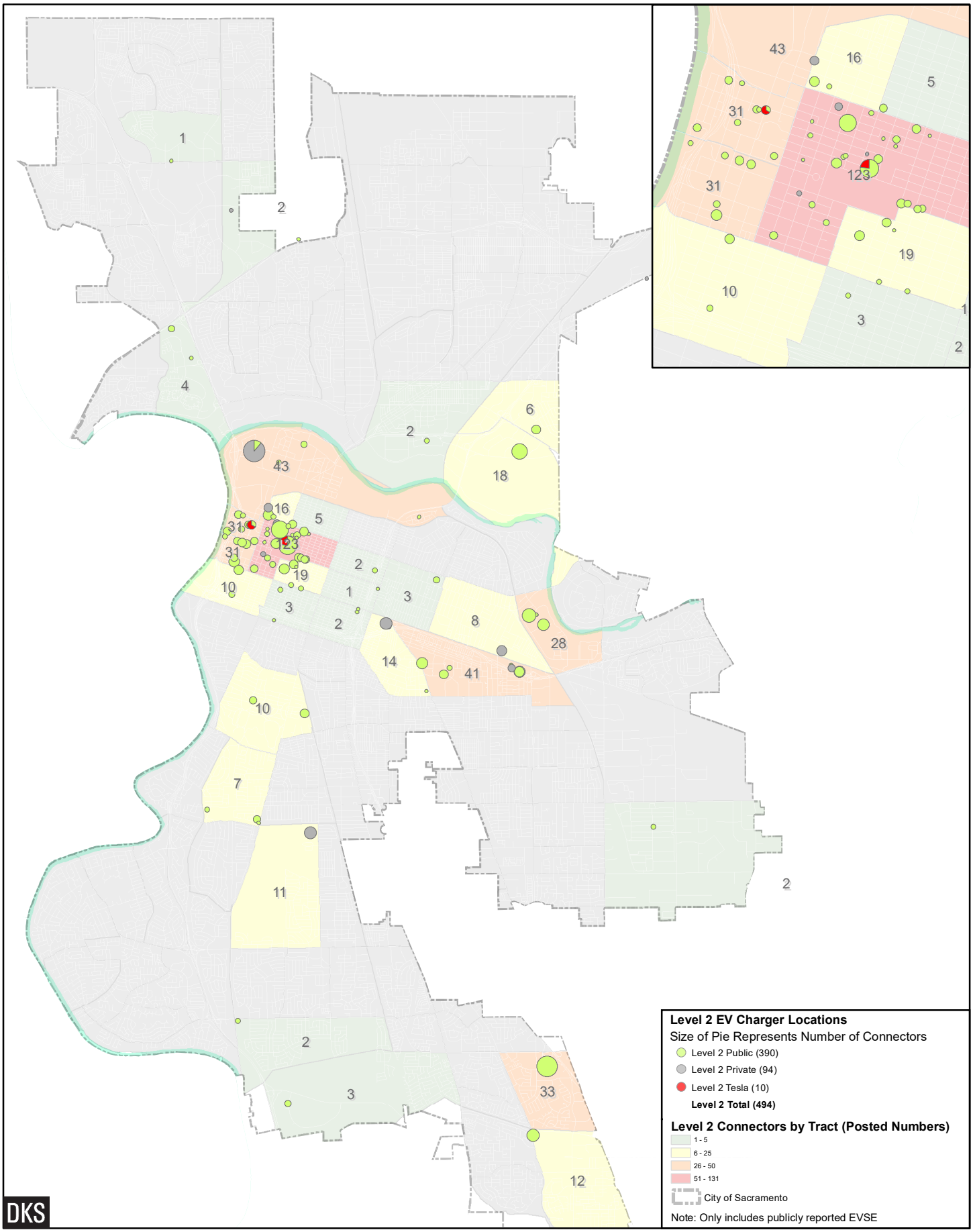
Table 9: E-mobility hub cost estimate

Item	Cost	Explanation
Land acquisition	$0	Project assumed to be in an existing parking lot
Engineering, design, and construction	$500,000-$800,000	SACOG grants for developing light rail stations[33] and Safe Route to School improvements[34]
PV array and battery storage	$130,000 (PV) + 10,022 (storage)	From EV Blueprint tasks 3.2 and 6.2
Establish car-share hub	$750,000-$1,300,000	Energy Commission grants for ZEV car share programs.[35] Initial grant for Our Community CarShare that included purchase of eight cars and four Level 2 EVSEs[36]
Expand microtransit	$849,000	City of West Sacramento cost to establish and operate Via for one year after deducting operator's revenue[37]
Establish bike/scooter share	$0	To date, operators have not applied for grant funding
Implement technology solutions	$536,000	FTA award to San Diego for integrated app for paratransit[38]
Installation of DCFC	($2,000)	EVgo pays the City of Sacramento a $2,000 annual licensing fee for curbside DCFC[39]
Total funding needed	**$2.7-$3.5 million**	

[33] https://www.sacog.org/sites/main/files/file-attachments/description_of_funded_projects_round_7.pdf
[34] https://www.sacog.org/funding-award-recipient/2019-regional-atp-funding-awards
[35] https://ww2.energy.ca.gov/contracts/GFO-16-605_NOPA.pdf
[36] http://policies.sharedusemobilitycenter.org/#/policies/853
[37] https://blob.cityofwestsacramento.org/civica/filebank/blobdload.asp?BlobID=16816
[38] https://www.transit.dot.gov/funding/grants/grant-programs/access-mobility-partnership-grants-fy2019-project-selections
[39] http://www.cityofsacramento.org/-/media/Corporate/Files/Public-Works/Electric-Vehicles/EVgo-Charging-Southside-Park.pdf?la=en

Attachment 3: Sacramento Electric Vehicle Blueprint – Relevant Baseline Maps

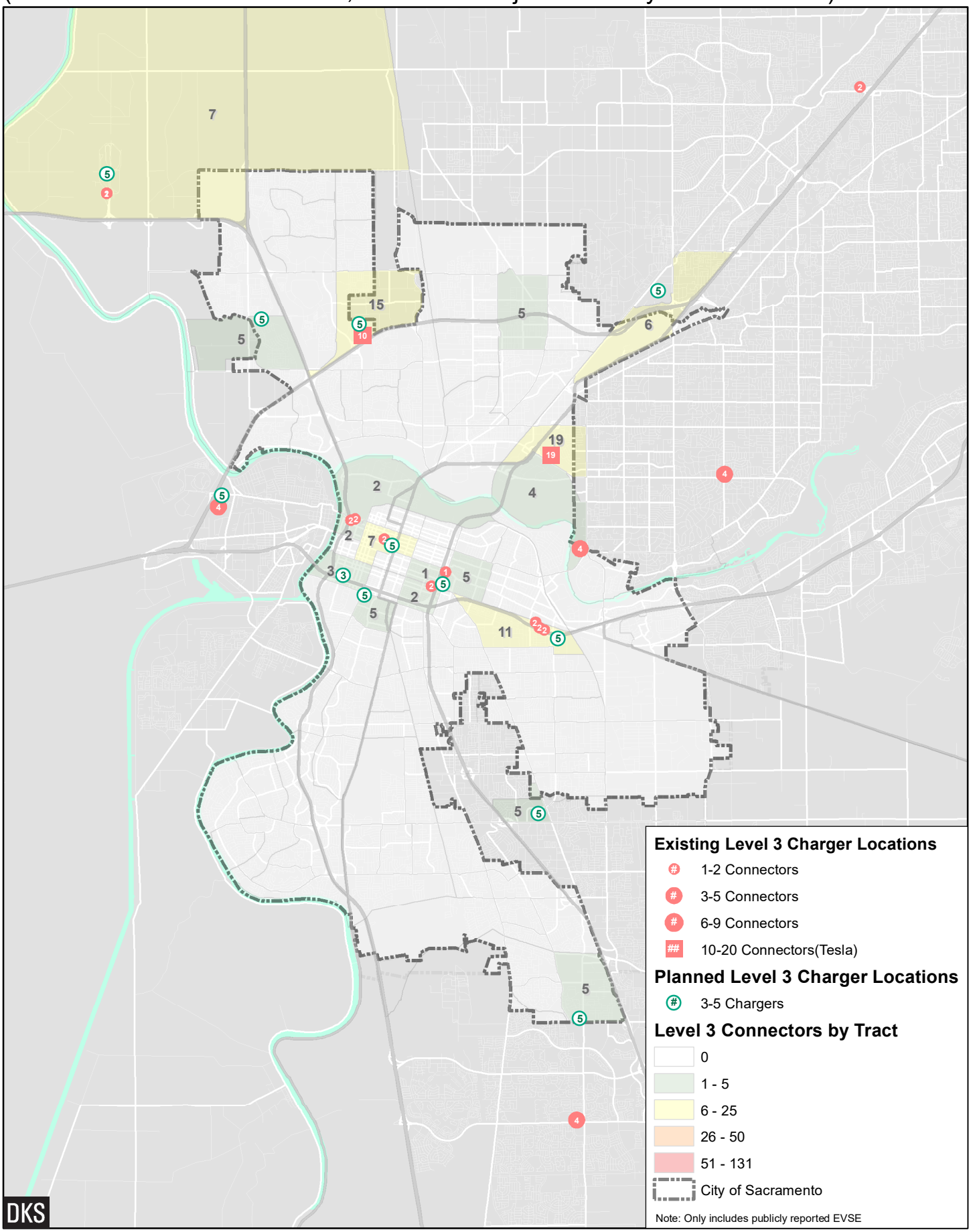
Locations of Existing and Planned Level 2 EV Charging Stations (Public and Private Connectors)



Source: City of Sacramento Data Portal, With Frontier and DKS Revisions

Figure 1

Locations of Existing and Planned Level 3 (DCFC) Charging Stations
(Public and Private Connectors, Within and Adjacent to City of Sacramento)



Sources: City of Sacramento AFDC, Plugshare, Electrify America

Figure 2

Low Income and Disadvantaged Areas Lacking Convenient Charging Access
(Greater than 1/4 Mile From Existing/Planned Electric Vehicle Service Equipment)

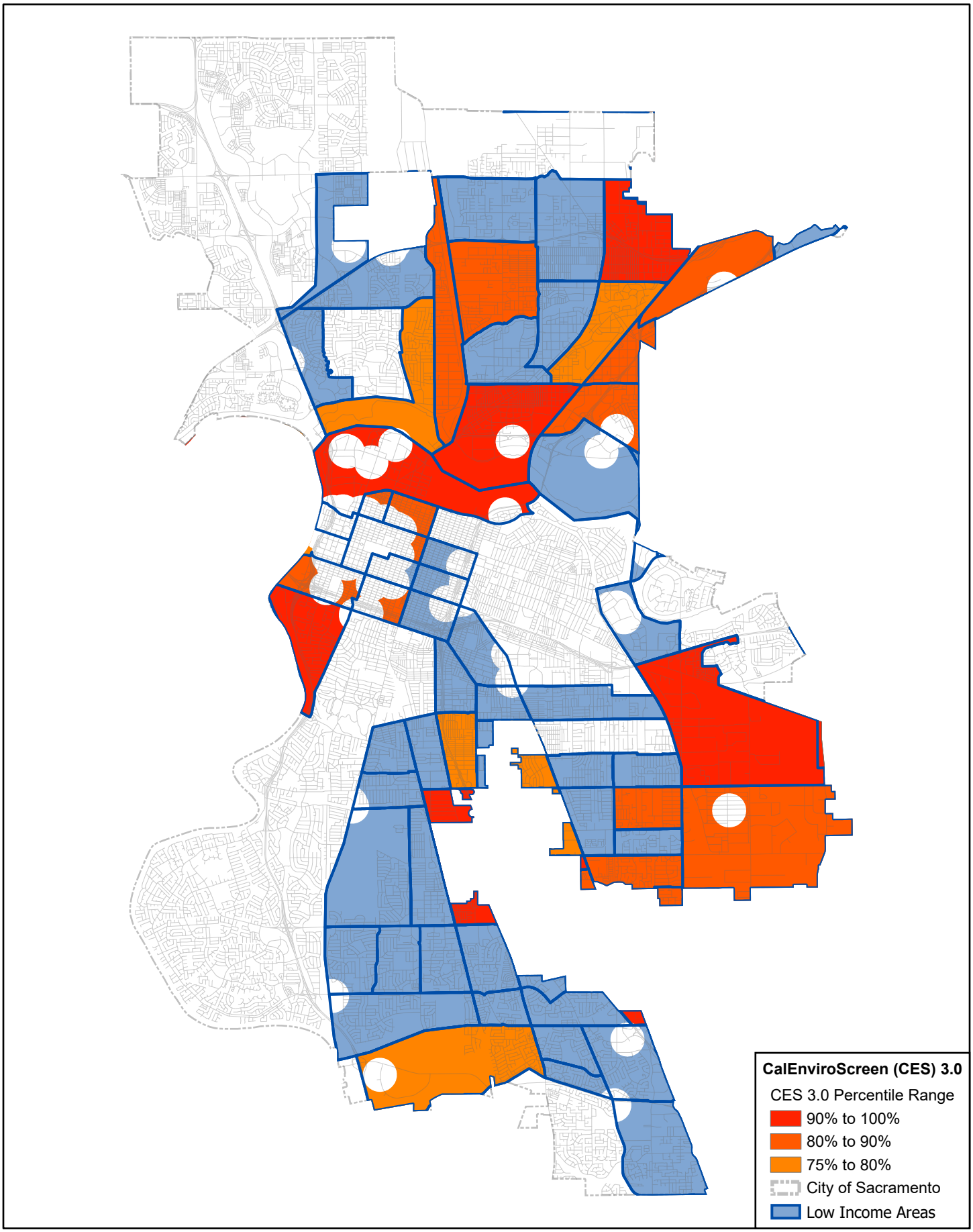
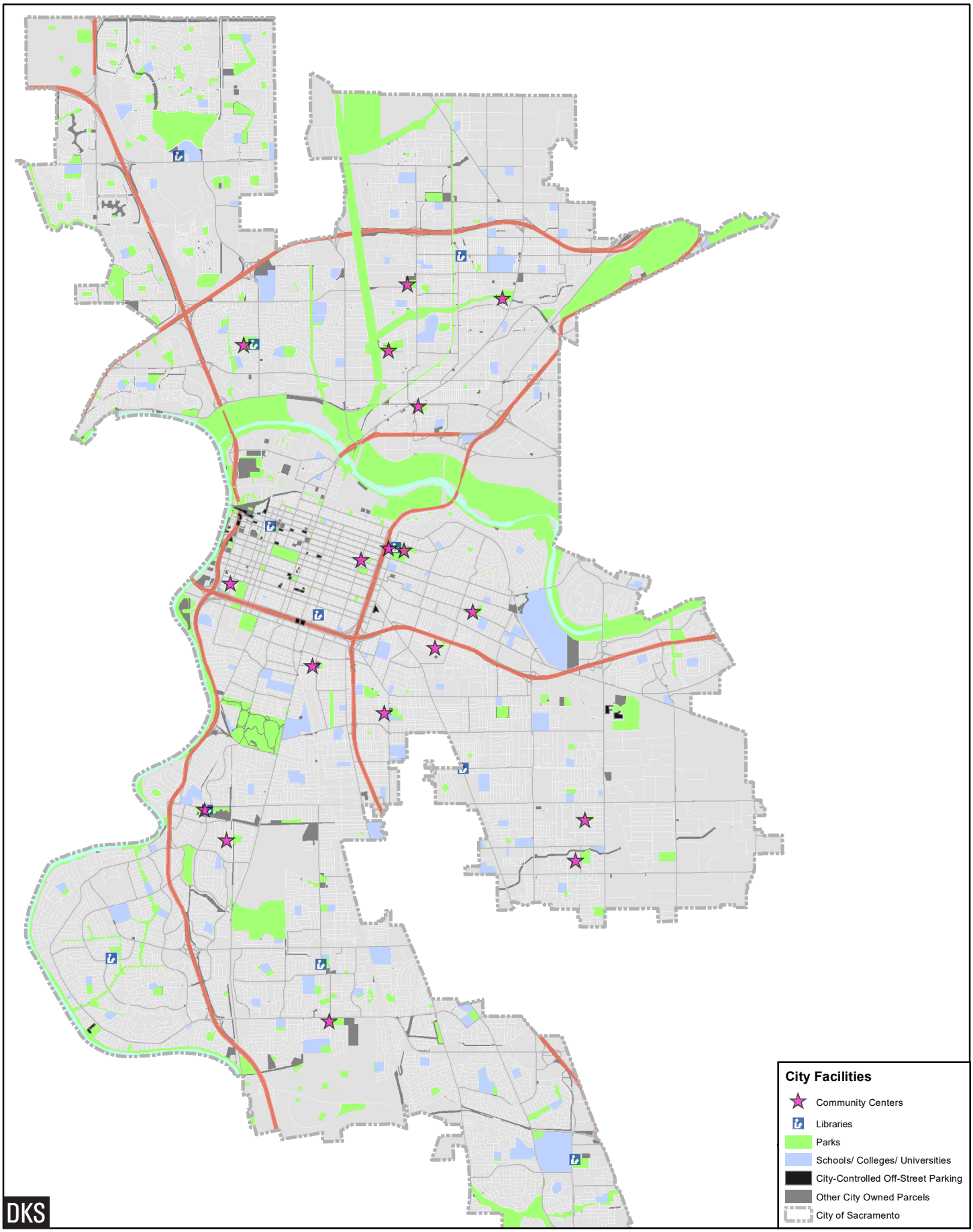


Figure 3

Source: California OEHHA

Locations of Publicly Owned Properties (Including City Facilities)

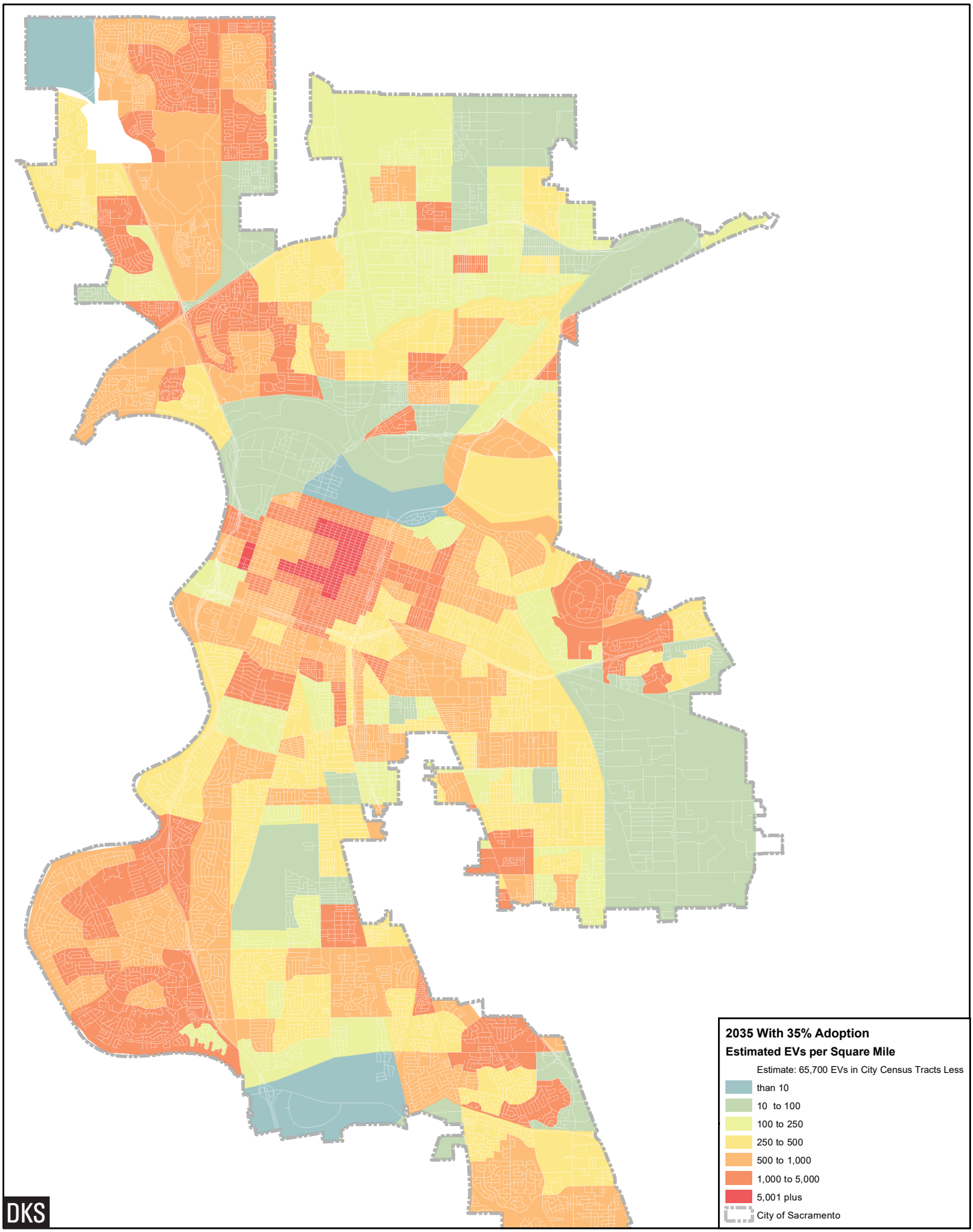


Sources: Sacramento County Parcel Database, CIty of Sacramento GIS Portal

Figure 4

Note: City-owned parcels identified for informational purposes only. Parcels may already be dedicated to specific purposes, or planned for future uses.

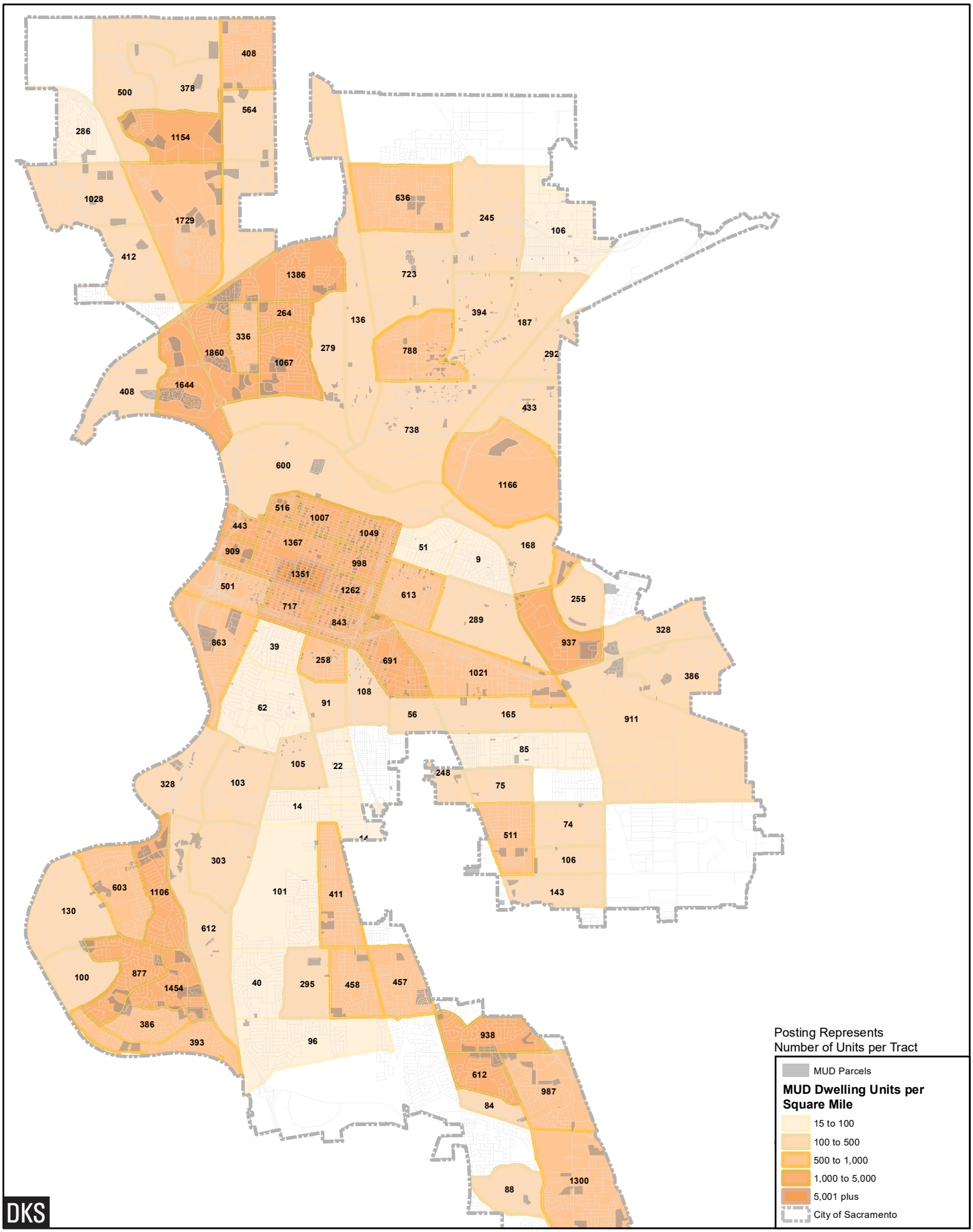
Plug-In Electric Vehicle Adoption Density Estimate by 2025 (by Census Tract)
Assumes 35% Adoption Rate using UC Davis EV Toolbox



Source: DKS Associates using UC Davis PHEV Market Demand Toolbox with default probabilities
https://phev.ucdavis.edu/project/uc-davis-gis-ev-planning-toolbox-for-mpos/

Figure 5

Existing Multi-Unit Dwellings (MUD) Density by City Census Tract
Apartment Complexes of 3 or More Units



Source: Sacramento County/ City of Sacramento Parcel Database

Figure 6

Attachment 4: Sacramento Electric Vehicle Blueprint Task 5.2 – EV Economic Pathways

Sacramento EV Blueprint

Task 5.2:
EV Economic Pathways

ARV-17-042

Prepared for the City of Sacramento by Frontier Energy

Final Report

Table of Contents

EV Economic Pathways

The purpose of this memo is to identify local programs to prepare the workforce for advanced transportation employment opportunities, identify an operational structure for a potential zero-emission vehicles (ZEV) service center, and develop a guide for agency efforts to strengthen the local ZEV workforce.

Summary of Key Findings

Most zero-emission vehicles (ZEVs), which includes plug-in hybrids, battery electric, and fuel cell electric vehicles, are leased from major automakers. Dealerships performs all maintenance, and leased cars are typically returned before they need major servicing, and dealerships hire technicians that have completed automaker-specific training. Dealerships stated that ZEV servicing is more like data analysis than automotive repair, and that auto mechanic classes offered at community colleges and trade schools neither equip students to work on ZEVs nor attract people who have an aptitude for data.

Fleet managers expect that their staff will eventually take on maintenance tasks related to electric vehicles (EVs), but do not anticipate offering training. Instead, they expect to hire people who have necessary certifications. At least one individual instructor teaches an EV certification course for experienced mechanics.

Journeyman electricians were identified as the largest employment gap in the next five years related to EV workforce needs. The International Brotherhood of Electrical Workers Local 340 estimates a current shortage of 1,500 people in the apprentice program. Apprenticeship, however, has significant barriers to entry.

All industries identified a need for people with customer service soft skills: from service writers at automotive repair to insurance estimators to agents answering phone calls about EV chargers or car-sharing, companies reported difficultly hiring qualified employees.

Specific steps that could develop a ZEV-ready workforce include:

- Integrating ZEV servicing into computer classes at high school, community college, and adult education. Computer and technology classes are often presented as a pathway to a four-year degree and a desk job. Demonstrating the link between data analysis and cars could entice a new segment of people into EV service classes.
- Extending the City of Sacramento's Community Workforce Training Agreement (CWTA)[1] to include apprentices for mobility-related projects to provide a pathway for residents of low-income and disadvantaged communities. CALeVIP recipients will be required to pay installers a prevailing wage[2] and could create a pathway to using electrical contractors that participate in CWTA.

[1] http://sacramento.granicus.com/MetaViewer.php?view_id=22&clip_id=4129&meta_id=512761
[2] https://calevip.org/faq/what-are-applicant-requirements-0

- Offering targeted tutoring, potentially through "bridging" classes or pre-apprenticeship programs—to help people pass reading comprehension and math tests required for apprenticeship programs
- Partnering with each council member to stage a customer service bootcamp followed by career fair with local business and e-mobility providers.
- Arranging for one or more train-the-trainer sessions to certify local instructors to teach the Automotive Career Development Center's (ACDC) EV certification course to experienced mechanics. Grow Sacramento Funds[3] or Rapid Acceleration, Innovation, and Leadership (RAILS) grants[4] could provide funding for a private company to lead this effort and purchase equipment for training.

Jobs that ZEVs can Bring to Sacramento

The ZEV industry employs workers in many industries, some of which require specialized training or work experience. The U.S. Department of Labor, Bureau of Labor Statistics (BLS) tracks jobs related to electric vehicles and infrastructure.[5]

Sacramento has many technology and clean energy businesses and the Great Sacramento Economic Council is particularly focused on attracting more of these companies that bring high-paying science, technology, engineering, and math (STEM) jobs in the region. With two state universities—Sacramento State and UC Davis—and the private William Jessup University, Sacramento is well positioned to have a workforce of scientists, engineers, software developers, and industrial designers for the ZEV-related STEM occupations in Table 1 that BLS identified that typically require a college or post-graduate degree. Some occupations may also be filled by people with two-year degrees from one of Sacramento's many community colleges or technical and vocational schools.

Table 1: ZEV-related occupations in STEM fields

ZEV-related occupations	Median annual wages in Sacramento metro area[6]
Chemists	$82,460
Materials scientists	$85,680
Electrical engineer	$115,250
Industrial engineer	$91,580
Mechanical engineer	$98,290
Mechanical engineering technician	$63,480
Software developer	$106,870
Industrial designer	$68,780

[3] https://www.cityofsacramento.org/Economic-Development/Grow-Here/Incentives/Grow-Sacramento-Fund
[4] https://sacramentocityexpress.com/2018/07/05/2018-19-rails-grants-support-innovation-and-entrepreneurship-in-sacramentos-underserved-communities/#0
[5] https://www.bls.gov/green/electric_vehicles/
[6] May 2018 National, State, Metropolitan, and Nonmetropolitan Area Occupational Employment and Wage Estimates https://www.bls.gov/oes/current/oes_40900.htm

Sacramento has one employer that assembles vehicles, Siemens, and Clipper Creek that manufactures and distributes electric vehicle service equipment (EVSE). A few small companies manufacture vehicle or EV-related components. Mather Business Park has been particularly interested in attracting manufacturing to the transformed base. In 2016, a Chinese bus manufacturer considered Mather Business Park for an assembly plant, but ultimately located in Orange County. As manufacturers arrive in Sacramento, they will look for a skilled workforce that has specific on-the-job training, completed an apprenticeship program, or received technical training at a community college, trade school, or high-school career pathway program. Table 2 lists ZEV-related occupations in manufacturing and assembly that may come to Sacramento.

Table 2: ZEV-related occupations for manufacturing and assembly

ZEV-related occupations	Median annual wages in Sacramento metro area
Equipment assemblers	$41,390
Team assemblers and fabricators	$31,780
Computer-controlled machine tool operators, metal and plastic	$47,280
Machinists	$40,810

Automotive service technicians and mechanics need special skills and knowledge to work on electric vehicles. ZEV technicians generally are trained to work on vehicles made by a single manufacturer and the auto manufacturers typically provide the training. Dealerships already report a shortage of ZEV-certified technicians because none of Sacramento's schools offer an automaker's Professional Automotive Career Training (PACT) program. Table 3 lists vehicle service-related jobs. (BLS does not have a separate category for ZEV service technicians.)

Table 3: ZEV-related occupations for vehicle maintenance and repair

ZEV-related occupations	Median annual wages in Sacramento metro area
Service technicians (light-duty vehicles)	$49,680
Service technicians (bus and truck)	$57,810
Heavy-equipment mechanic (e.g., construction equipment)	$58,320

Building charging stations and hydrogen stations will require changes to existing infrastructure. Urban and regional planners will be involved in planning the infrastructure upgrades, electrical power-line installers and repairers will lay the wires, and electricians will install charging stations. According to interviews for this report, stakeholders expect that infrastructure will be the biggest source of ZEV-related jobs in the next five years. Table 4 lists common occupations related to infrastructure, most of which require degrees and/or training to receive a license and can be considered a STEM pathway.

Table 4: ZEV-related occupations for infrastructure

ZEV-related occupations	Median annual wages in Sacramento metro area
Urban and regional planners	$87,780
Electrical power-line installers and repairers	Information not released
Electricians	$61,190
Electrical drafter	$71,240
Electrician helper[7]	$39,850
Construction project manager	$109,2608

BLS also considers jobs in sales and customer service, which are becoming increasingly important across all business sectors. Although customer-facing jobs rarely require advanced education or extensive training, employers and business associations point out a sharp decline in people who have the soft skills needed to interact with customers. In Sacramento, customer service jobs are about 15% of all jobs in the metropolitan area. Table 5 lists customer service jobs that are related to ZEVs and mobility.

Table 5: ZEV-related opportunities for customer service

ZEV-related occupations	Median annual wages in Sacramento metro area
Insurance appraiser, auto damage	$72,390
Customer service representative	$40,410
Office clerks	$36,370
Driver/Sales worker[9]	$39,500
Executive administration	$63,530[10]

BLS does not have a listing for "data scientist," a job that Deloitte, the Center for American Mobility, Boston Consulting Group, and others identified as an important need in government and industry and will become more important as connected and autonomous vehicles take the road. In April 2019, Uber had 91 job openings with "data scientist" in the job title. The basic duties are:

- Interpret data to develop analytical insights
- Design experiments and interpret the results to draw actionable conclusions
- Build production grade models on large-scale datasets
- Understand user behavior and predict future performance
- Translate data-driven learnings into actionable insights

[7] In Sacramento, this position is usually called "wireman assistant" and is a pre-apprentice job
[8] The BLS wage classification closest to "project manager" position used by EVgo, ChargePoint, Black & Veatch, and Fiedler Group
[9] The BLS wage classification closest to the "field technician" position used by JUMP, Gig, and other shared mobility providers
[10] The BLS wage classification closest to the "project manager" position used by Center for Sustainable Energy and Frontier Energy

Existing Higher Education

American River College (ARC)[11] and Sierra Community College (SCC)[12] have certificate courses in auto repair and offer limited training in ZEVs, but are aware of the demand for technicians that can service electric vehicles. Neither school offers an automaker-specific certification course, oftne called a Professional Automotive Career Training (PACT) program.

Both colleges expressed that access to vehicles is an impediment to implementing ZEV programs. Combustion vehicles are inexpensive and easy to obtain for hands-on training—which is not the case with advanced technology vehicles. More than 15 years ago, Rio Hondo College developed relationships with Toyota and with SunLine Transit to train mechanics for the Prius and SunLine's alternative fuel fleet. The Sacramento area schools don't have the same access to vehicles. In a project with Sacramento Metro AQMD, Frontier Energy arranged:

- A connection between ARC and AC Transit (in the Oakland area) about hands-on education with AC Transit's battery and fuel-cell buses.
- Communication between ARC and Ryder about curriculum that Ryder is developing about heavy-duty high-voltage electric vehicles. ARC submitted a proposal to Ryder and the program is in development. ARC may offer this as a certificate program in late 2019.
- A connection between Sierra College and the regional Nissan EV testing center to facilitate donating a vehicle and electric drive-train components for hands-on education. Nissan donated five hybrid electric transmissions and a vehicle will be donated in early 2019.

Through the Sacramento Plug-in Electric Vehicle Collaborative, additional steps started to arrange for retired SMUD EVs to be donated to one or both programs and a decommissioned Smith Electric Truck was donated to ARC. ARC also formed a partnership with The Lion Electric Company, a Sacramento-based manufacturer of electric school buses and cargo trucks, to create a Lion-certified mechanic program.

In partnership with the National Association of Fleet Managers and ARC, Sacramento Clean Cities holds a one-day workshop about new technologies for existing fleet managers and technicians. The June 2019 workshop had nearly 200 attendees, many of whom had their first exposure to battery and fuel cell vehicles. Sacramento Clean Cities plans more of these workshops.

In the Los Rios Community Colleges, only Consumes River College (CRC)[13] offers a class in data analysis. None of the community college classes equip students with data scientist skills.

UC Davis is headquarters to the renowned Plug-in Hybrid & Electric Vehicle (PH&EV) Research Center.[14] The Center collaborates closely with California utilities, automakers, regulators, and other research institutions about research aimed at developing a sustainable market for plug-in vehicles.

[11] http://web.arc.losrios.edu/~autotech/cert_alternatefuel.htm
[12] https://www.sierracollege.edu/academics/divisions/baape/auto-tech.php
[13] https://www.crc.losrios.edu/catalog/areas/cis
[14] https://phev.ucdavis.edu/

The Institute of Transportation Studies,[15] a post-grad program, offers a master and doctoral degrees in transportation technology and policy, and the university has a host of STEM degrees. UC Davis also has a Data Science Initiative[16] and a degree program with a statistical data science track for statistics majors.

Sacramento State[17] has undergraduate and graduate degrees in STEM fields, and master's degree programs in public policy and urban land development. Several of the theses on the website include mobility.[18] The College of Business Administration's Center for Business Analytics has workshops that are open to the public and cost about $250 for a one-day class.[19]

William Jessup,[20] a private college, has areas of study that include geographic information systems (GIS) and will introduce degrees in public policy and administration beginning the fall 2019 semesters.

Opportunity for Sacramento

It's challenging for colleges to offer coursework and degrees in developing fields of study. For example, in the late 1970s and early 1980s, personal computers were just entering the market. Computer-related courses at post-secondary schools taught skills related to mainframes and minicomputers. Many of the people who established the microcomputer industry, including Bill Gates, Steve Wozniak, Steve Jobs, and Larry Ellison, were self-taught. Colleges started offering coursework and degrees in microcomputer programming, networking, databases, and software applications after PCs were established in business.

Early movers in ZEVs, like the City of Sacramento, can influence college students though guest lectures, participating in mixers, and inviting students and teachers to job shadow. It may be years before colleges can invest in ZEV-specific degree programs or major coursework.

Training Programs

Sacramento Works, the website of the Sacramento Employment and Training Agency, has a list of local training providers[21] with details about certifications/degrees, costs, and time commitments. Training programs (excluding community colleges) that are applicable to ZEV-related jobs include:

1. Building construction, cost $5,500, time 16 weeks
2. Electrical training, cost $12,995, time 50 weeks
3. Electrician training, cost $14,995, time 42 weeks
4. Commercial Electrician Trainee, cost $16,500, time 26 weeks
5. Energy Apprenticeship, cost $0, time 4-5 years
6. Electrician trainee, cost $6,777, time 3 years
7. Data analyst (entry level), cost $8,000, time 11 weeks
8. Data analyst (Level 2), cost $8,4000, time 17 weeks

[15] https://its.ucdavis.edu/
[16] http://datascience.ucdavis.edu/
[17] https://www.csus.edu/
[18] https://www.csus.edu/uld/thesis-project/bank/
[19] https://www.csus.edu/cba/analytics/certificate.html
[20] http://jessup.edu/
[21] http://seta.net/pdfs/etpl.pdf

Several schools offer electrician training, which is reflected in multiple costs and timelines (items 2, 3 and 4 in the preceding list). The International Brotherhood of Electrical Workers (IBEW) offers Energy Apprenticeship (item 5) that is paid for by union dues. The Electrician trainee program (item 6) is the cost of the classroom education, books, and materials for non-IBEW apprentices. The two data analyst classes (items 7 and 8) are offered by a for-profit computer training center.

Many of the training programs offer computer classes that range from a $90 class in computer basics to specialized certifications (e.g. mobile app development, network security) that cost several thousands of dollars.

The International Association of Machinists offers a California Automotive Apprenticeship Program but doesn't include ZEV-related programs and has no job sites in the Sacramento area.

Alternative Education

Alternative programs seek prepare targeted populations for jobs and careers. Examples of several local programs are identified below.

Green Tech (www.greentechedu.org) is a community-based organization (CBO) that trains "opportunity youths" between 12 and 21 for "green collar" jobs. The school conducts weekly classroom instruction in urban farming, forestry, and aquaponics and weekly web-building bootcamps. Instructors take participants on tours of green environmental-related manufacturing businesses and expose them to clean energy jobs opportunities. Funding is a combination of donations, Sacramento County Office of Education, and grants. Facility are from Consumnes River College and Hacker Lab.

The California Conservation Corps operates the Sacramento Energy Hub (ccc.ca.gov/locations/sacramento-energy-hub/), a nonresidential program to teach Corpsmembers about energy efficiency retrofits (lighting, solar installation, smart power, etc.) Corpsmembers are California adult between 18 and 22 that are free of felony convictions and not on parole. In addition to serving the State of California and learning a trade, Corpsmembers can earn a high school equivalency degree, take community college courses, and earn scholarship money for continuing education.

Sacramento Regional Conservation Corps (www.saccorps.org) is an education and workforce training program established by the Sacramento Metro Chamber of Commerce. It serves adults 18–25 years old, 90% of whom are high school drop outs and read below grade level. Funded by state and local government agencies, foundations, corporate grants, sponsorships, and private donations, its work-related education focuses on recycling, litter abatement, and roadway maintenance.

Northern California Construction Training (NCCT) (www.ncct.ws/) is a pre-apprenticeship training program for construction trades apprenticeship programs. NCCT is a non-profit, community-based organization. NCCT students receive unpaid classroom training and hands-on building experience. When the student completes training he or she can join an apprenticeship program. NCCT offers preparation and testing for high-school equivalency, work boots, and tools. Many of students are referred by county probation departments and school districts Career Training Education (CTE) programs.

Asian Resources (ARI) (asianresources.org/) serves limited-English and low-income Sacramento communities. Among its services, ARI assists people with job training and job placements to drive economic growth. The adult program includes weekly workshops and computer classes. The youth program has a two-week summer camp for at-risk youth that includes career, life, and leadership skills training followed by a paid internship. Funding is from grants, local government, and donations.

Opportunities for Sacramento:

Job training recommendations are covered in the following sections.

Interviews with Sacramento-area Stakeholders

Table 6 is a list of people and organizations identified for interviews. This table includes all stakeholders identified for interviews, regardless of whether responses were received to interview requests. The purpose of including all stakeholders Table 6 is to ensure a record of stakeholders for this issue areas and provide a good starting point for future engagement and advancement of opportunities anticipated by this report.

Table 6: People and organizations identified for interviews

Person/Organization	Description	Purpose	Status
Electrified Garage	An independent Tesla service center	Understand business model, training needed or acquired	Did not respond
Argonaut	An independently owned auto repair shop in Berkeley that repairs hybrids and EVs	Understand business model, training needed or acquired	Short phone interview
Craig Van Batenburg, ACDC	Helps existing mechanics learn how to service EVs and provides equipment lists	Understand business model, training needed or acquired	Long phone interview and follow up emails
Nissan Leaf data center	Collects and analyzes data	Understand training needed or acquired, projected job growth	In-person interview
AAA	Previously operated an EV service center in Sacramento	Understand business model and why center closed	Short phone interview
Tim Taylor	Executive director of Clean Cities Sacramento	Understand training that Clean Cities offers, needs of local fleet operators, future job needs	Phone interview
Kniesel's Auto Service Centers	Operates three automotive service centers in Sacramento	Understand business model, training needed or acquired,	Phone and in-person interviews

Person/Organization	Description	Purpose	Status
	and repairs collision damage to Tesla cars	future workforce needs	
AutoNation Honda Service Center	Local Honda dealership that services plug-in and fuel cell Hondas	Understand business model, training needed or acquired, future workforce needs	In-person interview
Mark Stevens, City of Sacramento	Manages City fleet, including ZEVs	Future workforce needs, training needed and acquired	Phone interview
Sacramento/Shasta Butte Area Electrical Training Center	Job training programs for electricians	Future workforce needs, training needed and offered, barriers to education	Multiple phone and in-person interviews
Noah Painter, KMP Strategies	Apprenticeship programs for the City of Sacramento	Future workforce needs, training needed and offered, barriers to education	Multiple phone and in-person interviews
Connie Samla, Commercial Education Specialist Energy Education & Technology Center, SMUD	Training programs and workshops	Past and future education	Phone interview
ALLDATA	Local manufacturer of diagnostic equipment for auto repair shops	Equipment for an EV service center	Did not respond
Charles A Jones Career and Education Center	Adult education program aimed at low-income students	Integrating EV-related training	Did not respond
Sacramento RT	Operator of electric buses	Future workforce needs, training needed and offered	Did not respond
Transdev	Contractor for municipal transit services; operates Yolobus and others	Future workforce needs, training needed and offered	Did not respond
Dealership[22]	Local service center for ZEVs	Understand business model, training needed or acquired, future workforce needs	In-person interview

[22] Asked that name not be used in report

Person/Organization	Description	Purpose	Status
John L Sullivan's Roseville Toyota	Local service center for Prius Prime and Mirai	Understand business model, training needed or acquired, future workforce needs	Did not respond
Brian Moore, Manager, Honda PACT program	Oversees the dealership-specific training program in Northern California	Opportunities to offer Honda PACT at local colleges	Could not schedule interview within project time frame

Independent Service Centers

Kniesel's Auto Service Centers is a local repair business that operates three facilities in the Sacramento area. The company does not perform repair or maintenance on EVs or plug-in hybrids, but its Roseville location is certified to perform collision damage repairs to Tesla cars. Owner Rebecca Kniesel stated, "We haven't had a demand for EV service and maintenance yet. Most of the cars are leased and the dealerships do all the work. That might change, and it would be good to get our managers and senior staff more knowledgeable about EVs."

Tim Taylor, Executive Director of Sacramento Clean Cities, said that fleet operators often have their own technicians, but currently don't need people who service EVs. Echoing Rebecca's sentiment, he stated that most fleet vehicles are leased and include dealership servicing in the lease price. "The used EV market will start to create a demand for non-factory technicians who can work on EVs, but we're years away from that." Clean Cities has an annual two-day "academy" for technicians and fleet managers that covers a wide range of alternative fuels. It is not a hands-on maintenance program, but does educate technicians about fuels, equipment, terminology, and overall needs

Mark Stevens from the City of Sacramento said, "as we transition the City fleet to ZEVs, technicians will be necessary to repair the EVs. We expect that our staff will be trained to make these necessary repairs." He expects that the City will hire people with factory training or college-level certifications for ZEV repair but thinks it will be more than five years before the City has the volume of ZEVs to need a full-time technician.

Craig Van Batenburg teaches experienced mechanics to work on EVs and hybrids with the goal of helping independent shops stay open as cars become more electrified and less mechanical. "In 1999, I bought a Honda Insight—serial number 157—and I wanted to know how to work on it," he said during a phone interview. Craig taught himself to be a hybrid mechanic and soon started teaching others at his Automotive Career Development Center (ACDC) in Worchester, MA.[23]

Craig is devoted full time to training, consulting, technical writing, and class development for hybrid and electric cars. He and his three full-time instructors trained more than 15,000 people and "and 95% of classes are outside of Massachusetts. I come to California a lot!" he exclaimed.

[23] http://www.fixhybrid.com/

Classes include disassembling cars that the school owns (Leaf, Bolt, Volt, Civic hybrid, Prius, etc.) and hands-on diagnostics and repairs. "Each class sells out in less than two days," he said. His seven-day train-the-trainer class costs $5,000 plus travel expenses. Online training is video recordings of instructors teaching live classes and cost $60 per class. ACDC also sells textbooks that Craig wrote (one of which is in Spanish), cut-away parts, cars, tools, and equipment.

Rebecca was interested in sending people to the ACDC training, but only if it was offered locally. The online courses were intriguing, particularly the Hybrid 101 series, which is a series of eight 60-minute classes. Rebecca said, "It would be hard to get someone to stay with one 60-minute recorded class. I'm not sure we'd get the value from it."

Among the ACDC classes is a series called Shop Management. It includes "Hybrid and EV Service Writer Training" that includes teaching EV terminology that EV owners know, but service writers often do not. Rebecca, and several of the other interviewees, liked the idea of a class to teach service writers and customer service agents the terminology, if done in a self-paced, engaging manner.

Opportunities for Sacramento:

- Arrange for an ACDC train-the-trainer class in Sacramento, or send a group from Sacramento to Worchester, to educate and certify local instructors.
- Use grant funding to create interactive, online classes from ACDC's recorded training. Sacramento's Rapid Acceleration, Innovation, and Leadership in Sacramento (RAILS) Grant program, Clean Cities, SMUD, and the Energy Commission are among programs that have awarded grants for EV education and innovation in the past.
- Purchase a license to the Service Writer Training and offer a version as adult or CTE education through Sacramento Works/ETP training partners. This could be leveraged into internships and jobs with existing auto service centers.
- Create a pool of cars and cut-away parts from retired municipal fleet vehicles or from auto dealerships that instructors could borrow for classes.

EV Service Centers

In 2005, AAA of Northern California, Nevada, and Utah launched the Greenlight Initiative to help build awareness about alternative fuels and vehicles. During Greenlight, the AAA Car Care Plus facility on Power Inn Road became a "model shop" for servicing hybrids. None of the AAA people interviewed for this report were familiar with the service center, and no records can be found. The California Fuel Cell Partnership (CaFCP) was a Greenlight Initiative partner and provided some insight into the service facility that operated between 2006 and about 2010.

The facility held classes for hybrid drivers and conducted alternative fuel vehicle outreach events. For a short while, AAA operated a mobile charging truck, in Figure 1, that could give a stranded EV driver enough charge to drive a few miles. AAA operated the trucks in five cities, but they saw little action and were retired in 2016.

Figure 1: AAA Mobile charging truck in 2011

Service technicians were authorized to perform maintenance on the cars' mechanical systems, but not batteries. Few modifications were made to the service center to accommodate vehicles with batteries or fuel cells. CaFCP staff recall antistatic matts placed at every service position and that technicians immediately disconnected the 12-volt battery before servicing. (Neither of these are necessary.) The center also had an NRG-funded charger that included an inductive connector and now-standard connector. In 2012, AAA wrapped up the Greenlight Initiative and the service center became an office, and the office does not have an EVSE.

The independent auto repair businesses and dealerships contacted for this report all say that EV repair is a small part of their overall business. Equipment needs are minor; insulated tools, an Ohm-meter, scopes, and probes. Some vehicles require automaker-specific scan tools used to download data, but other cars use laptop computers with automaker software. Each automaker also has custom tools for removing the battery and/or motor, but service centers said those tools are rarely necessary.

The most important tool that an EV service center needs is a Level 2, high-amp charger. One dealership (not in Sacramento) has been trying to install Level 2 electric vehicle service equipment (EVSE) for almost six months. "The EVSEs are sitting in a crate in the back," Mr. X said during an interview. "We keep having to redraw and resubmit the plans to install them. So far, the planning has cost more than the equipment."

Opportunities for Sacramento:

- Use the business license database to identify existing independent service centers and conduct targeted outreach about servicing ZEVs. This might include an educational package about terminology, an equipment list, and a streamlined process for installing EVSE. Consider a priority application for small shops to use Grow Sacramento Funds[24] for EVSE.

Dealership Service and Repair

Nick Gilliland, the Director of Service for AutoNation Honda in Roseville, is very interested in developing ZEV technicians. Of the five Sacramento-area Honda dealerships, only AutoNation services all-electric vehicles (battery and fuel cell.) Other dealerships service Honda's hybrids, "but only the mechanical systems. Everything electrical comes here," he stated.

[24] https://www.cityofsacramento.org/Economic-Development/Grow-Here/Incentives/Grow-Sacramento-Fund

AutoNation has 44 full-time technicians and 12 service writers. All the technicians completed a Honda Professional Automotive Career Training (PACT) course. Butte College in Oroville is the closest Honda PACT training center to Sacramento. "Almost all our new technicians commute every day from Oroville," Nick said.

Five of his current technicians are trained to service ZEVs, and all five are recent hires. "I tried training some of the technicians that have been here for a long time, but they just don't get it," he said. "Working on ZEVs is completely different than conventional cars." With engines, mechanics are used to seeing, feeling, smelling, and hearing problems with the equipment, and they start to develop short cuts to service the cars more quickly. ZEVs require looking at data and performing each step in order.

He gave an example of a plug-in hybrid car that the driver said lost power during acceleration. "The cars store all the data internally and the technician plugged in a laptop to read the data. He could see the power loss but couldn't replicate the problem." The tech reset the battery and sent the car home. It came back—twice. One of the new EV techs looked at the data with an analytical eye and found that the problem was related to incline; the car lost power when driving up the mountain, not a flat road. She changed a setting in the car and solved the problem.

"I think we're targeting ZEV repair to the wrong people," Nick said. "I need people who look at EVs as investigation instead of fixing."

When asked, Nick mentioned three barriers to employment he seen at automaker service centers:

1. Service shops are not female friendly for customers or employees. "When our first female service writer joined the team, I realized that our shop was more playful than professional. We changed the culture here, but the overall service center culture needs to change so that more women see themselves in this type of workplace."
2. The availability of PACT training. "It's not just that the training is in Oroville, it's that the training is in person, in English, and expensive." A PACT program for any dealership is typically four semesters (16 months) and costs $3,200, excluding boarding. PACT training through a private school like Universal Technical Institute can be faster—18 weeks—but costs up to $10,000.
3. Reaching young people who have an aptitude for EV repair. "Right now, we're squeezing EV repair into auto mechanics, but it's entirely different approach." Nick suggested that students in computer, technology, and robotics classes could be told that ZEV repair is a technology career pathway. "We pay technicians up to $45 an hour, with benefits. It's a good living that doesn't require a four-year degree."

MITO, a technical training school in New Zealand, EV Service Automotive Engineering certificate program on March 28, 2019.[25] Funded by the New Zealand government, the program targets working adults that have some background in automotive repair with online, self-paced training. In 2018, MITO tested a scaled-down version of the class—a six-week EV Service Technician certificate course—that was offered free to 120 unemployed single mothers. At a presentation in November 2018 a MITO representative stated that 110 students graduated and found jobs within 30 days.

[25] https://www.mito.org.nz/get-qualified/our-industries/automotive/electricvehicle/

Opportunities for Sacramento

- Sacramento's new car dealerships are concentrated in the Auburn Blvd./Fulton Road and Florin Road areas, both of which have active property business improvement districts (PBIDs). Partnerships with the Fulton Avenue Association and Florin Road Partnership could create a workforce training initiative that includes internships and/or pre-apprenticeships. (Apprenticeships are discussed later in this report.)

Infrastructure and Electricians

"Demand for EVSE installation is growing the fastest," said Tim Taylor from Sacramento Clean Cities, "and there's demand for the kind of professionals who can plan for and install EVSE and provide competent project management."

The City of Sacramento's Mark Stevens said, "Any electrician can handle the requirements of installing chargers. Eventually, our Facilities Division may need to train staff to repair the chargers."

Matt Nootenboom is the training director for the Sacramento/Shasta Butte Area Electrical Training Center that is operated by the International Brotherhood of Electrical Workers (IBEW) Local 340. In an email Matt wrote, "Electric vehicle infrastructure has been a passion in the electrical industry for several years now. We've seen an influx of jobs in EVSE installation and maintenance in Southern California, and a lot of the work is being done by apprentices and journeymen."

The process of becoming a State of California certified electrician starts with an apprenticeship program that consists of 1,000 hours of classroom training and 8,000 hours (4-to-5 years) of paid, supervised work experience and on-the-job training. After completing this training, an apprentice can take the state test to be licensed as a journeyman. After two years of full-time work, which may include supervising apprentices, a journeyman can take the test to become a master electrician. Master electricians can pull permits, design wiring systems, and supervise job sites.

Apprenticeships may be through union or non-union organizations or employers, including private employers, labor unions, the U.S. military, apprenticeship training centers, and community colleges. The largest apprenticeship program is the Electrical Training ALLIANCE, a joint program established under the National Electrical Contractors Association (NECA) and the International Brotherhood of Electrical Workers (IBEW). Apprentices in the NECA/IBEW program do not pay for classes. Sacramento's Local 340 also provides the books and a starter toolkit for free, as pictured Figure 2. Matt added, "Apprentices can also earn an associate degree from American River College by taking a few general education classes to supplement the college credit they receive from apprentice training."

Figure 2: Books and starter toolkit for electrical apprentices

IBEW, and non-union electrician training programs,[26] also offer the Electric Vehicle Infrastructure Training Program (EVITP). Bernie Kotlier with EVITP explained, "EVITP is a non-profit partnership of automakers, utilities, EVSE manufacturers, energy storage device manufacturers, electrical inspectors, electrical contractors, electrical workers, and first responders. It was established in 2011 to provide a structured platform to facilitate training and certification for EVSE installation in the residential, commercial, and public markets." Experienced volunteer instructors teach the program nationwide to state-certified electricians who pay $75 per person for the two-day class to cover materials costs.

In Sacramento, the IBEW training center is the only place the offers the class. "The community colleges in Sacramento don't offer it, and it's easy to understand why. They need to charge for the class to cover expenses, the IBEW offers it for just the $75."

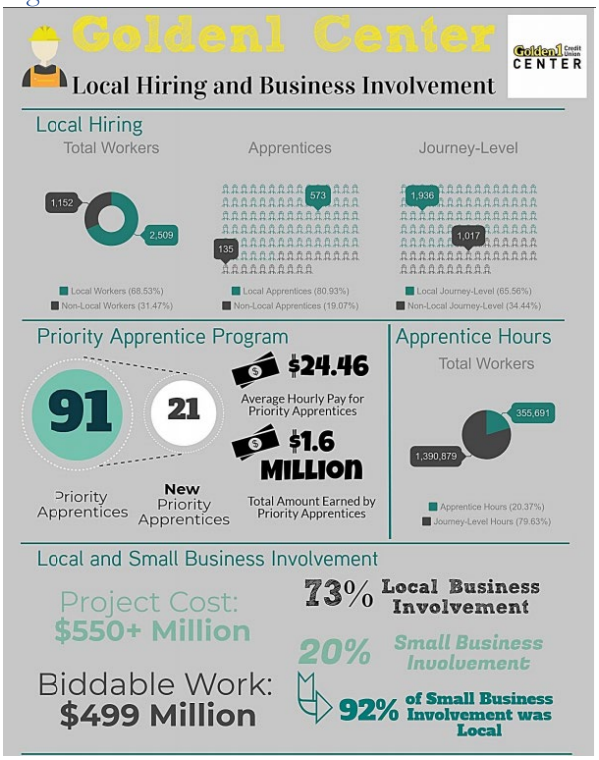
At an in-person meeting and tour of the IBEW training center, Matt stated that they have incorporated EVITP into the apprenticeship program. "Every new apprentice leaves here knowing exactly how to install and maintain EVSE." The training center has several Level 2 chargers installed in the parking lot for students to use for hands-on training, albeit they are older units and not networked.

Noah Painter with KMP Strategies joined the meeting and tour at IBEW. Noah worked with the City of Sacramento during construction of the Golden1 Center to create the Community Workforce Training Agreement (CWTA). "Industry committed to the City of Sacramento to employ 25% of the apprentices on that project from targeted communities within the City boundaries," Noah explained. "Essentially, it was job creation for those who need it most. It was a smashing success for the City and the apprentices who gained careers as a result."

[26] From American River College, Western Electrical Contractors Association, and Independent Training & Apprenticeship Program. All charge a fee ranging from $6,000 to $16,000.

A report[27] by the Office of the City Auditor concurred, as shown in Figure 3 from the report. Noah said that the City continues to use the agreement in other projects.

Figure 3: Results of CWTA at the Golden1 Center



Noah and Matt are working together to fill the Sacramento/Shasta Butte Area Electrical Training Center's pipeline with prospective apprentices. To qualify for the apprenticeship program, applicants must:

- Be 18 or over
- Have a valid driver's license
- Graduated from high school or have equivalency
- Read and write in English
- Pass an aptitude test in math and reading comprehension
- Pass drug test
- Be able to lift 50 pounds

Matt said, ""We need about 1,500 people in the pipeline. We get plenty of applicants, but few qualified applicants." When asked about the difference between a qualified and unqualified applicant, Matt answered that it came down to two things, "People don't pass the drug test, which is getting more difficult with legalization of cannabis. The other is that people can't pass the aptitude test."

Community colleges also find that first year students do not have the reading and math comprehension required for college-level work. A 2017 study by the State of California Legislative

[27] http://sacramento.granicus.com/MetaViewer.php?view_id=22&clip_id=4129&meta_id=512761

Analyst Office found that 75% of first-time community college students and 40% of university students needed remedial reading, writing, and math skills.[28] A national study stated 68% of community college students require at least some developmental education. [29]

Washington State launched the Integrated Basic Education and Skills Training Program (I-BEST) in 2005 to quickly teach students literacy, work, and college-readiness skills so they can move through school and into living wage jobs faster. Pioneered by Washington's community and technical colleges, I-BEST uses a team-teaching approach. Students work with two teachers in the classroom: one provides job-training and the other teaches basic skills in reading, math or English language. Students get the help they need while studying in the career field of their choice; they learn by doing.

Northern California Construction Training (NCCT) is a pre-apprenticeship program that feeds IBEW. NCCT pairs hands-on skill training with language and math tutoring. A similar approach in Sacramento high schools' Career Technology Education classes and adult education may help students pass aptitude tests for apprenticeship programs and for entry-level jobs. Working directly with IBEW, educators could conduct test prep specifically for the basic algebra that electricians need to know.

Noah works with the community colleges and SETA to identify residents of low-income and disadvantaged communities (LIC/DAC) that could join the program. He noted that 35% of new applicants are low-income and a significant portion have Slavic backgrounds. He admitted that even a free program has significant barriers for some participants. "The training center is not on a transit route—people have to drive to get here—and they have to drive to work sites. Most of the classes are at night and weekends, which presents a problem for people who need child care." English literacy is a requirement, too, because the books are only in English.

Women Employed, a national nonprofit aimed at improving working conditions for women, worked with community colleges across the country to identify actions to reduce barriers to education for single mothers.[30] Recommendations that could open access to apprenticeships (and education in general) in Sacramento include:

- Offering tutoring or classes (e.g. art, sports) for school-aged children while parents are in college classes. Tutoring has different staffing and legal requirements than child care and may help children be more successful in school as well.
- Forming cohorts of three or four apprentices that work and study together. Research shows that students, and women in particular, are more successful when part of a team. The cohort can also include a mentor from outside the education program.
- Providing small "emergency" grants to cover immediate needs, like a car repair or a shortfall until pay day. The Women Employed study noted a high percentage of women dropped out of college when they hit a financial bump in the road.

[28] https://lao.ca.gov/handouts/education/2017/Overview-Remedial-Education-State-Public-Higher-Education-Segments-030117.pdf
[29] https://www.ccsse.org/docs/underprepared_student.pdf
[30] https://womenemployed.org/sites/default/files/resources/LowIncomeSingleMothersatCommunityCollege2012.pdf

Opportunities for Sacramento

- Address the transportation issue, which may include a pilot program with a shuttle or mobility hub at the Richards Blvd. light rail station that could transfer students to and from the training center on the nights that classes are in session.
- In collaboration with the Natomas Community Center or Parks Department, launch a pilot project with tutoring and recreation programs for students' school-age children.
- Extend the CWTA principles and practices to contracts that will install EVSE that receive CALeVIP funding. This will require coordination with Center for Sustainable Energy and the Air Resources Board to understand the process and implications on the State's requirement to pay a prevailing wage.
- Following the I-BEST principles, work with Green Tech, Asian Resources, Sacramento Regional Conservation Corps, and other community-based programs to develop and implement a pre-apprenticeship program that includes paid work experience with tutoring to pass the aptitude test.

Data Collection and Analysis

ZEVs and infrastructure both collect massive amounts of data, and data analysts separate meaningful data from noise.

At a Nissan office tucked into a quiet office park, test drivers take cars out on the road and drive a prescribed pattern that includes roads, speeds, charging/fueling, and commands like accelerate quickly or coast to a stop. The cars are in a blind study with a control vehicle and one or more cars that have an undisclosed modification. Data analysts sift through and analyze the data to make the cars more efficient—or perhaps to have a super power. (Nissan doesn't say.)

According to American Public Power Association, data collection for EVs and EV charging was one of the top 2018 trends.[31] Utilities want data to understand charging patterns, jurisdictions want data to understand mobility use and needs, automakers collect data to build more-competitive cars, and data is becoming more important with connected roadways and mobility as a service.

In December 2018, Natural Resources Canada launched a $7 million project to "improve the operation and deployment of charging infrastructure for EVs by demonstrating charging based on the innovative and intelligent use of real-world, vehicle-side data."[32] In April 2019, the U.S. Department of Energy issued funding opportunity announcement of $4 million to "collect, validate, analyze, and make summary results publicly available an updated national dataset that includes a variety of vehicle and charging equipment types, climate conditions, and end-user segments that will be of high value to government at all levels, the research community, local planners, industry, and others."[33]

In 2017 and 2018, Frontier Energy facilitated workshops with councils of governments and metropolitan planning organizations nationwide to develop action plans for autonomous and

[31] https://www.publicpower.org/periodical/article/data-collection-charging-patterns-among-top-2018-ev-trends-report
[32] https://www.nrcan.gc.ca/energy/funding/icg/19496
[33] https://eere-exchange.energy.gov/#Foald439d5a28-e6a1-48a2-b453-093d3bfbe1df

connected vehicles. In each workshop, cities and counties identified 'data science' as a workforce gap. Groups made the following recommendations:

- Look for conventional and unconventional ways to develop technical skills, including boot camp/hacker lab events.
- At high schools that teach computer programming, consider a STEM path for data science to create a skilled workforce that will be needed in the next 5-to-10 years.
- Review job descriptions at municipalities ensure a city (county or state) can hire data scientists, including appropriate pay.
- Use an "externship" model in which local tech companies spend time with government counterparts to share their knowledge and methods.

Opportunities for Sacramento

- Review City job descriptions and future-proof by creating job descriptions and internships for data scientists. Collaborate with UC Davis and Sac State.
- Partner with Hacker Lab and I/O Labs, a recipient of a 2018 RAILS grant, to have companies like Uber, Jump, EVgo, and GIG explain their data needs to tech entrepreneurs.
- Partner with Code for Hood[34] to host a transportation-focused hackathon.

Soft Skills and Customer-Facing Jobs

Businesses across the region talk about the difficulty in finding good employees. When asked to define good, the answers were surprising. Matt Nootenboom from the Sacramento/Shasta Butte Area Electrical Training Center said that new apprentices are surprised to learn that a job start time isn't "a window to shoot for" and that they are expected to work on days they are scheduled.

From greeting customers to handling complaints, many businesses owners said that people new to the workforce don't understand customer service skills. In an interview for a regional business magazine, the owner of a mortgage broker said she hired a receptionist who seemed great, "but answered the phone by saying 'Yeah! Speak!'" The receptionist didn't last the day.

Customer service, like every other skill, needs to be taught. Businesses interviewed for this report underscored the need customer service education and all of them volunteered to participate in a training program.

In West Sacramento, the Chamber of Commerce teamed with the City of West Sacramento and River City High School to conduct bootcamps in the high school's resource center. Open to every student and parent, local employers will explain what they expect from employees. Students will practice skills like answering the telephone and resolving customer problems. Those that complete the bootcamp will receive a digital badge.

"These are highly important skills," said Kniesel's Auto Centers owner Rebecca Kniesel. "We assume that people know how to do these things. Having a certificate or badge that says you completed customer service training would be great!"

[34] http://codeforhood.com/

Soft skills and customer service translate into one often-overlooked EV-related job: insurance estimator. "Body damage is body damage," said a participant who asked not to be named. "But Teslas are different. I can estimate the repair to a Leaf or a Mirai in about 10 minutes. I need to take a Tesla apart to see what's broken. It takes an hour or more, and the customer is fuming the whole time." Tesla teaches people to estimate repairs, but Mr. X said, "they don't teach you how to talk to customers. I had to learn that."

Multilingual customer service representatives (CSRs) are in particularly high demand. In April 2019, the Center for Sustainable Energy (CSE) had job postings on its website for rebate processing specialists that speak Tagalog, Russian, Mandarin, Korean, and Hmong. CSE manages clean vehicle rebates for California, Massachusetts, and New York and will soon manage Oregon's program. The company also manages CALeVIP and has applied to manage other California mobility voucher programs. All rebate processing in done in San Diego, but CSE recently opened an office in Sacramento.

Opportunities for Sacramento

- Partner with high school and adult education, business associations, and PBIDs to host customer service bootcamps in each council district. At the end of the bootcamp, area businesses and Sacramento's mobility providers might host a job fair.
- Collaborate with Sacramento Works and CSE to expand the Sacramento office to include a multilingual rebate processing center. Coordination with on-the-job training providers to teach specific skills, including customer service, computers, and EV terminology, may qualify CSE for a tax credit.[35]

Cost of a ZEV Service Center

LoopNet shows an auto repair business at 4520 Auburn Blvd. listed for sale at $675,000.[36] Pictured in Figure 4, the shop is properly zoned and is in high-traffic area. A neighboring business, in Figure 5, is for lease with a monthly rent of about $6,000. Obtaining equipment, tools, a lift, business license, EVSE, and insurance is between $50,000 and $60,000. Overhead (excluding lease) and supplies average $10,000 a month, plus salaries, employment taxes, and worker's compensation. A one-person shop needs to gross about $200,000 a year to break even.[37]

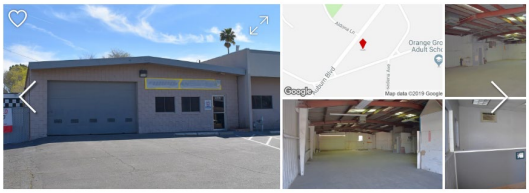
The service center operators interviewed for this report all stated that servicing only ZEVs (or hybrids and ZEVs) is not financially viable. Many interviewees stated that most people lease ZEVs and the dealerships service the cars, but they also pointed out that ZEVs don't need oil changes, tune-ups, and smog checks that are the bread-and-butter for most service centers.

[35] http://www.sacramentoworks.org/employers-business/assistance-incentives/
[36] https://www.loopnet.com/Listing/4520-Auburn-Blvd-Sacramento-CA/15474006/
[37] Based on interviews with auto service and repair businesses

Figure 4: Auto repair shop for sale in Sacramento County

4520 Auburn Blvd $675,000

Sacramento, CA 95841 · Retail For Sale



RETAIL PROPERTY FOR SALE

Get Financing

Price	$675,000	No. Stories	1
Property Type	Retail	Year Built	1961
Property Sub-type	Auto Repair More...	Tenancy	Single
Building Class	C	No. Drive In / Grade-Level Doors	1
Sale Type	Owner User	Zoning Description	GC, Sacramento
Lot Size	0.17 AC	APN / Parcel ID	240-0132-031
Gross Leasable Area	3,200 SF		

Figure 5: Auto repair shop for lease in Sacramento County

4500 Auburn Blvd $12.00 /SF/Yr

Sacramento, CA 95841 · Retail For Lease

AUTOMOBILE REPAIR SHOP

Rental Rate	$12.00 /SF/Yr	Gross Leasable Area	5,988 SF
Property Type	Retail	Year Built	1961
Property Sub-type	Auto Repair		

Listing ID: 15036260 Date Created: 1/31/2019 Last Updated: 3/26/2019

Potential Business Partnerships

In writing this report, five potential partnerships models were identified:

1. Automotive Apprenticeships – Nick Esquivel is the California Apprenticeship Initiative (CAI) Coordinator for the California Community Colleges Chancellor's Office. He coordinates State and Federal funding sources and issues grants of up to $500,000 to community colleges so they can partner with businesses to establish apprenticeship programs. Advanced transportation is one of the CAI's priority areas.[38] All of the auto service centers interviewed for this report, including those that want to remain anonymous, said they would gladly participate in a ZEV apprenticeship program for technicians, service writers, and data analysts. Several were particularly interested in partnering with initiatives to bring women into the automotive field. A program that provides flexible, self-paced learning with the ACDC curriculum and on-the-job paid training at neighborhood service centers could make this a career path within reach of people in LIC/DAC neighborhoods. The Florin Road and Fulton Avenue PBIDs may partner in this effort.
2. Fill the IBEW apprenticeship pipeline—Noah Painter was not aware potential recruiting points including Mutual Housing where Community CarShare is based, Green Tech, the Franklin Neighborhood Development Corporation, or community-based organizations serving Asian and Russian communities. Introducing Noah to these groups can help identify qualified people, and these groups can target education that can help their participants pass the entry exam. Partnering IBEW with EVgo and other EVSE manufacturers can provide students with newer equipment to use, and perhaps open a pathway to teach electricians how to network the EVSE.
3. Create a business around the Del Paso Blvd. mobility hub pilot to teach students and adults how to collect, read, and make decisions based on data. A partnership with CleanStart[39] could create a pathway for area entrepreneurs to deploy their new ideas while mentoring students that can collect and analyze data.
4. In late 2019 or early 2020, the California Air Resources Board (ARB) will accept applications for the Clean Mobility Voucher Pilot Program.[40] The intention of the program is to "fund small-scale car sharing and ridesharing projects with zero emission vehicles that enable users in disadvantaged communities to have short term access to transportation modes on an as-needed basis." Defining a pilot project that includes training and workforce development now will ensure that Sacramento will be first in line for the program when voucher applications open.
5. Clean Cities is working with American River College to expand the course offerings about alternative fuel vehicle maintenance. A pipeline of students from Twin Rivers to American River College could demonstrate student demand for the classes. The appropriate people are already coordinating and are aware that they can include the City of Sacramento in requests for support.

[38] https://foundationccc.org/What-We-Do/Workforce-Development/Workforce-Services/California-Apprenticeship-Initiative
[39] https://cleanstart.org/
[40] At the writing of this report, ARB had awarded the contract for administering the program, but not contracted the program.

Toolkit for Economic Pathways

The City of Sacramento can take steps to implement or encourage three of the recommendations in this report in concert with other City departments.

Extend the City of Sacramento's Community Workforce Training Agreement (CWTA) to include apprentices for mobility-related projects. Noah Painter from KMP Strategies already works with the City on the CWTA and is aware of the EV Blueprint. One option is to ensure that project funded from local sources, like an Energy Commission grant for installing infrastructure or an AQMD grant for mobility pilots, includes a provision that contractors participate in CWTA for grant-funded EVSE.

Arrange for train-the-trainer sessions to certify local instructors to teach the Automotive Career Development Center's (ACDC) EV certification course to experienced mechanics. The State of California workforce development initiative might fund for a private company to lead this effort and purchase equipment for training. One option is to work with the Franklin Neighborhood Development Corporation, which has expressed interest in helping their local auto service business learn to service EVs and hybrids. A series of one- or two-day classes for mechanics in the neighborhoods where they work could increase interest in installing EVSE at their business as well as teaching mechanics new skills.

Separate funding, potentially from a technology grant like the Rapid Acceleration, Innovation, and Leadership in Sacramento (RAILS) grant program, could transform ACDC's recording training into interactive, online classes that are shorter and more engaging for computer-based learning. Short courses that teach basics of EV customer service, service and maintenance issues, working with high voltage, charging behavior are a good starter set for people who may go on to learn more. If online training is coupled with one or more hands-on sessions, it can be a low-cost introduction to well-paying jobs in EV repair and customer service.

Finally, to support this effort, the City can create a pool of cars and cut-away parts from retired municipal fleet vehicles that instructors could borrow for classes. Potentially managed by Clean Cities or Sacramento Works, certified teachers could check out equipment and return it when done.

Explore establishing a multilingual customer service center for clean mobility partners. A one- or two-day class with Sacramento Works partners like Asian Resource Center, Green Tech, Sacramento Food Bank, and Sacramento Urban League can teach basics of customer service, computer skills, and terminology about electric cars and charging. An additional day (or separate class) might focus on energy efficiency programs that utilities offer their clients. A partnership with the Center for Sustainable Energy that operates several rebate programs for ZEVs and energy efficiency could incorporate on-the-job training or practical experience.

Other actions are outside the direct sphere of influence of a city government and are summarized here so that other groups that are vested in developing a strong, skilled workforce might identify ideas that they can implement.

- Integrate ZEV servicing and data science into computer classes at high school, community college, and adult education to demonstrate the link between data analysis and mobility.

Partnering with Hacker Lab, I/O Labs, and Code for Hood may reach a variety of tech audiences

- Offer targeted tutoring to help people pass reading comprehension and math tests required for apprenticeship programs.
    - Develop and implement a pre-apprenticeship program that includes paid work experience with tutoring to pass the aptitude test.
    - Partner with CBOs to focus on reading and math skills
- Stage a customer service bootcamps followed by career fairs with local business and e-mobility providers.
- Address barriers to night-time classroom education that apprenticeships require
    - Target mobility hubs between light rail stations and classrooms to transfer students to and from the training centers on nights that classes are in session.
    - Collaboration with the community centers or Parks Department on a pilot project to have tutoring and recreation programs for students' school-age children.
- Review City job descriptions and future-proof by creating job descriptions and internships for data scientists.

Appendix A: All Recommendations

All recommendations in this report are listed below. Potential partners, funding, and benefits are detailed in the body of the report.

- Integrate ZEV servicing into computer classes at high school, community college, and adult education. Computer and technology classes are often presented as a pathway to a four-year degree and a desk job. Demonstrating the link between data analysis and cars could entice a new segment of people into EV service classes.
- Extend the City of Sacramento's Community Workforce Training Agreement (CWTA) to include apprentices for mobility-related projects to provide a pathway for residents of low-income and disadvantaged communities. CALeVIP recipients will be required to pay installers a prevailing wage and could create a pathway to using electrical contractors that participate in CWTA.
- Offer targeted tutoring, potentially through "bridging" classes or pre-apprenticeship programs—to help people pass reading comprehension and math tests required for apprenticeship programs
- Partner with each council member to stage a customer service bootcamp followed by career fair with local business and e-mobility providers.
- Arrange for one or more train-the-trainer sessions to certify local instructors to teach the Automotive Career Development Center's (ACDC) EV certification course to experienced mechanics.
- Apply for or encourage another training organization to apply for grant funding to create interactive, online classes from ACDC's recorded training.
- Purchase a license to the Service Writer Training and offer a version as adult or CTE education through Sacramento Works/ETP training partners. This could be leveraged into internships and jobs with existing auto service centers.
- Create a pool of cars and cut-away parts from retired municipal fleet vehicles or from auto dealerships that instructors could borrow for classes.
- Use the business license database to identify existing independent service centers and conduct targeted outreach about servicing ZEVs. This might include an educational package about terminology, an equipment list, and a streamlined process for installing EVSE. Consider a priority application for small shops to use Grow Sacramento Funds for EVSE.
- Partner with the Fulton Avenue Association and Florin Road Partnership to create a workforce training initiative that includes internships and/or pre-apprenticeships at the auto dealerships concentrated in these two areas.
- Increase access to apprenticeships (and education in general) by:
    - Offering tutoring or classes (e.g. art, sports) for school-aged children while parents are in college classes.
    - Forming cohorts of three or four apprentices that work and study together. The cohort can also include a mentor from outside the education program.
    - Providing small "emergency" grants to cover immediate needs, like a car repair or a shortfall until pay day.

    - Address the transportation issue, which may include a pilot program with a shuttle or mobility hub centering at a light rail station that could transfer students to and from training centers for night classes.
- Review City job descriptions and future-proof by creating job descriptions and internships for data scientists.
- Partner with tech entrepreneur incubators to have companies like explain their data needs to tech entrepreneurs and/or host a transportation-focused hackathon.
- Develop a multilingual rebate processing center that includes on-the-job training to teach customer service, computers, and terminology specific to EVs and energy efficiency.

Attachment 5: Sacramento Electric Vehicle Blueprint Task 6.3 – Identify Advanced E-Mobility Options

Sacramento EV Blueprint

Task 6.3:
Identify Advanced E-Mobility Options

ARV-17-042

Prepared for the City of Sacramento by DKS Associates and Frontier Energy

Final

Table of Contents

Task 6.3: Advanced E-Mobility Opportunities

The goal of this report is to document e-mobility project successes and challenges, identify recommendations for improvement, and provide lessons for replicating projects in other geographies. This task also recommends a concept for an e-mobility hub.

Mobility hubs are a new concept; many cities are talking about them, some are funded, few are operational. Mobility hubs don't have a "typical' site; some are large transit centers, other are park and ride lots, while others may be limited to a bus stop with a car and a bike. They are, ideally, centers of connectivity at which multiple modes of travel converge. The concept is to provide an integrated suite of mobility services like from transit to bike share to parking along with wayfinding and urban design enhancements and technologies that include dynamic parking management strategies, real-time traveler information, and real-time ridesharing. Mobility hubs may include pick-up/drop-off zones for ride-hailing and "kiss-and-ride," freight delivery hubs and connections to bike and pedestrian routes.[1]

An e-mobility hub is Sacramento's concept that takes the mobility hub one step further by adding the infrastructure and support services to encourage every vehicle to be electric instead of running on petroleum. It includes charging stations for a variety of vehicles, potentially energy storage, and amenities that can serve all populations.

To understand the elements and potential business models for an e-mobility hub, the EV Blueprint team interviewed companies and organizations that operate individual elements of a future e-mobility hub.

Summary e-mobility operator interviews and other sources

The following is a summary of interviews conducted with advanced mobility operators, most of whom operate electric-vehicle programs in Sacramento. The team also interviewed mobility operators in West Sacramento, Squaw Valley, and Seattle, Washington. Companies operating outside Sacramento were contacted for interviews but declined to participate.

Interviews were with the following mobility providers, all of which responded to requests for interviews:[2]

- Sloane Morgan of GIG Care Share
- Allen Bates of Envoy
- Gina O'Neal and Anne Marie Flynn of Our Community CarShare
- Alva Carrasco of SacRT
- Sarah Strand of the City of West Sacramento

[1] *Electrifying Ride-Sharing: Transitioning to a Cleaner Future*
[2] Interviews focused on community EV car share operators, in addition to micromobility projects. Additional interviews were requested of other local operators that did not respond to interview requests.

- Casey Gifford of King County Metro Transit
- Stephen Murray of Downtowner

All interviews were conducted between April and June 2019 and supplemented by online research and other sources.

Electric Car Share

Car sharing refers to a model of car rental where vehicles are rented out for shorter periods of time (usually on a per hour basis) and often intended for shorter distance trips in urban areas where personal car ownership can be challenging. Car sharing is often seen as a popular alternative method of transportation in cities because it is more flexible than mass-transit, car ownership may be too expensive, or the dense urban environment may make vehicle ownership unfeasible. Car sharing has also been shown to reduce vehicle ownership and vehicle trips, enabling participants to "shed" personal vehicles, using a car-share vehicle only when needed, and relying on transit or active transportation as primary travel modes.

Round-trip or docked car share is "traditional" car sharing that requires users to borrow and return vehicles at the same location. In larger urban areas, multiple carshare vehicles or groups of vehicles may be available within just a few block radii, while in smaller towns or suburban centers, round-trip carshare vehicles may need to be strategically placed to capitalize on locations with a strong user base, like pockets of dense housing, rail stations, and employment centers. When round-trip carsharing is placed in a lower-density environment, it often needs an anchor tenant that can guarantee a certain level of usage to support the costs of locating the vehicles. The *Bay Area Carsharing Implementation Strategy* developed by the Metropolitan Transportation Commission stated, "Including on-site vehicles at more locations can help reduce single occupancy vehicle trips, and the deployment of EVs at more dispersed locations could help build out the availability of charging infrastructure. Public and private fleets can reduce their vehicle numbers and increase their utilization by using carsharing vehicles."[3]

One-way carsharing works best in dense neighborhoods and urban centers because it needs a mass of users to meet demand and avoid costly rebalancing measures (moving cars from low-demand areas to places where they are more likely to be picked up). The two models of one-way car sharing are:

- Free-floating that includes a fleet of vehicles that can be located and reserved by app, then picked up or parked at any legal parking spot within a specific geographic zone (often an entire municipality).
- Point-to-point (also called A/B) carsharing in which users park and pick up cars designated locations. This kind of carsharing typically works best when many destinations are within two-to-four miles of one another.

[3] http://policies.sharedusemobilitycenter.org/uploads/documents/carsharing_report_vfinal_06.21.18.pdf

UC Berkeley's study of car2go free-floating car sharing in five cities found that one car served an average of eight people a day and that each car-share car eliminated between seven and 11 personally owned vehicles.[4] San Francisco Metropolitan Transit Authority's On-Street Car Sharing Pilot Program with ZipCar found that one car served an average of 19 people a day.[5]

Three common categories of car-share operation are:

- Peer-to-Peer Car Sharing—a community of existing car owners make their vehicles available for others to rent for short periods of time. Car sharing software matches owners of cars that are available to other drivers to rent.
- Business to Consumer (B2C) Car Sharing—a company owns a fleet of cars and facilitates the sharing amongst members.
- Not-For-Profit or Co-Op Car Sharing—a local organization facilitates sharing vehicles to provide social and environmental benefits.

GIG, Envoy, and other operators like ZipCar, car2go, Flinkster, Autolib, and cambio are B2C car sharing. Our Community CarShare is a public, subsidized program funded by grant dollars.

GIG Car Share Interview

GIG Car Share, which is powered by AAA Northern California, Nevada and Utah (AAA NCNU), operates in the Bay Area and Sacramento, is an on-demand, short-term free-floating car share service. As a project of AAA NCNU, GIG Car Share is a non-profit, with revenues and learnings reinvested back into member services. Users can use the GIG app to reserve a hybrid or electric vehicle (in Sacramento, all the vehicles are electric) up to 30 minutes in advance, locate the closest car, use the car for a trip of any length, and return it to GIG's designated service location, that is, they can end the trip in any legal on-street location that allows parking for one hour or more, including metered or residential parking (certain restrictions apply). In this way, cars can "free-float" throughout the service area, with trips beginning and ending in different locations.

According to Sloane Morgan, Grocery shopping is the most popular use of GIG vehicles and 26% of trips are shared with another person, providing a viable alternative to vehicle ownership for several demographic groups. GIG supports active modes of transportation such as bicycling, one reason that every GIG vehicle has with two bike rack on the roof.

GIG's car share service began in April 2017 in the San Francisco Bay Area and currently covers a 26-square-mile service area in San Francisco, Albany, Alameda, Berkeley, and Oakland, and has provided hundreds of thousands of trips with its hybrid fleet. The service was expanded to Sacramento in March 2019 with an all-electric vehicle (EV) fleet of 260 Chevy Bolts. The GIG program in Sacramento is the largest launch of free-floating electric car share service in the United States, and one of the largest EV car share services in the nation. GIG believes its service will be well received in Sacramento because of Sacramento's relatively high urban density, low crime rates, and support of EV fleets.

[4] http://innovativemobility.org/wp-content/uploads/2016/07/Impactsofcar2go_FiveCities_2016.pdf
[5] https://www.sfmta.com/blog/one-car-19-people-3-key-findings-how-sf-uses-street-car-sharing

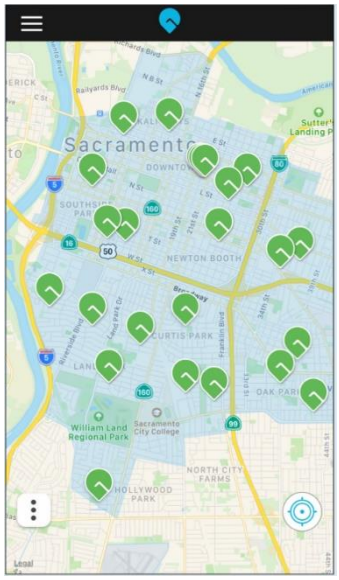
From March to May 30, 2019, Sacramento GIG cars drove more than 133,000 zero-emission miles and 17,000 people downloaded the app. In the month of May 2019, after the official program launch, people took over 9,400 trips and logged 65,000 electric miles. The current rental rate is 40 cents per minute or $15 per hour, whichever is less, up to $85 per day and AAA members receive a 10% discount. and Figure 2 is the GIG app on a smartphone.

Figure 1 is a picture of the GIG home zone, the 13-square-mile area in which travelers can pick up or drop off a car and Figure 2 is the GIG app on a smartphone.

Figure 1: GIG 13-square-mile home zone

Approximately fifty percent of GIG's Sacramento service area covers low-income and/or disadvantaged community areas. GIG doesn't require a subscription or membership fee; the intention is that GIG's pay-as-you-go model will encourage trips by users of all economic levels. The costs for fuel/charging, insurance, and parking are all included in the vehicle rental price. GIG is a partner to Electrify America and the City of Sacramento's Green City Initiative. GIG can measure trips to and from low-income and disadvantaged communities by evaluating trip origins and destinations by zip code.

Figure 2: Screenshot of GIG Carshare app (Source: GIG)



Initial lessons learned from this new program are the challenge of communicating this new car-sharing concept to prospective users, many of whom may not have driven an EV before. As a result, GIG is devising and testing new ways to communicate to potential customers to overcome the challenge of 'mode shift' in California's auto-oriented culture, and adoption has increased as people become more familiar with this concept. GIG is also designing new ways to communicate with its customers to explain that electric GIGs are charged and ready to go and how to charge a GIG for long-distance trips. Providing parking locations near transit locations and installing EV charging, especially DC fast charging, will assist operations at e-mobility hubs. However, in general, service launch issues have centered more on issues of parking, rather than the electrified nature of the service.

Envoy Technologies Interview

Also, part of Sacramento's Green Cities Initiative, Envoy Technologies is a commercial startup that operates a "docked" electric car share program; trips begin and end at the same location. Envoy car-share began in Southern California as a mobility amenity to market-rate residential development.

The company, Envoy Technologies, as describes itself as "an integrated technology platform and operations solutions that allows property owners to implement mobility as a community or municipal amenity founded by a team of seasoned real estate investors with a passion for technology." It is a for-profit, private company.

Typically, property managers pay Envoy Technologies to provide the car-share amenity at the property and residents, tenants, or guests pay to rent the car by the minute or hour. The company installs attractive Level 2 chargers, as seen in Figure 3 and, at some locations, an on-site car wash station; Envoy Technologies also provides full insurance, fleet maintenance, and 24/7 customer support for property owners and drivers. Drivers use the Envoy app to reserve and unlock cars.

Figure 3: Envoy's docked car share at Whispering Pines apartment complex in Sacramento

Envoy Technologies and the site host typically operate under a revenue-sharing model, which reduces or completely offsets costs to the site host as utilization increases. However, through partnership with Electrify America in Sacramento, Electrify America invested in vehicles and EV charging infrastructure for Sacramento properties, allowing Envoy Technologies to provide its service at no cost to site hosts. Residents of properties pay to rent the car by minute or hour and vehicles are only available to residents of the host property.

Envoy Technologies' Sacramento operation is tailored to address specific needs of-low income and disadvantaged communities. Envoy's goal was to deploy 140 Volkswagen e-Golfs at 70 specific locations. As of mid-June 2019, Envoy car-share operates at approximately twenty residential properties in Sacramento through the Electrify America program, with over 75% of properties located at low-income and/or disadvantaged communities as defined by CalEnviroScreen. Deployment of additional cars to meet the target of 70 properties is ongoing.

Envoy is committed to serving all populations with sustainable transportation options and continually learning the best way to serve low-income/disadvantaged communities, which includes evaluating the costs that site hosts and drivers pay and ability to use vehicles without an app. At the time of report preparation, Envoy vehicles are available at 15 cents per minute or $9 per hour, up to $45 per day.

Envoy evaluates effectiveness by measuring the number of people who use service, vehicle utilization time, awareness of the service, and from self-reported survey. Envoy's Sacramento program, which began operation in March 2019, is in the early stage of deployment. Using experience in other cities, Envoy's best carshare sites appear to be locations with one or more of the following attributes:

- Private car ownership is low
- Limited or no parking
- Close to transit and other mobility options
- Limited access to basic services (i.e. near a "food desert")
- Proximity to students
- Willing marketing partners

To date, the most popular sites in Sacramento have been student housing sites.

In addition to Sacramento, Envoy operates in Culver City, Orange County, Irvine, Los Angeles, Marina Del Rey, and one location in New York City. Locations primarily multifamily apartments and condos, although two Southern California locations are hotels and one is a WeWork shared workspace. The New York location is student housing for State University of New York (SUNY) Brockport campus. (None of the locations outside Sacramento meet the criteria for low-income housing.)

Envoy Technologies is also implementing projects in Sacramento and the Bay Area with an award of $1.5 million from the California Energy Commission.[6] These programs will have a different cost-share model, which is under development, and stated that want to use EVs and fuel cell electric vehicles (FCEVs) in areas that have easy access to one or more hydrogen station in Sacramento and the Bay Area.

Our Community Carshare Interview

Our Community CarShare is a free, membership transportation available to residents of affordable housing communities that started in May 2017. The program is funded by a partnership of multiple public agencies to place docked EV car-share vehicles and Level 2 charging at low-income housing communities throughout Sacramento. Residents use an app to reserve and use the cars for up to three hours at a time and up to nine hours per week without charge. Since starting, membership has grown to 504, about 30% of the eligible population. Members must be over 21, have a driver's license, and an email.

[6] https://ww2.energy.ca.gov/contracts/GFO-16-605_NOPA.pdf

Figure 4: Our Community Carshare with member and resident, Susan Brown (Source: Sacramento County)

Each of seven communities has two car-share EVs and two Level 2 chargers. Three of the communities are managed by Sacramento Housing and Redevelopment Agency (SHRA) and the other four by Mutual Housing. Two additional EVs are at the Sacramento Valley Train Station, hosted by the City of Sacramento. Breathe California is another project partner supporting with outreach, and Zipcar is managing car share operations.

As a new mobility service, Our Community CarShare identified and continues to address barriers to users accessing the cars, including language, risk aversion, familiarity with technology, and the age and mobility of residents. SHRA and Mutual Housing continue to help bridge the barriers: Mutual Housing conducted outreach in eight languages spoken by community residents and provided more ground support, frequent events, a call-in number with answering services, representatives at each site, full-time project management, and websites in most languages. They have also collaborated with Breath California, a non-profit organization promoting healthy air quality. SHRA is focused on sustainability by providing more cars at a lower price.

Anecdotal information helped contextualize the effectiveness of serving low-income and disadvantaged communities. Program administration by the Air District and site host staff has been critical to program success. Residents needed assistance enrolling in the service, understanding the technology, and reserving the vehicles, and learning how to charge the vehicles. Due to the Air District's funding of the program, the Air District was equipped to overcome program barriers for low-income participants. For participants without credit cards, the Air District created a work-around to the standard Zipcar requirement that all participants provide a credit card, which allowed "unbanked" individuals to participate in the program.

Site staff serve as ambassadors for the program, with residents volunteering to chauffer other neighboring residents using their own CarShare credits to provide mobility to residents that are unable to drive themselves. Breathe California staff worked to understand other barriers and challenges and learned that many people are precluded from participating due to legal issues that prevent them from obtaining driver's licenses. Through the program, Breathe California staff provide supportive resources to address barriers and increase participation in the program.

Collection of additional data is ongoing to refine and evaluate the program. A survey was distributed but only 1% of users responded. New surveys are being launched but results are not yet available.

One technical lesson learned is that several of the communities opted for the lowest-cost EVSE that is no longer supported by the manufacturer. In a June conversation with the program manager, two of the EVSE have failed and need to be replaced. The program manager stated the future projects will not go to the most reliable, not the lowest cost, vendor. Sacramento Metro AQMD is also leading an effort to expand Our Community CarShare with more vehicles at existing locations and more locations. In a June 2019 conversation with Air District project leads, they stated that up to 10 of the new vehicles will be FCEVs that can use existing hydrogen infrastructure and have longer range than battery EVs. The program started with seven Kia Soul EVs but has since expanded to six Chevy Bolts and one Chrysler Pacifica plug-in hybrid to support people that have longer-range trips.

On-demand transit

On-demand transit (ODT), also called microtransit and demand responsive transit, is an integration of ride-hailing and shared-ride services. It can function as a replacement for a fixed route, particularly in low-density areas where fixed bus routes are infrequent, or as an overlay of existing transit service to help people with the first-mile/last-mile transportation; how they get to and from the bus stop. Transit agencies across the country are experimenting with ODT as transit ridership falls and cities are adding ODT to reduce congestion, decrease emissions, and serve marginalized populations.

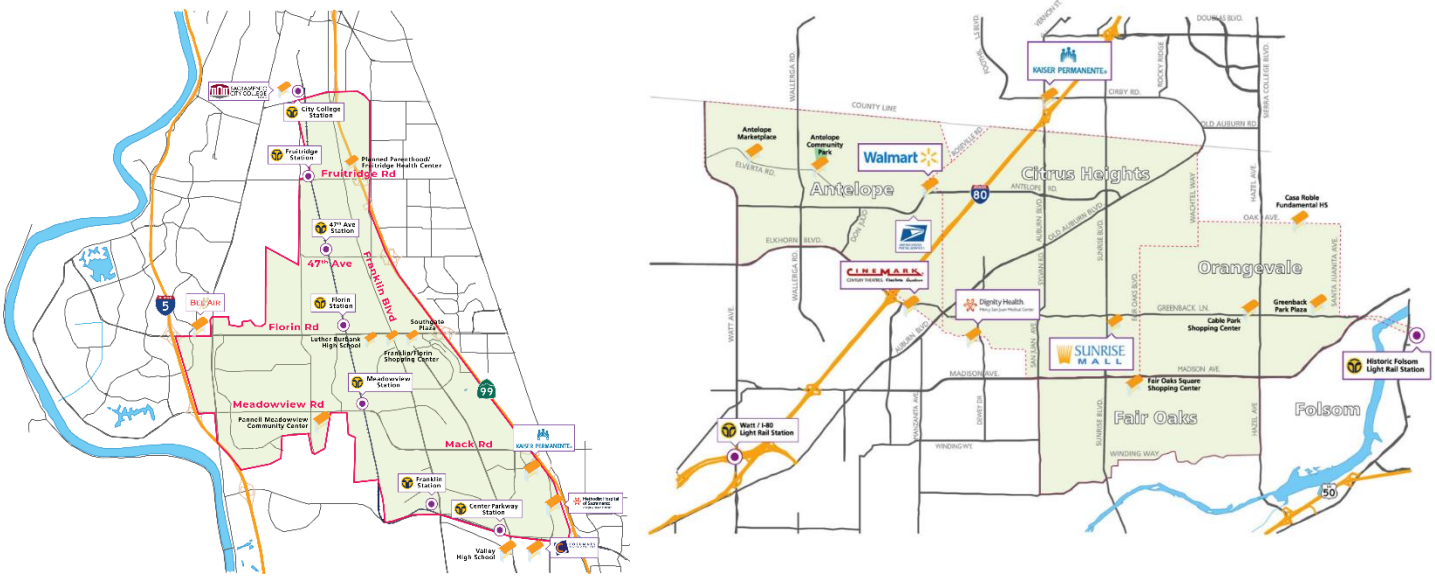
The following is a summary of interviews with ODT operators around Sacramento and beyond.

Sacramento Regional Transit

SmaRT Ride is a microtransit[7] service operated by Sacramento Regional Transit (SacRT). Currently SmaRT operates two service areas shown in Figure 5: Citrus Heights, Antelope and Orangevale; and Franklin-South Sacramento. SacRT will add a Downtown, Midtown and East Sacramento route in mid-June 2019.

[7] SacRT uses “microtransit” instead of ODT

Figure 5: SmaRT's Franklin Blvd. and Citrus Heights Service Area (Source: https://smartride.sacrt.com/)



SmaRT Ride passengers download a smartphone app to request a ride, similar to how ride-hailing apps work, and pay the same amount as a bus or light rail ride. A shuttle bus, which will soon be an electric shuttle in the Franklin service area, picks up the passenger and will drop off anywhere within each designated service area. The shuttle will pick up and drop off other passengers on the way. SmaRT Ride service began in February 2018 and has served more than 95,000 passengers. Each vehicle can seat between 10-22 passengers and is equipped with two wheelchair positions. Approximately 12 to 16 vehicles are in use per day from 6:00 AM to 9:00 PM, Monday through Friday.

Students can ride SmaRT Ride for free, and every group of five passengers rides free as well.

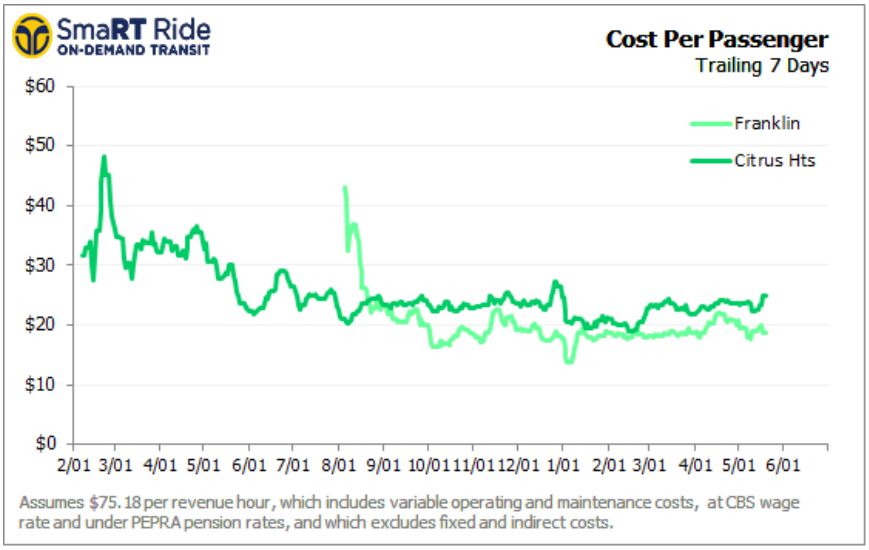
The Franklin service has been in operation since August 2018, with average daily ridership between 350-450 riders. The service averages 40 revenue hours per day (the number of buses * the number of operating hours) compared to 60-to-70 revenue hours per day for the Citrus Heights service. As Figure 6 shows, the number of riders per day in less on the Franklin route. It's important to note that the Citrus Heights route operates in an area that has traditional bus service as an overlay whereas the Franklin neighborhood was not previously service by transit.

Sacramento RT outreach in multiple languages to the diverse Franklin community, Figure 7 shows an uptick in the riders per hour. SacRT set its budget based on three boardings per hour and is averaging about four riders per hour.

The program costs SacRT $75.18 per revenue hour, which equates to $19 to $25 per passengers. In comparison, it costs SacRT $8.11 per passenger for a standard transit bus and $19.77 per passenger

for the Community Bus Service, which is deployed in three neighborhoods.[8] Figure 6 shows that the cost-per-passenger is decreasing as people become more aware of the program.

Figure 6: SmaRT Ride Per-Passenger Operations Costs (Source: SacRT)



In a conversation, Chris Flores, Special Assistant to the CEO/GM at Sacramento Regional Transit District, was asked if he foresaw on-demand transit replacing transition fixed route buses. He answered no, with a caveat. He said that ODT can increase ridership on light rail and commuter routes, and believes it is a wise investment in addressing transportation equity in neighborhoods where it is difficult to operate a fixed route. However—the caveat—electric shuttles for ODT might be more cost effective to operate and may be a way to expand transit service to other, underserved regions without investing in 30- or 40-foot zero emission buses.

The Franklin service area will soon transition to three fully electric GreenPower shuttles in October 2019, to replace the existing three diesel shuttles, paid for by Electrify America. Electrify America is also investing in two DC fast chargers to support the service with charging speeds of up to 150-kW. Future expansion plans include additional service to 12 areas contingent upon funding. Additionally, SmaRT Ride will test six zero emissions vehicles and purchase up to 20 after evaluating the vehicles' reliability during the testing period.

The team contacted the Franklin Neighborhood Development Corporation to understand the impacts of SmaRT Ride in the community but could not schedule an interview.

Via-operator Interviews

Via is an on-demand mobility service that operates in the United States and in Europe through its joint venture with Mercedes-Benz vans. Via's technology is also deployed worldwide in partnership

[8] http://www.sacrt.com/documents/Performance/KPI0319.pdf

with public transportation agencies, private transit operators, taxi fleets, private companies, and universities. In some cases, Via provides first and last mile connections and in others serves in lieu of fixed-route transit. Via initially launched in September 2013 in New York City and expanded to other metropolitan areas including Chicago, Washington DC, Arlington TX, West Sacramento and Seattle. Worldwide, Via has more than 2 million members and 50 million rides. Via provides technology and operates routes as a contracted service to agencies, but also operates as a private ride-hail mode in dense geographies.

To book a ride on Via, users download and use the Via app or call Via's live support phone line. In some cities, passengers can pay using a transit pass. In others, riders pay by credit card or set up an account from which rides are deducted.

Figure 6: West Sacramento's on-demand transit pilot (source: City of West Sacramento

In May 2018, the City of West Sacramento began an on-demand rideshare pilot in partnership with Via's subsidiary NoMad Transit LLC, pictured in Figure 7. The City expected roughly 200 to 250 average daily rides. By March 2019, ridership had surpassed the early estimates by 50% and continues to grow. By spring 2019, Via was averaging seven rides an hour. In June, the program expanded operating hours to 6:00 AM to 11:00 PM Monday through Saturday, and in August it will add more vans and start operating on Sunday. Originally funded by grants from SACOG and AARP, Via West Sacramento will continue operation with funding from a voter-approved sales tax measure.

Because West Sacramento's program is specific to the City and not part of the county-wide regional transit, riders pay by credit card or a pre-paid account: $3.50 per ride or $15 a week for four rides a day. Seniors and disabled people pay a discounted rate.

Results from a recent survey of Via riders indicate that:

- Passengers of ages, incomes, educational backgrounds, and genders use Via, however people under the age of 21 appear to be the most-frequent users, followed by older adults (50+).
- Riders are more likely to come from households with between $15,000 and $35,000 household income and are slightly more likely to be women.
- Half of survey respondents said they were using the ODT service instead of taking Uber/Lyft and 34% said they were using it instead of driving alone or catching a ride from a friend or family member.
- 66% of respondents feel safer getting around town and 59% had a greater sense of independence, and 41% said their access to healthy foods and medical care had increased, especially among women, younger (under 21) and older (60+) riders, and households that earn less than $35,000 a year.

In addition to these statistics, the Washington Unified School District stated that participation in after-school activities at the high school increased by 40% during the 2018/2019 school year because students had a means of getting home.

Downtowner

Downtowner is private app-based microtransit service that contracts with transit and public agencies to provide fixed route, on-demand, and deviated route service. This shared mobility provider's priorities are to reduce single-occupancy trips and improve first-mile/last-mile connections to transit. In California's Sierra Mountains, the nonprofit Squaw Alpine Transit Company (SATCo) selected Downtowner to provide on-demand rides to ease traffic and parking congestion in Olympic Valley and Alpine Meadows ski areas. The service operated during the 2019 ski season from December 1, 2018 to April 30, 2019. At the April 18 SATCo board meeting, the board voted to extend the Downtowner contract. Rider statistics, survey results and lessons learned will be presented at the July board meeting, which is after the date of this report.

Downtowner also operates in Aspen and Vail Beaver Creek, Colorado; Summit County, Utah; Savanah and Sea Island, Georgia; and Tampa, Florida.

Downtowner is in the process of electrifying its operations, however, cold temperatures and the local need for all-wheel drive prevented Downtowner from using electric vehicles in its alpine locations. Tampa's program, which is free, uses a fleet of nine Chevy Bolts because the average passenger load is small, and the service is limited to the two-square-mile downtown core. The cars charge overnight at the company's operations base using Level 2 chargers.

Comparison of program outcomes and key service indicators

Despite some apparent similarities, each of these advanced mobility providers operate and track data differently making apples-to-apples comparison challenging. Table 1 summarizes available data from each service evaluated.

Table 1: Comparison of Mobility Programs

Program type	Service dates	Participation	Costs
Our Community CarShare	May 2017-present	504 members, about 30% of the eligible population	Free to driver Grant funded
GIG Car Share (Sacramento)	March 2019-present	15,000 trips	40 cents per minute or $15 per hour, up to $80 per day and AAA members receive a 10% discount. Electrify America funded
Envoy (Sacramento)	March 2019-present	Not disclosed	Fees not disclosed Electrify America funded
SmaRT Ride	February 13, 2018 to present	95,000 passengers	Riders pay transit fare costs; students ride free and groups of five or more ride free Costs SacRT $75.18 per revenue hour; depending on trip demand, the cost per passenger is $19 to $25.

Program type	Service dates	Participation	Costs
Via West Sacramento	May 14, 2018	350 ride per day	Riders pay $3.50 per ride or $15 a week with discounted fares for seniors and disabled. First year of operation cost the City of West Sacramento $890,000 from grant funding; continued operation is funded by sales tax.
Downtowner (SATCo)	December 2018-April 2019	Downtowner "Lessons Learned," rider statistics, and rider survey findings to be presented to SATCo board on July 18.	Squaw Alpine Transit Company (SATCo) funded Downtowner through the combination of a one percent assessment on lift tickets sold on-site by Squaw Valley/Alpine Meadows, and a one percent assessment on lodging and vacation rentals within Squaw Valley and Alpine Meadows

Analysis of business and service models

Envoy's docked car-share in Southern California and GIG's Bay Area car-share program are venture-funded start-ups. Both companies' deployments in Sacramento are funded by Electrify America as part of the Sac to Zero program, and Envoy Technologies was recently awarded Energy Commission funding.

The mobility pilots in Table 1 were led, launched, funded, or planned by local agencies to increase mobility, reduce vehicle miles traveled, and decrease greenhouse gas emissions. Each has a revenue model that relies on external funding to cover the gap between revenue and costs. Each company has a business strategy, but needs more time and data to understand which methods are effective for increasing ridership and decreasing operating costs.

Recommendations and opportunities for the e-mobility hub demonstration

Mobility hubs are centers of connectivity at which multiple modes of travel converge. Building on lessons from the projects outlined above, the concept is to provide an integrated suite of mobility services from transit to bike share to parking along with wayfinding and urban design enhancements and technologies that include dynamic parking management strategies, real-time traveler information, and real-time ridesharing. Mobility hubs may include charging for shared vehicles, pick-

up/drop-off zones for ride-hailing and "kiss-and-ride," freight delivery hubs, and connections to bike and pedestrian routes.[9]

An e-mobility hub is a concept for Sacramento to take the mobility hub concept one step further by adding the infrastructure and support services to encourage every vehicle to be electric instead of running on petroleum. It includes charging stations for a variety of vehicles, potentially energy storage, and amenities that can serve all populations.

Task 6.2, *E-Mobility Hub Recommendations,* analyzed concepts and plans of other regions' mobility hubs and expanded on those concepts to create an e-mobility hub. This report identifies how to accelerate the mobility hub principle a step further by ensuring that all vehicle transportation be electric. However, the emphasis should remain on active transportation and shared rides, including transit. Figure 8 shows an example of transportation modes that a traveler would ideally use to get to or from light rail or an electric bus.

Figure 8: E-mobility hub travel

Active transportation first: Enable people to walk or bike for five minutes on protected, well-lit lanes. People arriving at the hub by bike need secure storage. Include a charging dock for scooters and e-bikes so fully charged micromobility is ready to go when travelers arrive.

Connect people to affordable and clean shared rides: Prioritize transit connections in site design and layout with adequate loading spaces and quick connections to light rail and/or buses. Use distinctive, illuminated shelters with signage for pick-up and drop-off facilities for ODT and carpools. Include dedicated DC fast charging for drivers so that ride-hailing and on-demand transit vehicles can quickly charge on site or very close by between passengers or when waiting for transit to arrive.

Electric cars where transit doesn't go: Ensure adequate parking and use parking apps so that long-distance commuters can reserve spots in advance. Electric car-share vehicles are on site and fully charge. Equip parking lots with Level 2 charging—some dedicated to car-share vehicles and some for commuter cars—and Level 1 outlets so long-distance drivers can plug in continuing the commute on transit.

Sustainable design: Activate the hub with attractive design, art, and services that can encourage people to visit nearby business and community gathering spots. Provide free and fast Wi -Fi and plugs for charging cell phones. Enable travelers to order a shared ride or check out shared vehicles from a kiosk or from attendant or kiosk at the hub. Install electronic reader boards with real-time

[9] Electrifying Ride-Sharing: Transitioning to a Cleaner Future

transit travel information that can be read from a distance. Incorporate solar energy and energy storage where appropriate to reduce grid demand. Add e-commerce lockers and a dedicated cargo delivery space so that people can pick up packages, groceries, or other items at the e-mobility hub.

Mobility hubs might also include charging stations for transit buses, but hubs may be at light rail stations and travelers will use other modes of transit to quickly reach their destinations.

Locating an e-mobility hub

Ideally, e-mobility hubs will be located where multiple mobility modes already converge. To optimize first/last mile transit connections and utilize existing passenger facilities, transit centers and park-and-ride facilities are ideal. Task 6.2 included a list of candidate locations, however, to optimize recommendations in the EV Blueprint project, the team proposed a modular concept that can be at or near any high-capacity transit station.

This concept envisions re-configuring surface parking into a flexible, modular design prototype that can be scaled up or down depending on available space, mobility demand, and electrical capacity. Optionally, some elements could be adjacent to the transit stop—across the street or at a nearby community center.

As the anticipated demand for shared e-mobility services continues to grow, facilities can be expanded and replicated at other transit facilities to provide a regional multi-modal e-mobility network. The modular approach also future proofs the regional transit system as share mobility becomes more convenient and economical than private vehicle ownership. For example, commuter parking spaces can gradually be replaced with docks for shared vehicles, a larger drop-off zone, or additional light rail tracks.

The Sacramento e-mobility hub can include the features listed in Table 2: E-mobility hub components.

Table 2: E-mobility hub components

Feature Category	Components
Transit	• Direct connection to light rail or electric transit buses • Mobility-as-a-Service (MaaS) software to integrate arrival and departure of transit vehicles with other mobility services
Microtransit (On-demand transit)	• Curb space for two microtransit vans to board and alight passengers • Layover facilities for microtransit vans to park and charge between trips • If this is a separate area, visible signage and bright lighting
Ride hailing and car sharing	• Parking stalls for ride-hailing vehicles to pick-up and drop off passengers • DC Fast Chargers or higher-wattage Level 2 chargers for shared EVs and PHEVs • Vacuums, pressure washers, and waste and recycling containers to clean vehicles between uses • If this is a separate area, visible signage and bright lighting

Feature Category	Components
Micromobility	• Docks for parking, securing and charging electric scooter-share • Docks for parking, securing and charging electric bike-share • Lockers with electrical outlets to park and charge personal commuter bikes and scooters • Protected lanes for bikes and passengers to enter and exit the e-mobility hub
Commerce	• Lockers for delivery of merchandise from e-commerce vendors, food bank deliveries, or other parcels • Parking stalls with 50-amp charger for medium-duty vehicles like food trucks, bookmobile, cargo vans, and microtransit. Can double as a loading bay for e-commerce locker delivery
Amenities	• Accessible restrooms • Traveler information kiosk with reader boards displaying real-time transit and microtransit information; potentially attended • Kiosks that issue transit passes, conduct route mapping, call a shared ride, and check in and out shared vehicles • Kiosk or mobile office that has car seats, bike repair tools, cleaning supplies, first aid kits, and other materials that travelers need to rent, buy, or borrow • Free public WiFi • Electrical outlets for charging cell phones, tablets, etc. • Electrical supply to support events, including musicians, pop-up shops, and food vendors • Seating and tables for waiting passengers • Garbage, recycling, and compost disposal • Overhead solar canopy to provide weather and sun protection and off-set energy use • Motion sensor activated bi-level lighting for safety and theft deterrence while reducing energy use • Security cameras and emergency call station for personal safety • Landscaping vegetative buffers • Cultural art
E-features	• EV charging for all shared mobility • In suburban locations with commuter parking, Level 2 and Level 1 charging • Onsite energy storage to capture and store solar energy production, buffer grid impacts, and reduce electrical demand charges • Solar canopy to provide shade and weather protection and generate electricity to offset portion of electrical demand, sized as large as possible to provide maximum electrical generation and weather protection.

Feature Category	Components
	• Support infrastructure including transformer, smart meter, service cabinets, etc. To account for anticipated growth in transportation electrification, electrical support infrastructure should be sized as large as possible, providing capacity for installation of additional and higher capacity chargers that required larger conduits, meters, transformers, additional breaker panels, etc. Several manufactures such as Siemens and ABB currently produce modular charging systems that can be upgraded to support additional chargers.

Conceptual Site Layout

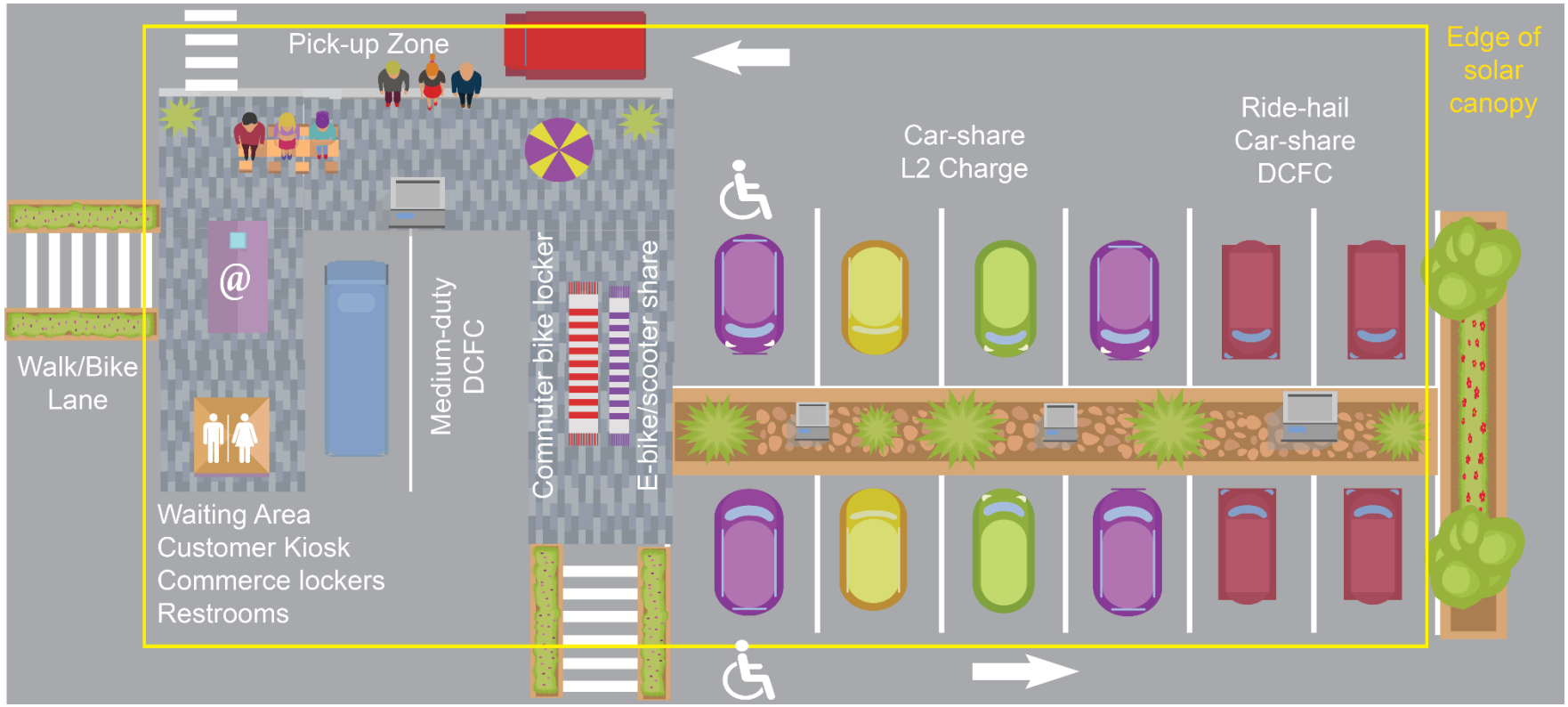
The layout of the e-mobility hub concept is intended to fit within a standard park-and-ride lot, which allows the e-mobility hub to be scaled up or down without impacting the design or operation of the lot.

Figure 9: E-mobility hub conceptis a concept drawing that fits within a row of parking stalls that is two parking spaces deep (36-40 feet) by approximately 20-25 parking spaces wide (170-215 feet). It assumes that this row would the closest to the light rail station. Some of the existing parking spaces would be transformed into a structure with public amenities concentrated at one end of the site. The other end would be for parking and charging car-share and ride-hailing EVs. The concept shows 12 spaces for shared-ride passenger cars and leaves two spaces for medium-duty vehicle charging.

To expand in the future as transportation becomes more dependent on shared EV mobility, the e-mobility hubs should be within the longest rows of parking at the transit center. This enables adding more chargers and/or expanding the active transportation portions as housing and commerce grow closer to the hub.

This is a concept drawing that will be modified to be appropriate for an individual site.

Figure 9: E-mobility hub concept



This drawing shows two car-share spaces that are ADA accessible. One charger in the center aisle can serve four vehicles. Plants in the center of the row ensure this is not interpreted as a walkway to the amenity area. The bike lockers and shared ridables are placed together so that one power source (conduit that all operators can tap into) can charge personal and shared bikes/scooters. The protected bike lane in this configuration enables people to safely cross the area where shared cars are pulling in and out. The 90-degree parking spaces allow for a protected bike lane in this configuration. Seating and waiting areas can be expanded to fit available space. The purple-and-yellow circle represents the customer service kiosk. This could be an attended station, a self-service kiosk, or a convenience store or coffee shop. A mobile office staffed by a person in an electric van could serve as an attendant who moves from hub to hub. A delivery van can pull into the medium-duty charger and quickly charge while unloading goods into the e-commerce lockers (marked with @ in the drawing). This can reduce VMT from the van and the person who might otherwise drive to a store, food bank, or library.

This drawing includes a solar canopy that covers the entire hub to provide weather protection and shade but does not show the necessary anchor mounts. It may be more feasible to build a roof with roof-mounted PV. The drawing does not show battery storage or electrical cabinets, which would presumably be located near other electrical systems for ease of maintenance and maintain lines of sight around the hubs. (No big boxes obstructing the view of people, bikes, and cars.)

This concept can also be deployed as individual elements. For example, the University and 65th Street transit station doesn't have a parking lot. The concept can still be deployed by moving the car-share vehicles to an adjacent parking lot accessed by a protected walkway and adding a dedicated pick-up zone for shared rides (microtransit and ride-hailing). The Department of General Services operates a park-and-ride lot under the I-80 freeway between X and W Street that has only car parking and bus stops. A portion of that lot could be transitioned to a waiting area and a fleet of shared micromobility vehicles that would all go downtown in the morning and all come back to the lot in the afternoon.

Potential Operational Structure

As cities and counties look to implement mobility hubs, local government is a likely candidate for leadership. Figure 10 from Seattle's *EVSE Roadmap for Shared Mobility Hubs*[10]summarizes roles within the primary phases of the project. The *Roadmap* states, "Successful implementation of the program relies on strong collaborative partnerships, clearly distinguished roles and responsibilities, frequent and open communication, and methods for tracking deliverables and success throughout the project period."

Figure 70: Seattle Department of Transportation's Roles and Responsibilities for Shared Mobility Hub

	SDOT	EVSE Provider	SCL	Shared Mobility Service Providers	Outreach Provider	OSE
Program Development	●	○		○	○	○
Community Outreach & Engagement	○				●	○
Electrical Feasibility Analysis			●			
Site Selection & Deployment	○	●		○		
Program Evaluation	●	○		○	○	○
EVSE Operation & Maintenance		●				

○ = Participant
● = Lead

Because of the importance of transit access, mobility hubs are typically targeted for public sites, often on land owned and managed by transit agencies or on state-owned or municipal property on behalf of or in conjunction with transit agencies. Federal funding provided by the Federal Transit

[10] https://www.seattle.gov/transportation/projects-and-programs/programs/new-mobility-program

Administration (FTA) is the primary source of funding for passenger facility infrastructure and FTA requires long-term interest in the property, typically through ownership or long-term lease or license if the facility is located on a privately-owned site. The site owner or leaseholder typically manages the facility. Therefore, it is feasible that Sacramento RT would be the site operator for a mobility hub in a SacRT park-and-ride lot, while the City of Sacramento or another agency could be the operator of a hub on City property, and/or a contracted vendor to be the operator of a hub on a private or public property.

Because local government support is essential to ensure the hub serves social and environmental goals, the City should provide program management or management support for hub development, but not lead actual day-to-day operations. A third-party non-profit or community-based organization could manage daily operations. The City of Sacramento Public Works Department could provide overall program oversight, including:

- Facilitate necessary conversations between project partners, stakeholders, and community stakeholders to guide project implementation.
- Work with the private industry partners to communicate and enforce City objectives, such as an emphasis on reducing vehicle likes traveled.
- Coordinate project partner meetings which to occur quarterly (at a minimum) and serve as the line of communication between the City and other regional partners.
- Hold the funding agreement with potential third-party funders and execute other contracting mechanisms with project partners and additional partners as appropriate but not own or have any legal interest in the equipment installed through this agreement.
- Coordinate with other departments that may contribute to the program like Transportation, Parking, Engineering and Facilities as well as the Department of Community Development including Planning and Building, and Information Technology Department.

Private industry, which includes providers of EVSE, shared rides, and micromobility, could take on one of two roles:

1. Be a contractor to the operator/property owner/site host (e.g., to the City of Sacramento, SacRT)—the operator/site host would pay the contractor to provide a service and the operator/site host could potentially collect revenue. It's a similar model to how many cities currently contract parking services.
2. Be licensed to provide an amenity at the e-mobility hub—the operator/site host would hire the provider as a concessionaire with access to the site. The provider would pay the operator/site host a monthly or annual fee and the contractor would collect the revenue. This is similar to the way State government provides food service operations at State buildings. In some scenarios, a contractor would provide revenue share with the site host to offset ongoing monthly or annual fees.

Under scenario 2, providers are concessionaires, the operator/site host would negotiate a contract with companies to provide EVSE, car-share vehicles, micromobility, and on-demand transit. The operator/site host may also sign a contract with a Mobility-as-a-Service provider to integrate the individual providers. This is especially important to coordinate ride-hailing and on-demand dispatching to reduce wait times at the e-mobility hub and the number of "empty" trips; those trips without passengers.

Providers should be held to performance standards to ensure working vehicles are available to match customer demand and the operator should require access to all data to understand how the system is working; not just if one element is successful. It is most likely that grants will be required to fund each providers' start-up costs and may need to fund the gap between revenue and operational costs for the first two years.

The concept has three, potentially four, EVSE implementations:

- DC fast charging
- Level 2 charging for car share
- Level 2 charging for commuter cars
- Potentially, charging for electric buses

The operator/site host would, ideally, contract all services to one EVSE provider. The provider could collect revenue from fee-for-charge and/or from the car-share operator. The provider could sell the Low Carbon Fuel Standard credits,[11] potentially use the site for load balancing and collect revenue from the utility and take advantage of future revenue models. The operator/site host would be relieved from maintenance of the chargers and staying abreast of developing revenue models.

Anticipated Costs

Table 3 is an estimate of the initial start-up costs based on public records of similar projects' initial costs. These do not include operational costs for the first two years because data isn't currently available.

Table 3: E-mobility hub cost estimate

Item	Cost	Source/Example/Potential funding sources
Land acquisition	$0	Project assumed to be in an existing parking lot
Engineering, design, and construction	$500,000-$800,000	SACOG grants for developing light rail stations[12] and Safe Route to School improvements[13]
PV array and battery storage	$130,000 (PV) + 10,022 (storage)	Refer to cost analysis in EV Blueprint tasks 3.2 and 6.2
Establish car-share hub	$750,000-$1,300,000	Energy Commission grants for ZEV car share programs.[14]

[11] https://www.arb.ca.gov/fuels/lcfs/electricity/electricityh2.htm
[12] https://www.sacog.org/sites/main/files/file-attachments/description_of_funded_projects_round_7.pdf
[13] https://www.sacog.org/funding-award-recipient/2019-regional-atp-funding-awards
[14] https://ww2.energy.ca.gov/contracts/GFO-16-605_NOPA.pdf

Item	Cost	Source/Example/Potential funding sources
		Initial grant for Our Community CarShare that included purchase of eight cars and four Level 2 EVSEs[15]
Expand microtransit	$849,000	City of West Sacramento cost to establish and operate Via for one year after deducting operator's revenue[16]
Establish bike/scooter share	$0	To date, operators have not applied for grant funding
Implement technology solutions	$536,000	FTA award to San Diego for integrated app for paratransit[17]
Installation of DCFC	($2,000)	EVgo pays the City of Sacramento a $2,000 annual licensing fee for curbside DCFC[18]
Total estimated funding needed	**$2.7-$3.5 million**	

If the mobility hub also installs Level 2 charging in the parking lot for commuter cars that the operator will own and operate, the cost would include $13,637 for each networked Level 2 EVSE with two connectors. If a provider owns and operates the Level 2 EVSE, the cost should be $0.

[15] http://policies.sharedusemobilitycenter.org/#/policies/853
[16] https://blob.cityofwestsacramento.org/civica/filebank/blobdload.asp?BlobID=16816
[17] https://www.transit.dot.gov/funding/grants/grant-programs/access-mobility-partnership-grants-fy2019-project-selections
[18] http://www.cityofsacramento.org/-/media/Corporate/Files/Public-Works/Electric-Vehicles/EVgo-Charging-Southside-Park.pdf?la=en