Planning for Electric Mobility

Creating a roadmap for cities and counties towards greater vehicle electrification

NorCAL ITE April Lunch Meeting, April 17, 2019

DKS

Mike Usen, AICP

Shaping a smarter transportation experience™

www.dksassociates.com

Presentation Overview

1. Introduction
2. Electric Vehicles and Charging Infrastructure
3. Benefits of Electric Vehicles
4. Regulations and Incentives
5. Planning for EV Charging Infrastructure

DKS Services Overview

- Transportation Planning & Engineering
- Intelligent Transportation Systems
- Complete Streets
- Transportation Technology
- Connected Vehicles
- Bike / Pedestrian
- Transit
- Freight
- Smart Mobility

DKS Services: Smart Mobility

Shared Mobility

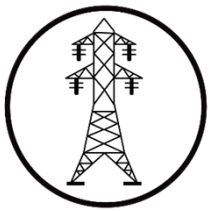
Autonomous Vehicles

Connected Vehicles

Electric Vehicles

DKS Services: Electromobility

EV Infrastructure Planning



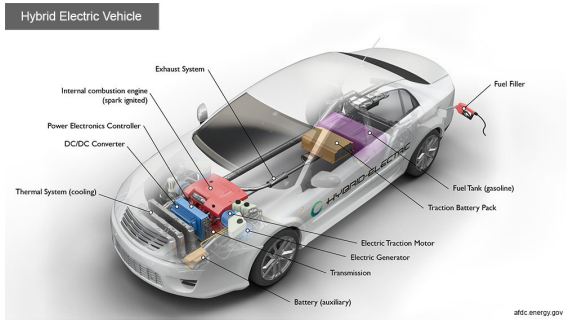
Utilities and Community Choice Aggregators

Fleet Electrification

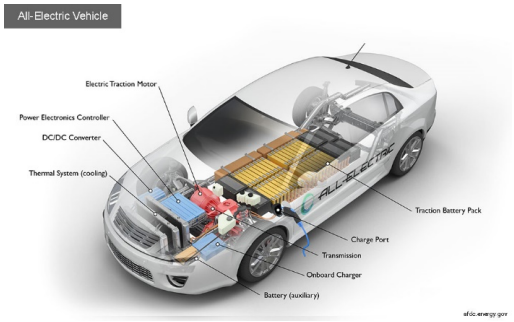
Transit Electrification

Types of Electrified Vehicles

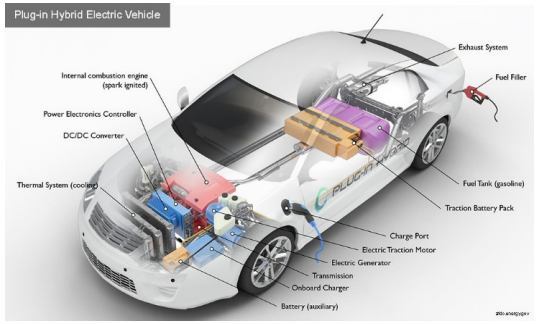
Hybrid electric vehicles (HEVs)



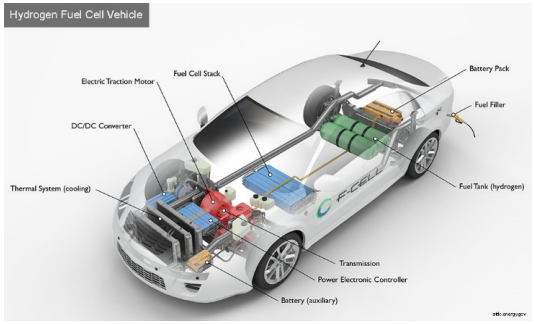
Battery Electric Vehicles (BEVs)



Plug-in hybrid electric vehicles (PHEVs)



Fuel Cell Electric Vehicles (FCEVs)



Electrical Vehicles: Future Models

DKS

2019

- Porsche Taycan
- Aston Martin RapidE
- Audi e-tron
- Mercedez-Benz EQC
- BMW Mini E
- Volvo Polestar 2
- Fisker EMotion
- Faraday Future FF 91
- Ford Model E
- Toyota EV
- Nissan EV

2020

- Volkswagen I.D. Crozz
- Tesla Model Y & Pickup Truck
- Tesla Roadster
- BMW iX3
- Ford's electric crossover
- Skoda Vision E
- Audi A9 e-tron & e-tron GT
- Mitsubishi e-evolution
- Mercedes-Benz EQS (or as late as 2022)

2021

- Subaru's all-electric crossover
- Byton K-Byte
- BMW iNext & i5 & i4
- Infiniti electric cars
- Hyundai electric car
- Mercedes-Benz EQS & EQB

2022

- Volkswagen I.D. Buzz
- Jeep Wrangler Electric
- Renault, Nissan and Mitsubishi Motors Alliance will manufacture 12 new full-EVs
- Mercedes-Benz intends to launch 10 new electric vehicle models
- Jeep aim to have ten PHEVs and four BEVs available

2023

- Volkswagen I.D. Vizzion
- Porsche aiming for 50% of sales to be EVs
- General Motors aim to have 20 electric vehicles

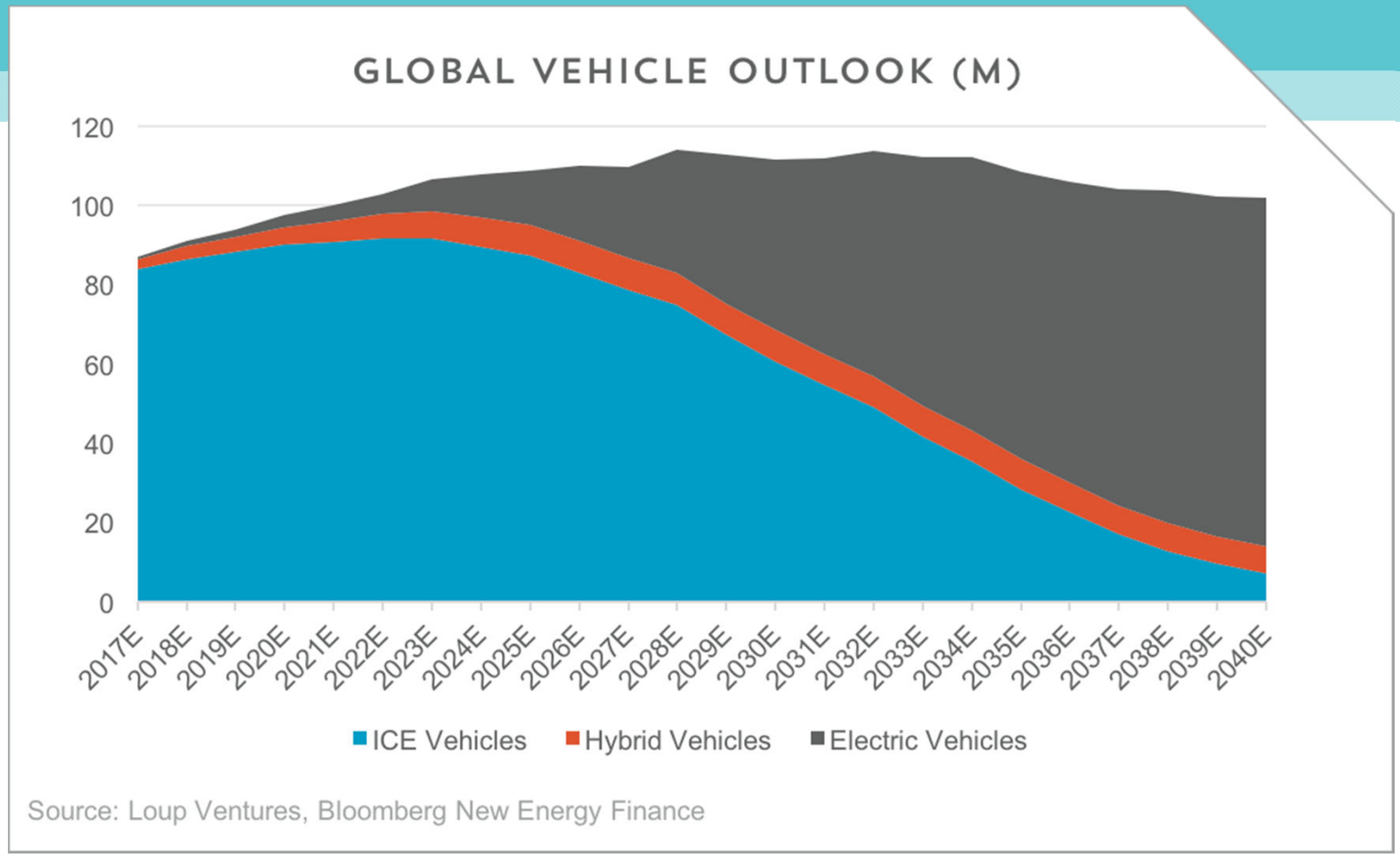
2024

- Volkswagen I.D. Lounge

2025

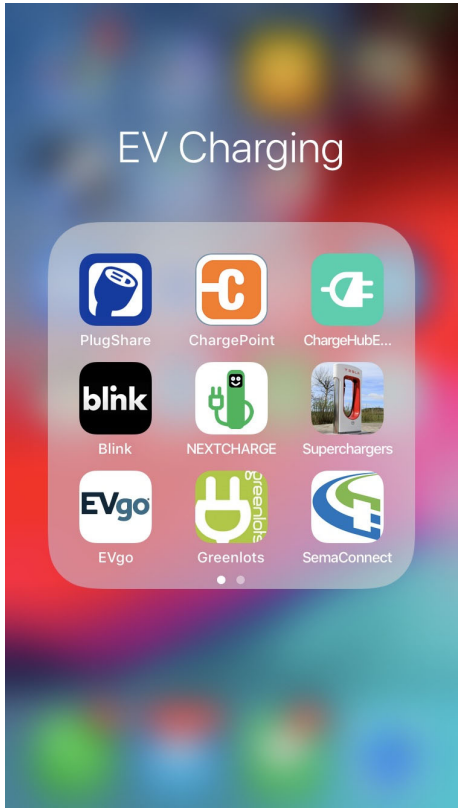
- Nissan IDS
- Volkswagen foresee selling 1 million EVs per year
- Audi aims to have one-third of their cars electrified
- BMW is expecting full electric (and plugin hybrids) to account for 15-25%
- Volvo aims to have sold a total of 1 million electrified cars

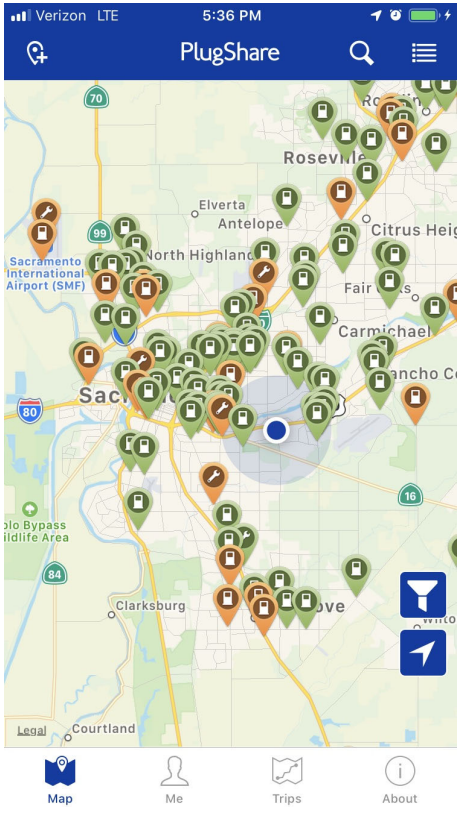
E Vehicles will Replace ICE Vehicles

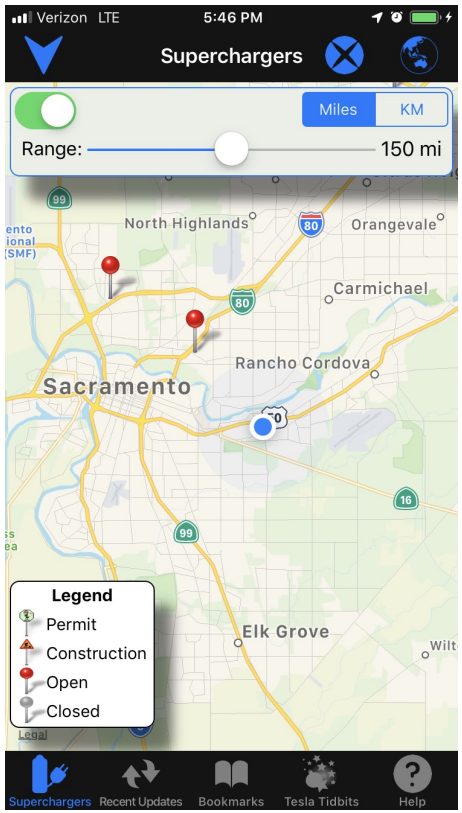


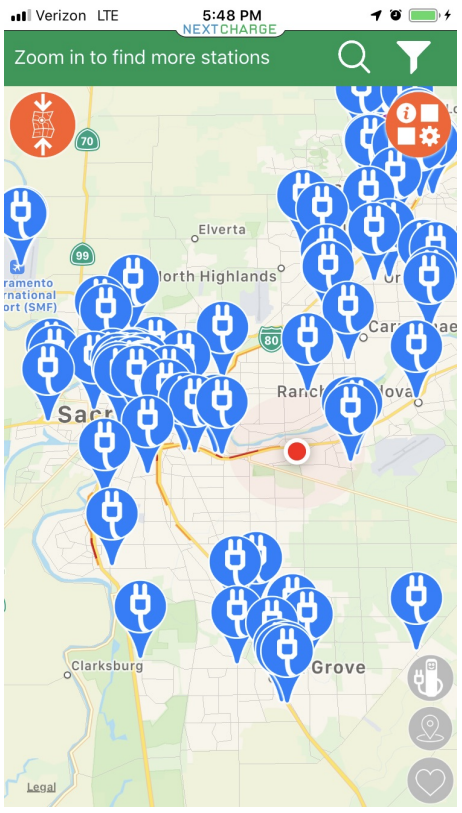
Source: Loup Ventures, Bloomberg New Energy Finance

EV Charging


EV Charging
PlugShare
ChargePoint
ChargeHubE...
Blink
NEXTCHARGE
Superchargers
EVgo
Greenlots
SemaConnect


Verizon LTE 5:36 PM
PlugShare
Roseville
Elverta
Antelope
Citrus Heig
North Highland
Sacramento International Airport (SMF)
Fair
Carmichael
Clarksburg
Courtland
Legal
Map
Me
Trips
About


Verizon LTE 5:46 PM
Superchargers
Miles
KM
Range:
150 mi
North Highlands
Orangevale
Carmichael
Rancho Cordova
Sacramento
Elk Grove
Legend
Permit
Construction
Open
Closed
Legal
Superchargers
Recent Updates
Bookmarks
Tesla Tidbits
Help


Verizon LTE 5:48 PM
NEXTCHARGE
Zoom in to find more stations
Elverta
Clarksburg
Grove
Legal

Types of Chargers

AC Level 1

Slowest and least expensive.
Mainly used for overnight domestic charging.

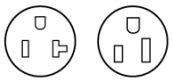
AC Level 2

Capable of charging a small- to medium-sized car (24 kWh battery) in 4 to 6 hours.

DC Fast Charge (Level 3)

Rapid chargers that can typically charge a 24-kWh battery to 80% in roughly 30 minutes.

Charging Station Connectors

Connectors	Level	Asia Makes	US/EU Makes	Tesla
Wall outlets (Nema 515, Nema 520) 	1	With Adapter	With Adapter	With Adapter
Port J1772 	2	Yes	Yes	With Adapter
Nema 1450 (RV plug) 	2	With Adapter	With Adapter	With Adapter
Tesla HPWC 	2	No	No	Yes
CHAdeMO 	3	Yes	No	With Adapter
SAE Combo CCS 	3	No	Yes	No
Tesla supercharger 	3	No	No	Yes

Charging Station Networks

Network/Operator	Membership Required	Region
ChargePoint	Yes	USA + Canada
Blink (CarCharging)	Yes	USA + Canada
SemaConnect / SemaCharge	Yes	USA + Canada
NRG eVgo	Yes	USA
Aerovironment	Yes	USA
Greenlots	Yes	USA + Canada
OP Connect	Yes	USA
GE WattStation	Yes	USA + Canada
Tesla (Superchargers at Destination)	No, but limited to Tesla vehicles	USA + Canada
Sun Country Highway	No	USA + Canada
Volta	No	USA
Doc Borné	No	USA + Canada
Astria	Yes	USA + Canada

Charging Types

Chargeway

DKS

Green Plug

Blue Plug

Red Plug

Charging Speeds

Chargeway

DKS

1	2	3	4	5	6
8 hours	90 Mins	45 Mins	20 Mins	10 Mins	5 Mins

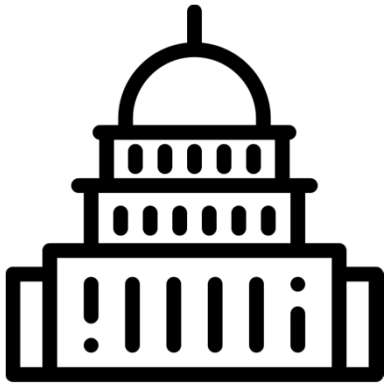
Where You Can Charge

Home Charging
Level 1
Level 2

Public Charging
Level 1
Level 2
Level 3

Workplace Charging
Up to the individual employer

Fleet Electrification and Charging



Public Sector
Electrifying City, County, State and Federal Fleet vehicles.

Helps to calculate the public sector's use of energy and GHG emissions with downloadable apps and energy tracking.

Commercial
Provides a lower cost per mile & total cost of ownership.

Provides real-time data for future scalability.

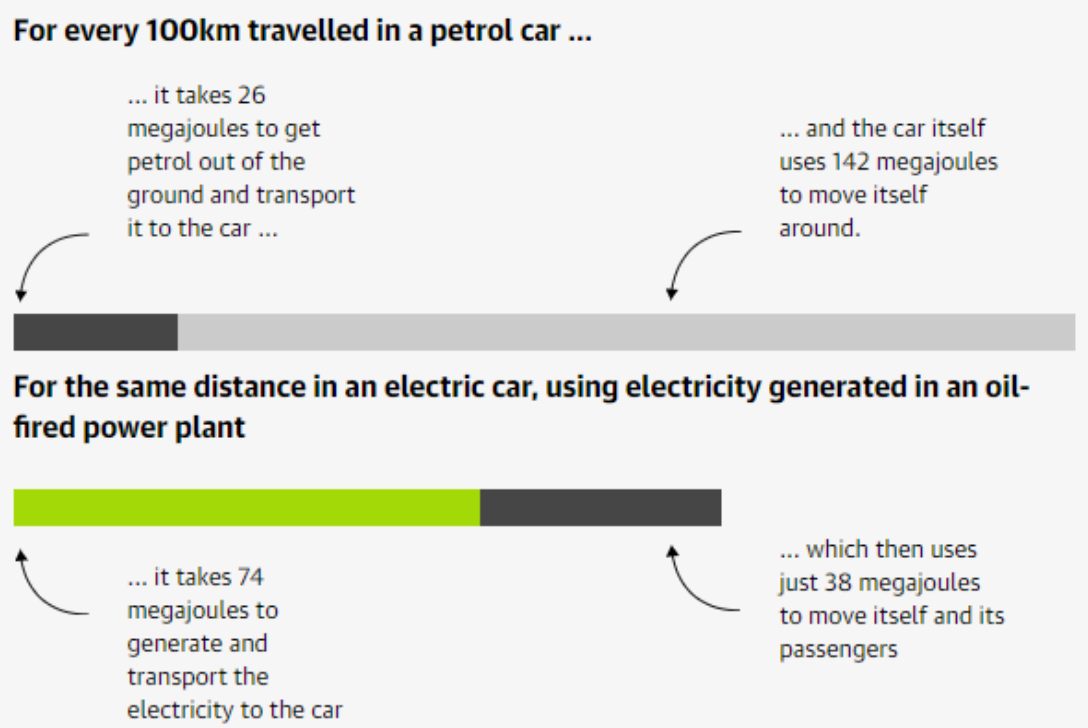
Transit Fleet
Replacement of fleet with e-Buses.

Smart chargers can adapt to the need of the buses.

Why Electrification?

Efficiency

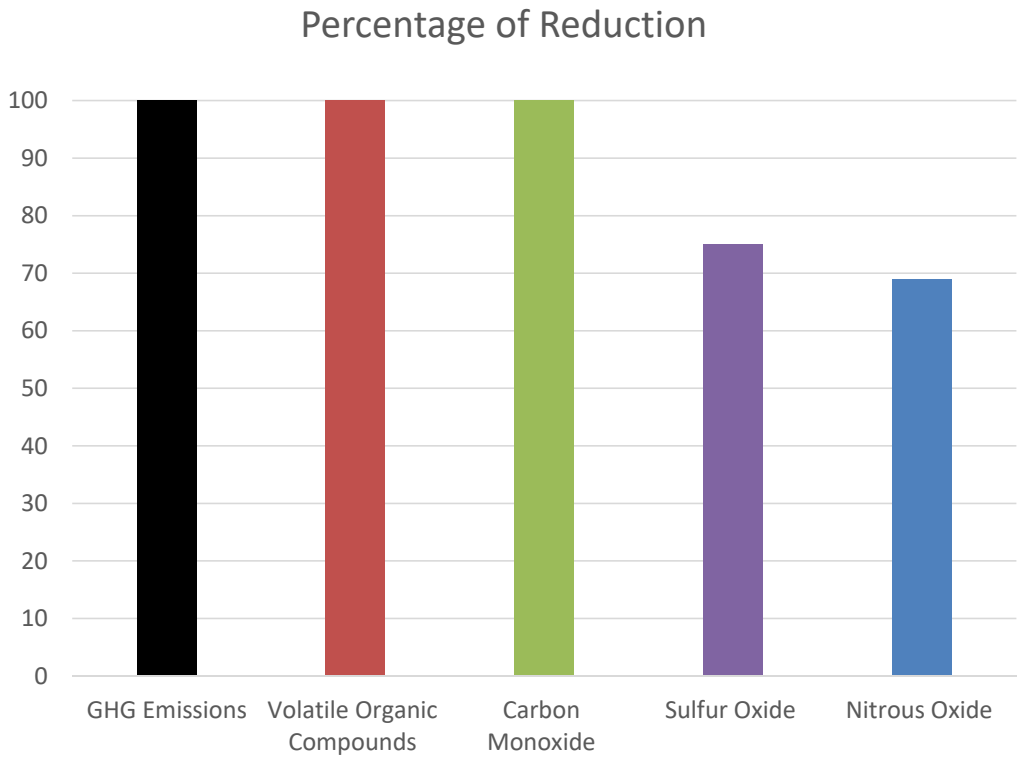
An EU study found that an EV powered by electricity generated solely by an oil-fired power station would use 1/3 less energy than an ICE car travelling the same distance.



Why Electrification?

Environmental

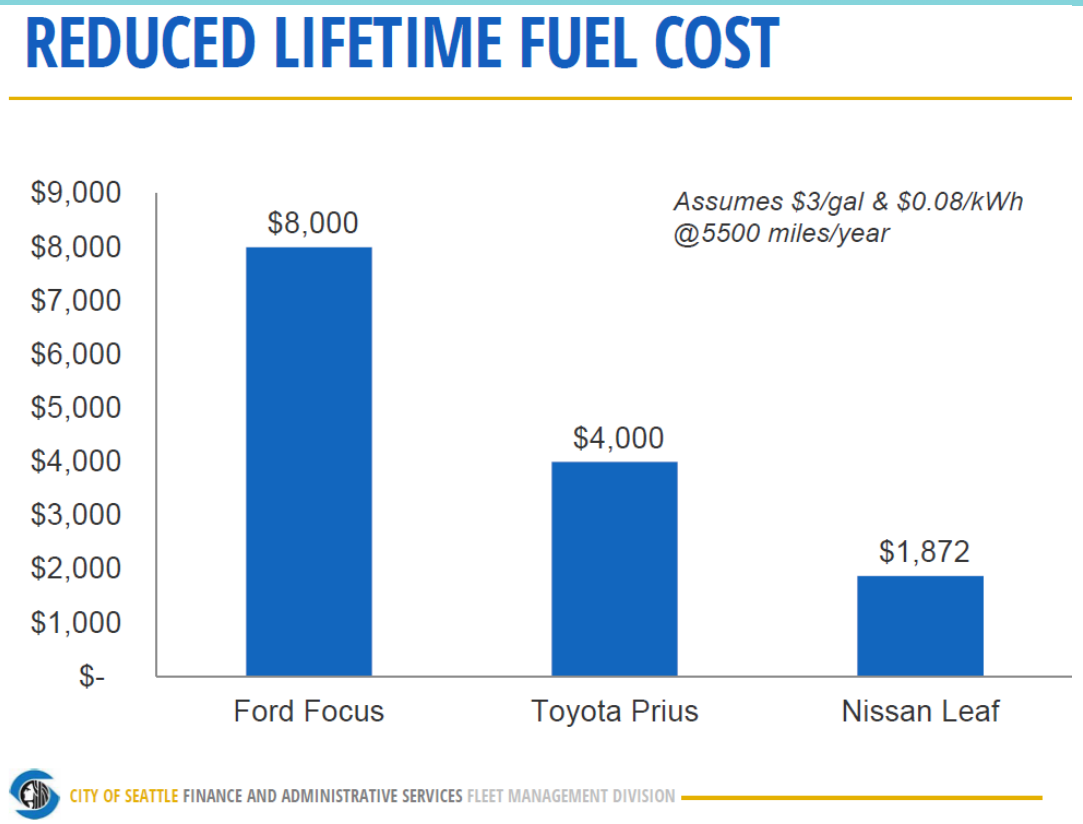
Switching from traditional combustion engines to electric vehicle in urban areas will reduce harmful emissions.



Why Electrification?

Economics

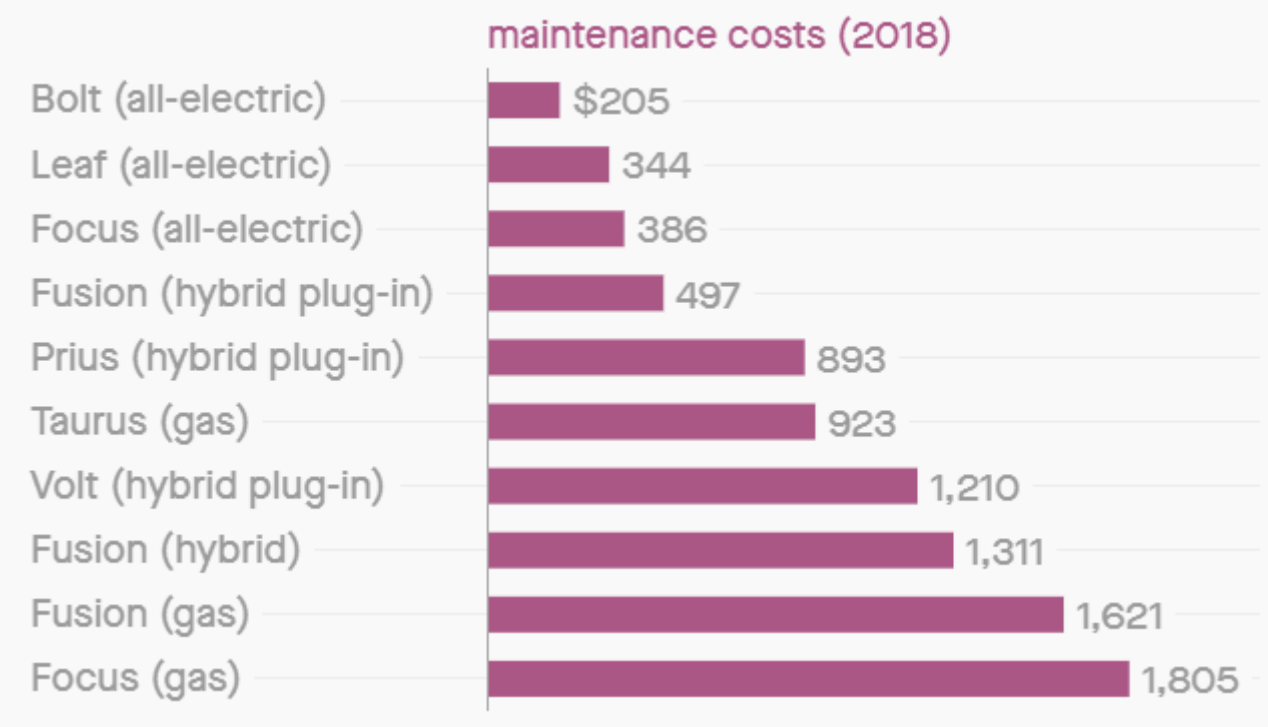
EVs are far less expensive to **fuel** than hybrids or ICE vehicles.



Why Electrification?

Economics

EVs are far less expensive to **maintain** than hybrids or ICE vehicles.



Why Electrification?

Economics

No more:

- Oil Changes
- Spark Plugs
- Air Filters
- Transmission
- Mufflers
- Catalytic Converters
- Less brake wear

NYC Fleet

Saving Maintenance Costs with Electric Vehicles

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

Data from DCAS Client Program, CY2018

Why Electrification?

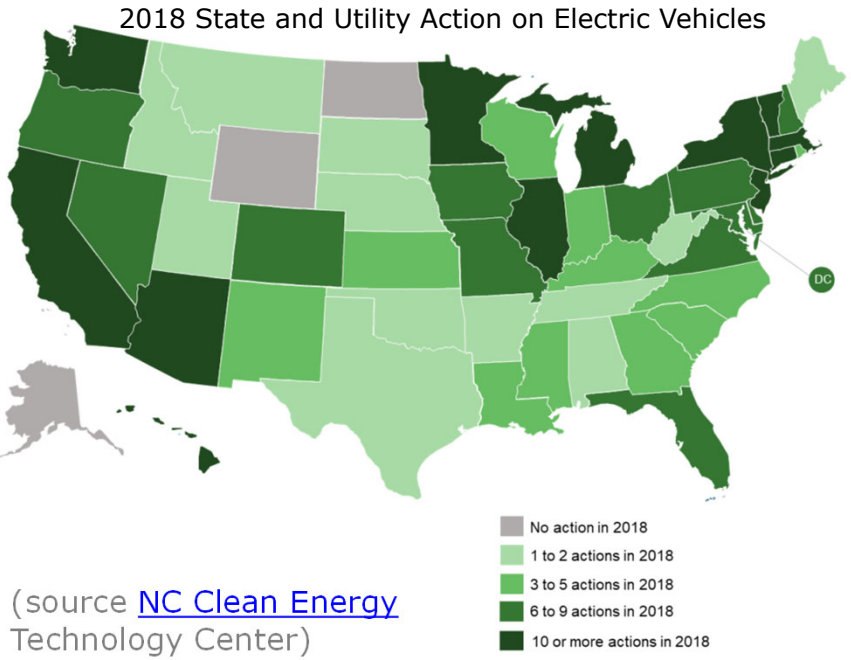
Economics

Significant **total cost of ownership** savings for EVs and hybrids relative to ICE vehicles.

	Leaf (all-electric)	Prius (hybrid)	Fusion (gas)
Purchase price	$25,797	$22,984	$22,866
Cost of fuel / yr	$141	$326	$765
Maintenance / yr	$317	$859	$1,287
EV charger	$2,656	$0	$0
Ownership cost / yr	$3,620	$3,738	$4,592
Total cost (9 years)	$32,580	$33,644	$41,328

Why Electrification?

In 2018, 47 states plus DC took a total of 424 policy and deployment actions related to electric vehicles and charging infrastructure



(source NC Clean Energy Technology Center)

Policy

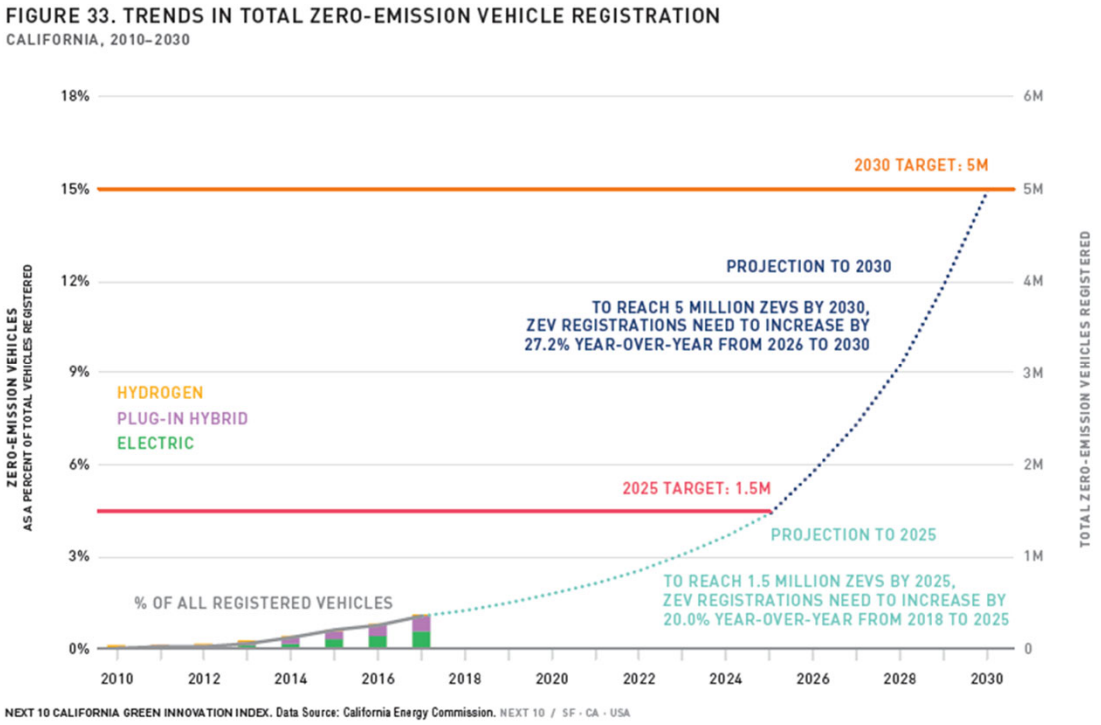
Sample of the Impactful EV Actions	
California	Regulators approved major transportation electrification plans and the state legislature enacted several bills related to electric vehicles
Washington	Current EV-related laws (WAC 194-29); Pending EV-related legislation (HB 1110, HB 1512, HB 2042, SB 5336); EV incentives (Electrification of Transportation Systems Program - Clean Energy Fund (CEF)
Oregon	Oregon Clean Vehicle Rebate Program (including plug-in hybrid electric vehicles) and other qualifying zero-emissions vehicles. In May 2018, the Zero Emission and Electric Vehicle Rebate rules were adopted

Why Electrification?

Regulatory

Executive Order B-48-18:

- $2.5B investment
- 250K EVSE by 2025
- 5M ZEVs by 2030



Why Electrification?

Regulatory

CALeVIP funding through the Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP)

Extended by Assembly Bill 8* through January 1, 2024.

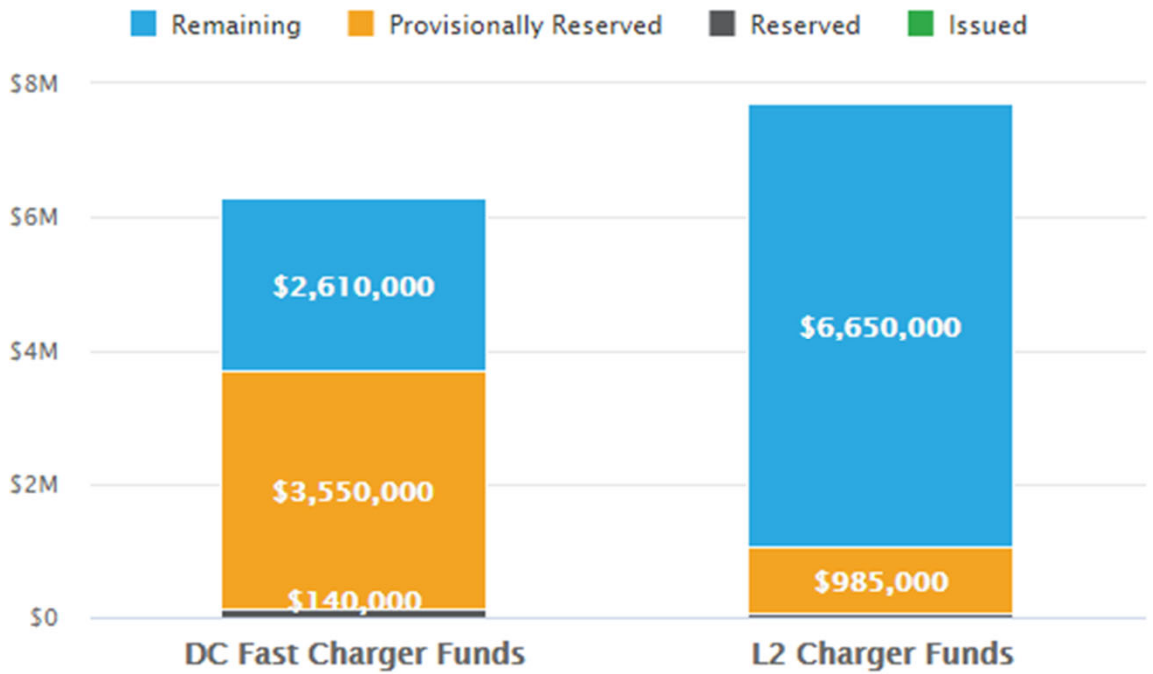
Receives up to $100 million per year to:

- ✓ Transform California's transportation market into a diverse collection of alternative fuels and technologies and reduce California's dependence on petroleum.
- ✓ Develop and deploy innovative technologies that transform California's fuel and vehicle types to help attain the state's climate change policies.

**Perea, Chapter 401, Statutes of 2013*

SACRAMENTO COUNTY INCENTIVE PROJECT

- ✓ $14 mil of available incentives
- ✓ Incentives for both Level 2 and DC Fast Chargers
- ✓ For Sacramento County businesses, nonprofits, work-places, multi-unit dwellings, and public facilities
- ✓ First-come, first-served
- ✓ Ongoing partnership discussions wi th SMUD
- ✓ Serving underserved communities
- ✓ Accepting applications NOW!



Source:
calevip.org/incentive-project/sacramento-county-incentive-project

SACRAMENTO COUNTY INCENTIVE PROJECT

Rebates and Equipment

General Market Rebates

Equipment Type	Rebate Amount
Level 2 Charger	Up to $5,000 per connector
DC Fast Charger	Up to $70,000 per charger

Disadvantaged Community Rebates

Equipment Type	Rebate Amount
Level 2 Charger	Up to $5,500 per connector
DC Fast Charger	Up to $80,000 per charger

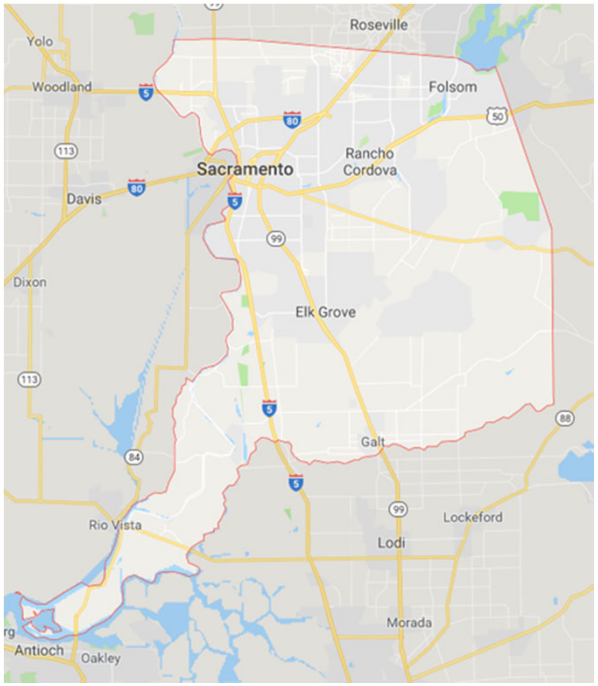
Source:
calevip.org/incentive-project/sacramento-county-incentive-project

SACRAMENTO COUNTY INCENTIVE PROJECT

Site Host Eligibility Requirements

Applicants must:

- ✓ Be site owner or have site owner authorization to install
- ✓ Be a business, nonprofit organization or government entity based in California or have a California-based affiliate
- ✓ Service providers are eligible to apply for CALeVIP incentives on behalf of a property owner but must provide documentation confirming authorization from the property owner to install at the proposed site



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SACRAMENTO COUNTY INCENTIVE PROJECT

Equipment must:

- ✓ Be new, installed for the first time
- ✓ Be on the eligible equipment list OR meet the eligibility criteria

Level 2	DC Fast Charger
Networked with minimum 2-year networking agreement	Be a dual DC fast charger with CHAdeMO and SAE CCS connector options
Capable of 6.2kW or greater	Networked with minimum 5-year networking agreement
Accept some form of credit cards	Capable of 50kW or greater
Be approved by a Nationally Recognized Testing Laboratory Program (NRTL)	Accept some form of credit cards
Energy Star Certified	Be approved by a Nationally Recognized Testing Laboratory Program (NRTL)

Source:
calevip.org/incentive-project/sacramento-county-incentive-project

SACRAMENTO COUNTY INCENTIVE PROJECT

Level 2 Installation Site Requirements

- ✓ Located in Sacramento County
- ✓ Well-lit, secure and in compliance with all federal, state and municipal laws, ordinances, rules, codes, standards and regulations

Eligible Sites	
Commercial	Public facility
Workplace	Light-duty fleet use
Multi-unit dwelling	Curbside

Source:
calevip.org/incentive-project/sacramento-county-incentive-project

SACRAMENTO COUNTY INCENTIVE PROJECT

DC Fast Charging Installation Site Requirements

- ✓ Located in Sacramento County
- ✓ Well-lit; secure; and in compliance with all federal, state and municipal laws, ordinances, rules, codes, standards and regulations
- ✓ Publicly accessible 24/365
- ✓ Cannot be in gated area closed to the public at any time

Eligible Sites		
Urban/suburban retail core	Hospital	Library
Retail shopping center	Sheriff/Police station	Casino
Grocery store	Airport (no long-term parking)	Public transit hub
Restaurant	Hotels	Curbside
Gas station	City/County/Privately owned parking lot or garage	

Source:
calevip.org/incentive-project/sacramento-county-incentive-project

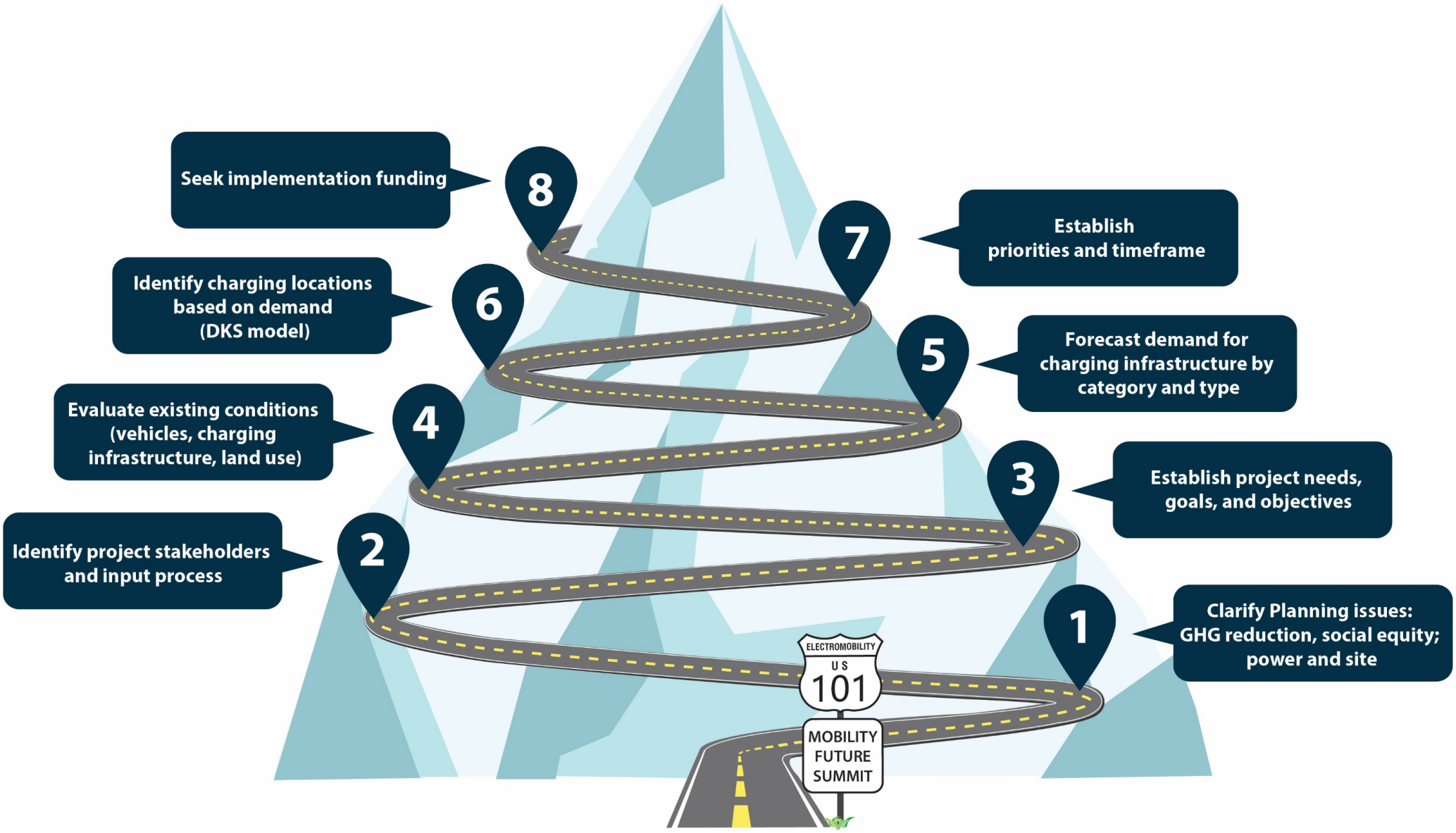
SACRAMENTO COUNTY INCENTIVE PROJECT

Rebate Eligible Costs

The following costs are covered by the incentive:

- ✓ Electric vehicle supply equipment (EVSE)
- ✓ Installation costs (labor and materials)
- ✓ Electric infrastructure related to EV charging upgrades
- ✓ Utility service order*
- ✓ Planning and engineering design costs*
- ✓ Project signage
- ✓ Energy storage
- ✓ Network agreement with network provider
- ✓ Warranty (service and parts)

Source:
calevip.org/incentive-project/sacramento-county-incentive-project


Seek implementation funding
8
Identify charging locations based on demand (DKS model)
6
Evaluate existing conditions (vehicles, charging infrastructure, land use)
4
Identify project stakeholders and input process
2
7
Establish priorities and timeframe
5
Forecast demand for charging infrastructure by category and type
3
Establish project needs, goals, and objectives
1
Clarify Planning issues: GHG reduction, social equity; power and site
ELECTROMOBILITY
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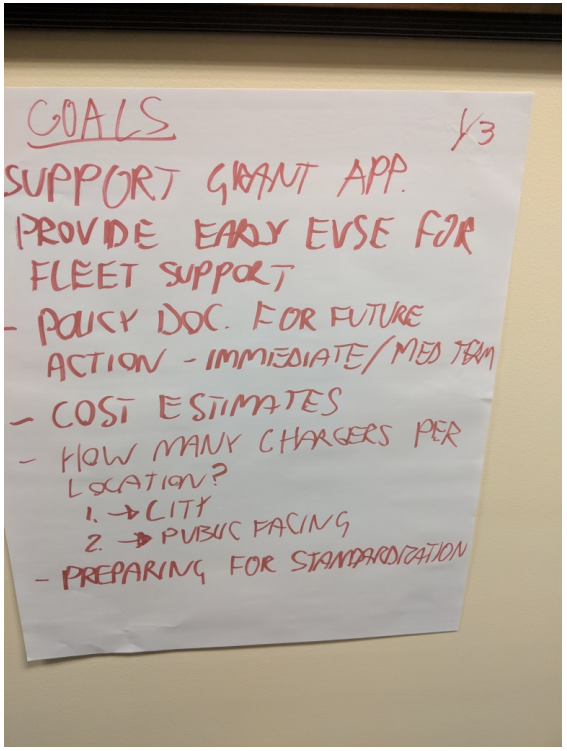
101
MOBILITY
FUTURE
SUMMIT

City of South San Francisco EVSE Masterplan

DKS Project



Goals and Objectives

This plan will be guided by the following three goals, each of which is clarified by specific objectives.

Goal 1: Provide direction for electrification of City fleets

Objective1.1: Project and clarify future PEV fleet needs by range, type and cost

Goal 2: Provide direction for EVSE infrastructure on City property for City fleet vehicles, employee-owned vehicles and public use

Objective 2.1: Provide technical guidance for EVSE deployment at City facilities addressing EVSE types, charging locations, EVSE quantities, design and maintenance considerations, prioritization and deployment timeframes.

Objective 2.2: Provide planning-level cost estimates for EVSE deployment

Objective 2.3: Provide documentation needed to support future grant and other program applications to fund and install EVSE

Objective 2.4: Provide policy direction for EVSE sharing by City and employee-owned vehicles

Objective 2.5: Provide guidance regarding liability and risk related to EVSE use

Goal 3: Support use of electric vehicles through expanded EVSE installation by the private sector on private property within the City of South San Francisco

Objective 3.1: Provide policy guidance for updates to land use, development and parking codes to ensure inclusion of appropriate EVSE in development projects

Objective 3.2: Provide recommendations for permitting and inspection streamlining

Objective 3.3: Provide information materials on EVSE deployment targeting homeowners, developers, and employers

City of South San Francisco EVSE Masterplan

DKS Project

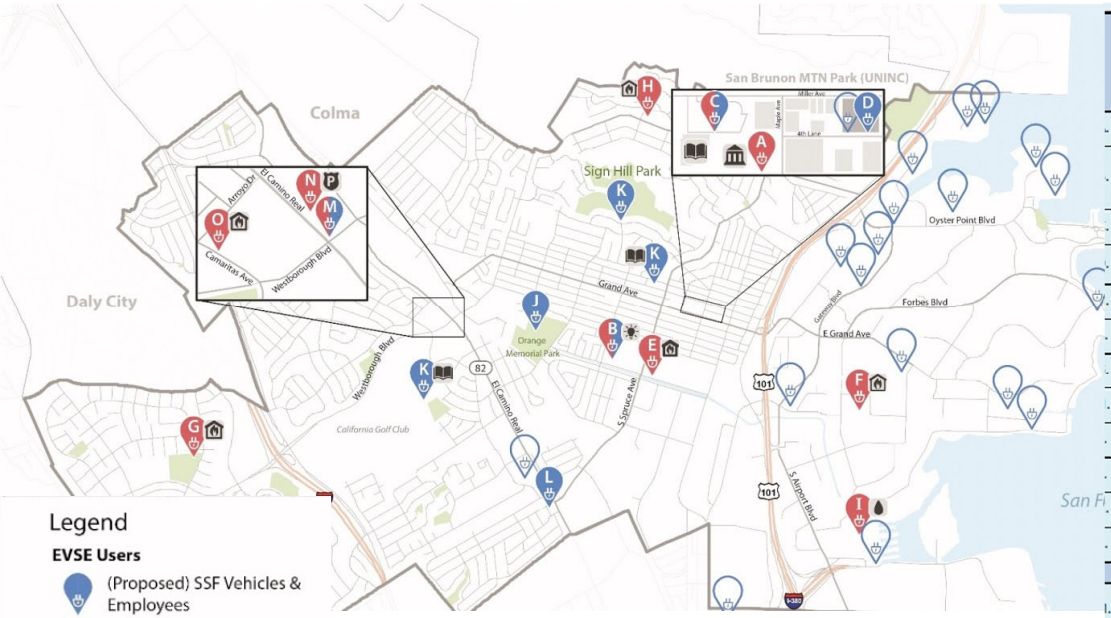


Table 1: Summary of Planned EVSE Funding at City-Owned Facilities

	SSF Facility	# of chargers		Potential Primary Funding Source	Priority	Phase
		SSF Vehicles & Employees	General Public			
.	SSF City Hall Annex, 400 Grand Ave	1		SSF	High	1
.	Public Works Corp Yard, 550 N Canal St.	1 20		SSF and PG&E	High	1 2
.	City Hall Parking lot, 400 Grand Ave	10		PG&E	High	2
.	Miller Ave Parking Garage, 329 Miller Ave		14 3-4 HPC	EVgo and PG&E	High	2
.	Fire Station #61, 480 N Canal St.	4		SSF or EA	Medium	3
.	Fire Station #62, 249 Harbor Way	2		SSF	Low	3
.	Fire Station #64, 2350 Galway Dr.	2		SSF	Low	3
.	Fire Station #65, 1151 South San Francisco Dr.	2		SSF	Low	3
.	Water Quality Control Plant, 195 Belle Aire Rd	2		SSF	Low	3
.	Fernekes Recreation Building at Orange Park, 781 Tennis Dr.		3-6	BAAQMD or EA	Low	3
.	Other City facilities: libraries; parks; senior & community centers.		1-2 per	BAAQMD	Low	3
.	Brentwood Parking Lot on El Camino Real at Hazelwood Ave		2-6	BAAQMD	Low	3
	Planned Future SSF Facility (2022 implementation)					
I.	Future Community Civic Center Campus at Antoinette Ln at Chestnut Ave	10	10 2-4 DCFC?	PG&E, SSF and/or EA	Medium	3
.	Future Police Station at Antoinette Ln at Chestnut Ave	4 + 2 DCFC?		SSF	Medium	3
.	Future Fire Station #63 at Arroyo and Camaritas	2-4?		SSF	Medium	3
.	Future Garage #2 (location to be determined)		50 50 DCFC	BAAQMD or EA and EVgo	Medium	3

Note: All numbers are Level 2 unless High Power Charger (HPC) or Direct Current Fast Charger (DCFC)

City of South San Francisco EVSE Masterplan

DKS Project

Determine Needs

Attribute	Options		
EVSE User	SSF Vehicles, SSF employees and general public		
Primary Funding Source	PG&E'S EV Charge Program, EVgo, SSF general funds		
Additional Funding Source	BAAQMD, Electrify America		
Chargers	**Level 2**	**DC Fast Charger**	**High Power Charger**
Existing	90	4	0
Planned (additional)	94	8	4
Total	**184**	**12**	**4**

City of South San Francisco EVSE Masterplan

DKS Project

Determine Priorities for Implementation

Priority	Description
High	✓ Urgency driven by immediate need to support City EV acquisition and operations where City vehicles are located. ✓ Current, limited-duration funding availability
Medium	✓ Needed for planned City EV fleet acquisition and operations ✓ Cost-effective opportunity ✓ Strong current public/political support
Low	✓ Potential future funding opportunity ✓ Potential expanded capacity for City EV fleet expansion ✓ Expanded employee charging

City of South San Francisco EVSE Masterplan

DKS Project

Determine Timeframe for Implementation

Implementation Phase	Timeline	Description
1	Late 2018	No delays, City responsibility for implementation
2	Early 2019	Minor delays pending implementation by third parties including PG&E and EVgo
3	2021	Pending future funding by City or third party or driven by City capital project schedule for development of the Future Community Civic Center Campus and Police Station, and planned Fire Station #63.

City of South San Francisco EVSE Masterplan

DKS Project

Funder	Use	Sites	# EVSE	Type	Phase	Summary of Contribution
ev charge network	Workplace & Fleet	City Hall Parking lot	10	Level 2	1	PG&E covers all project design, permitting and installation costs for workplace chargers equivalent to approximately 60-80% of total project costs.
	Fleet & workplace	Public Works Corp Yard (20)	20	Level 2	1	
	Workplace	Miller Ave Parking Garage	10	Level 2	1	
	Workplace & Fleet	future Community Civic Center	??	Level 2	3	
EVgo	Public	Miller Ave Parking Garage	3-4	Level 2	2	EVgo is contributing 100% of project costs including design, permitting, installation and charging hardware for new DC Fast Chargers and Level 2 replacement chargers.
	Public	Miller Ave Parking Garage	3-4	DCFC	2	
	Shared Mobility	future Municipal Garage	50	DCFC	3	
Bay Area Air Quality Management District	Public	Fernekes Recreation Building	3-6	Level 2	3	Bay Area Air Quality Management District funds $18-$25K per DC Fast Charger or $3K for single port/$4K for dual port Level 2 chargers.
	Public	parks, community centers & libraries	1-2 per	Level 2	3	
	Public	Brentwood Parking Lot	2-6	Level 2	3	
	Public	Future downtown parking garage	10-30	Level 2	3	

Source: PG&E, EVgo, and BAAQMD

City of South San Francisco EVSE Masterplan

DKS Project

Key takeaways

15x - return of investment for consulting and infrastructure

$1.5m - total amount the City leveraged in EV infractructure that was donated to the city

40 - EV stations were sponsored by PG&E and EVgo at no cost to the City

x2 - doubling the total number of EV chargers in the city from 90 to over 170 within the first year.

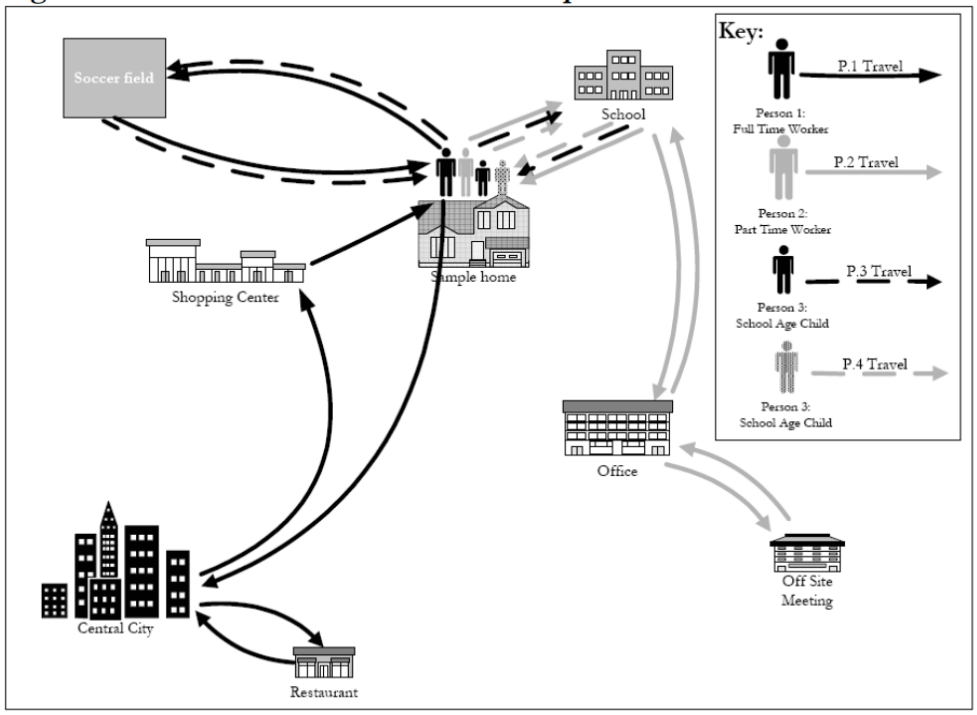
Activity-Based Travel Demand Model

Daily travel tours:

- Tours begin and end at home with intermediate stops at:
  - ✓ School
  - ✓ Soccer Field
  - ✓ Office
  - ✓ Restaurant
  - ✓ Shopping Center

Model tracks dwell times between trips of each tour

Figure 8-2. Activities and Travel for a Sample Four-Person Household



Source: SACOG, November 2008.

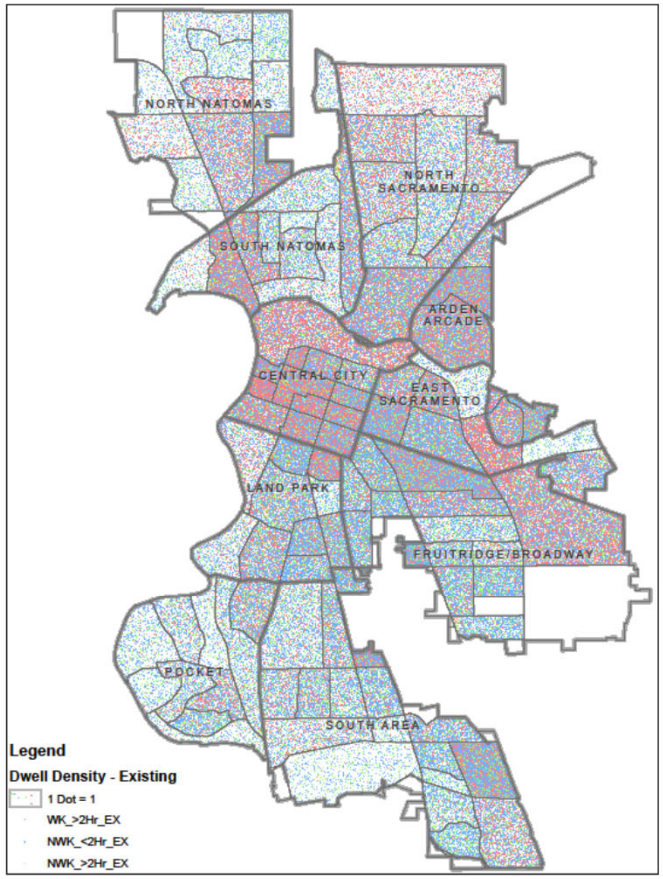
Activity-Based Travel Demand Model

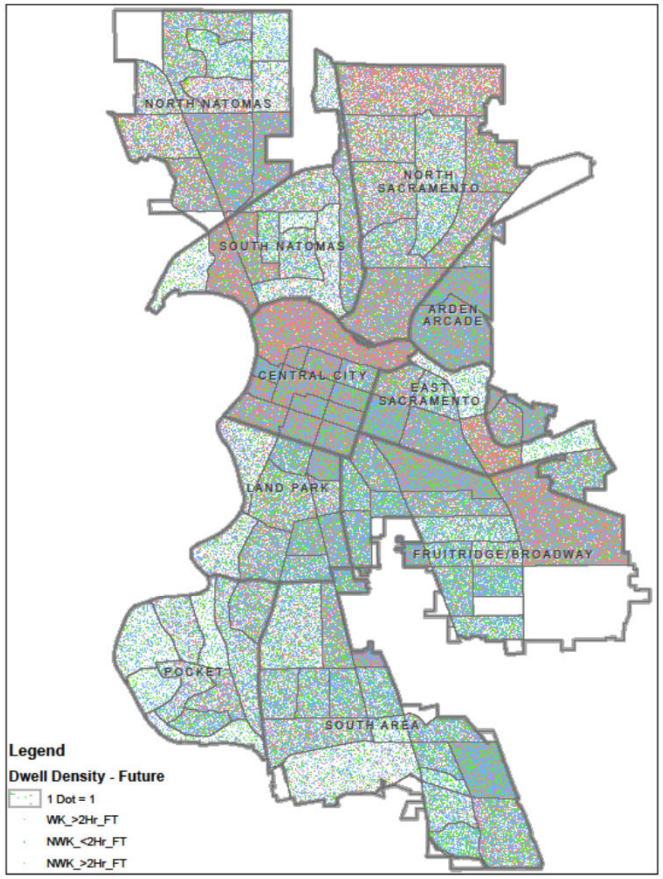
DKS

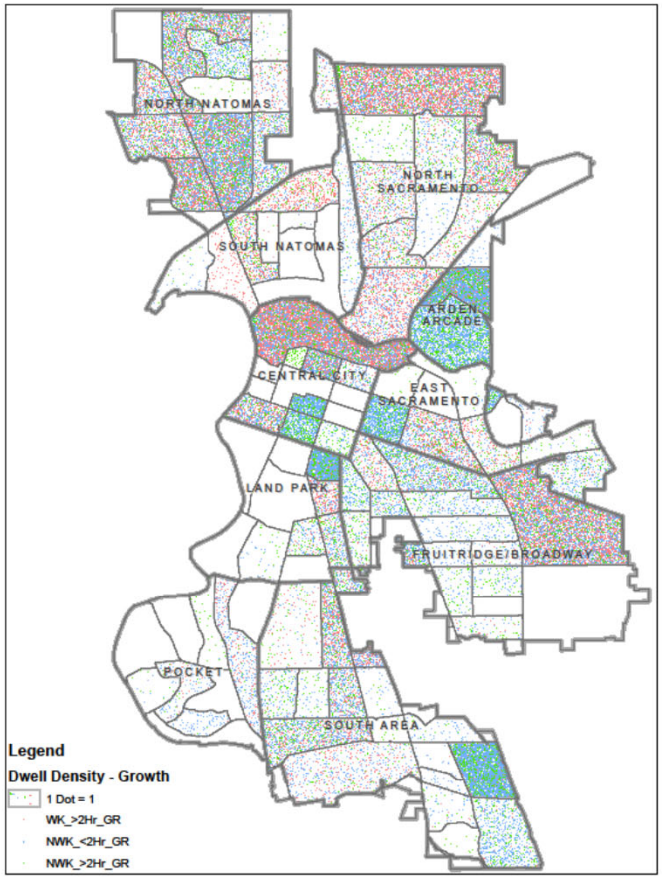
Using dwell times between trips to prioritize locations for Level 2 and DC Fast Chargers

C	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW
	Score Per Tract																		
	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R		<<Method (A=Absolute	
	1	1	1	1	1	-1	-2.0	1	1	1	1	5.0	1	1	5.0	1		<<Relative Weighting (t	
	ng Land Use					Existing EVSE		Land Use Growth Potential			SACSIM Activity-Based Travel Demand Model Tour EVSE Demand Ranking								
Resultant Rank	Park	MUD	Ind/ Whs	Off/ Prof	Ret/ Comm	Level 2	Level 3 (DCFC)	Vacant Residential	SACOG HH Growth	SACOG Job Growth	Workplace L2 (Current)	Non-Work L3 (Current)	Non-Work L2 (Current)	Workplace L2 (Forecast)	Non-Work L3 (Forecast)	Non-Work L2 (Forecast)	City Planning Factor	Total Points	Resultant Rank
25	82	71	74	95	78	-100	-200	0	1	46	116	**575**	115	114	**580**	117	0	1885	25
57	69	63	0	107	21	0	0	43	3	4	86	**335**	79	77	**295**	61	0	1398	57
34	30	0	0	100	69	0	0	39	13	5	90	**510**	103	87	**485**	95	0	1750	34
15	0	66	111	92	109	-95	-224	85	74	98	111	**555**	111	112	**570**	114	0	2123	15
73	17	70	103	59	82	0	0	71	66	11	68	**200**	36	60	**175**	28	0	1242	73
75	39	106	88	69	55	0	0	27	71	77	56	**170**	35	57	**165**	34	0	1230	75
43	37	107	106	78	90	-101	0	59	86	106	75	**220**	42	84	**335**	68	0	1686	43
50	36	109	84	108	104	-109	0	58	100	111	88	**180**	29	75	**245**	42	0	1554	50
17	95	102	0	111	110	-111	-216	0	108	107	108	**550**	110	82	**525**	105	0	2108	17
12	48	111	68	109	53	-110	0	0	111	110	114	**405**	78	104	**455**	83	0	2156	12
1	96	103	60	110	108	-112	-220	15	101	112	120	**595**	119	117	**585**	115	0	2556	1
20	38	112	67	96	105	-108	0	42	109	108	101	**305**	57	97	**470**	84	0	2003	20
36	32	110	73	106	97	-88	-202	30	90	72	102	**460**	94	93	**405**	80	0	1739	36
4	62	108	0	105	106	-93	0	0	97	99	113	**570**	114	108	**545**	110	0	2363	4
29	0	101	72	89	98	-91	-206	38	93	82	98	**480**	95	90	**440**	87	0	1832	29
5	0	100	76	101	102	-96	0	46	92	104	106	**505**	101	102	**515**	104	0	2352	5
18	79	82	93	85	83	-102	-208	52	104	105	97	**440**	88	100	**480**	89	0	2048	18
7	110	43	109	75	60	-103	-198	77	110	109	115	**540**	108	119	**565**	113	0	2251	7
99	112	38	0	0	33	0	0	21	18	37	25	**110**	22	22	**100**	22	0	672	99
59	25	14	63	67	44	0	0	89	61	1	93	**370**	84	38	**185**	40	0	1370	59
46	91	25	81	98	29	0	0	24	25	6	78	**295**	64	70	**230**	52	0	1617	46
22	0	85	66	94	77	-90	-212	18	64	75	107	**565**	113	107	**560**	112	0	1941	22
9	28	44	98	64	93	-94	0	26	79	84	99	**545**	109	103	**540**	108	0	2208	9

Activity-Based Travel Demand Model







Planning for Electric Mobility

Creating a roadmap for cities and counties towards greater vehicle electrification

DKS

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