EV Coordinating Council

EV Charging – Projecting and Planning for Demand

Welcome!

We will begin the meeting shortly.

Feel free to edit your Zoom display name to include your organization and pronouns.

This meeting will be recorded.

Bay Area Air Quality Management District

Metropolitan Transportation Commission

cool the earth

Acterra: Action for a Healthy Planet

EV Coordinating Council

Agenda

- Mailing List Change
- Bay Area EV Market Update
- EV Council Working Group Announcement
- Panel: EV Charging – Projecting and Planning for Demand
- MTC Presentation to Solicit Input on Electrification Planning Assistance
- Roundtable Announcements

Acterra ACTION FOR A HEALTHY PLANET

Bay Area EV Market Update

BAY AREA

ELECTRIC VEHICLE TRENDS AND GOALS

13,030 public charging ports currently

58,000 public charging ports needed by 2030 (NREL)

In 2022, 6.2% of the Bay Area fleet were EVs, with a goal of 90% by 2050

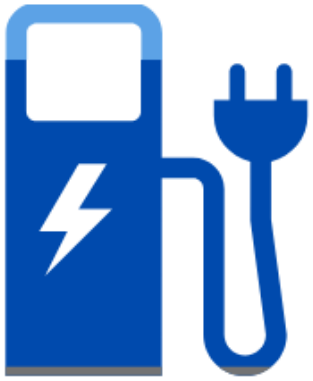
In 2023 Q3, 26.7% of all new sales in CA were EVs

Public charging ports

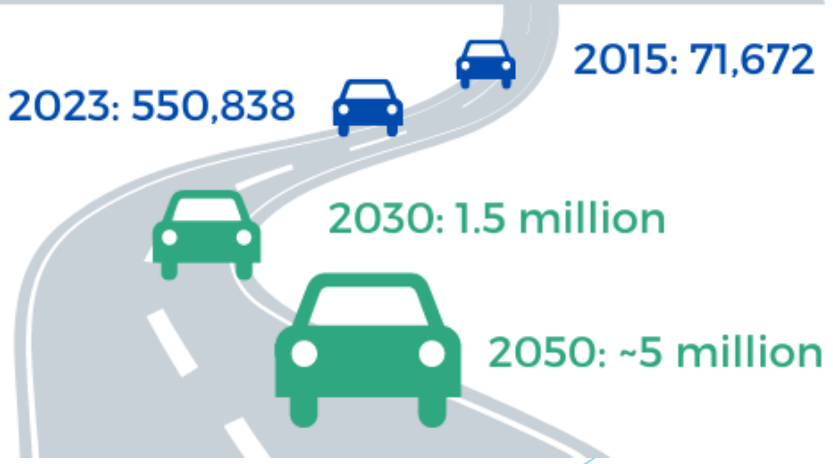
18% DC Fast

82% Level 2

<1% Level 1



Progress towards our EV Adoption Goals

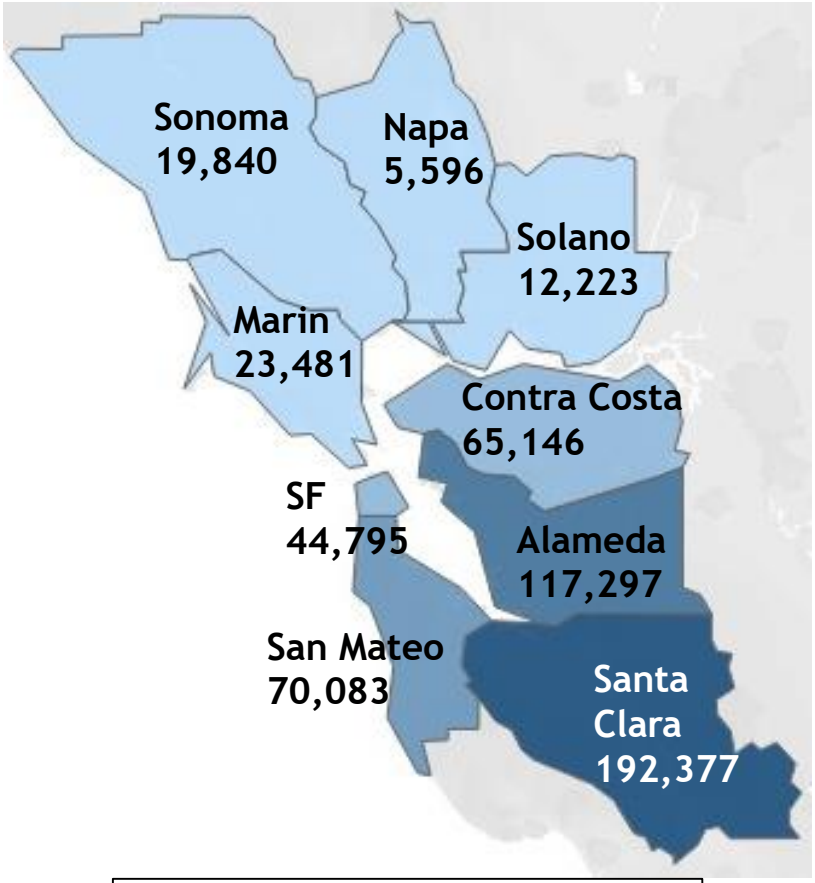


ZEV Adoption in the Bay Area

CA Total: 1,742,801

Total ZEVs in California

1 — 96,739



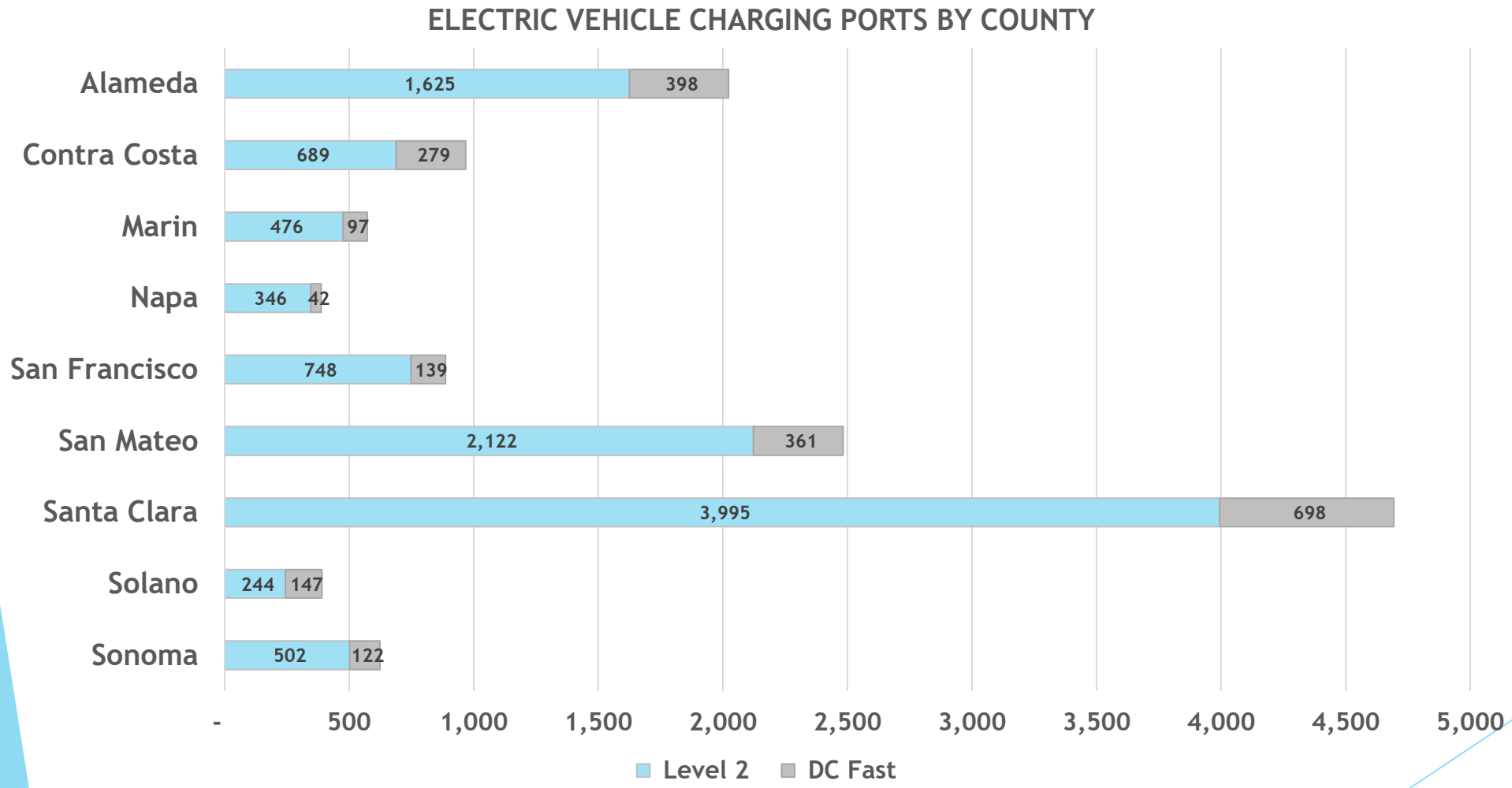
Bay Area Total: 550,838

Total ZEVs in Bay Area

921 — 30,347

California Energy Commission (2023). New ZEV Sales in California. Data last updated October 31, 2023. Retrieved December 6, 2023 from https://www.energy.ca.gov/zevstats

Existing Bay Area EV Infrastructure



Total public EV charging ports as of September 2023: ~13,030

California Energy Commission (2023). Electric Vehicle Chargers in California. Data last updated September 15, 2023. Retrieved December 6, 2023 from https://www.energy.ca.gov/zevstats

CA Medium/Heavy Duty EVs

272
CA Medium/Heavy-Duty EV Trucks

1,708
CA EV Buses

340
CA EV Delivery Vans

Image source: Veloz California Electric Vehicle Market Report. https://www.veloz.org/ev-market-report/
Data Source: California Energy Commission (2023). Medium- and Heavy-Duty Zero-Emission Vehicles in California. Data last updated June 5, 2023. Retrieved December 6, 2023 from https://www.energy.ca.gov/zevstats

Working Group Opportunity

EV Funding Navigator, streamlining access to grants

Opportunity: Unprecedented levels of funding available for EV transition

Purpose: Develop a centralized, easy to navigate funding information system to maximize efficiencies

WG Phase I:

Identify Funding Sources:

- Compile comprehensive list of EV funding opportunities

Define Spreadsheet Structure

- Decide key information categories for a top-line view of each funding opportunity,
- Determine hosting platform (e.g., Air District website) and format (downloadable file, online tool)

Stakeholder Communication Plan:

- Develop a strategy for notifying stakeholders about the resource
- Plan regular updates and communications to maintain relevance

Working Group Opportunity

EV Funding Navigator, streamlining access to grants

About the group

- Small group to advise on project
- Ideally one representative from a CCA, city, NGO, agency and utility

Benefits to participants

- Help accelerate the EV transition
- Collaborate and network with others
- Input on design to meet your organization's needs
- Listed on BAAQMD website (more LinkedIn content!)

Timing and commitment

- February - May
- 4 meetings, 1x/month
- No "homework"
- Opportunity to share ideas within small group

Contact Cathy Stanley, cstanley@cooltheearth.org

EV Coordinating Council

Panel
EV Charging – Projecting and Planning for Demand

Brennan Borlaug, National Renewable Energy Laboratory
Adam Davis, California Energy Commission
Zac Thompson, Ava Community Energy
Wendy Chou, Acterra, Moderator

A Q&A session will follow the panel presentations. Please hold questions until the end of the presentations.

Acterra ACTION FOR A HEALTHY PLANET

The 2030 National Charging Network: *Estimating U.S. Light-Duty Demand for EV Charging Infrastructure*

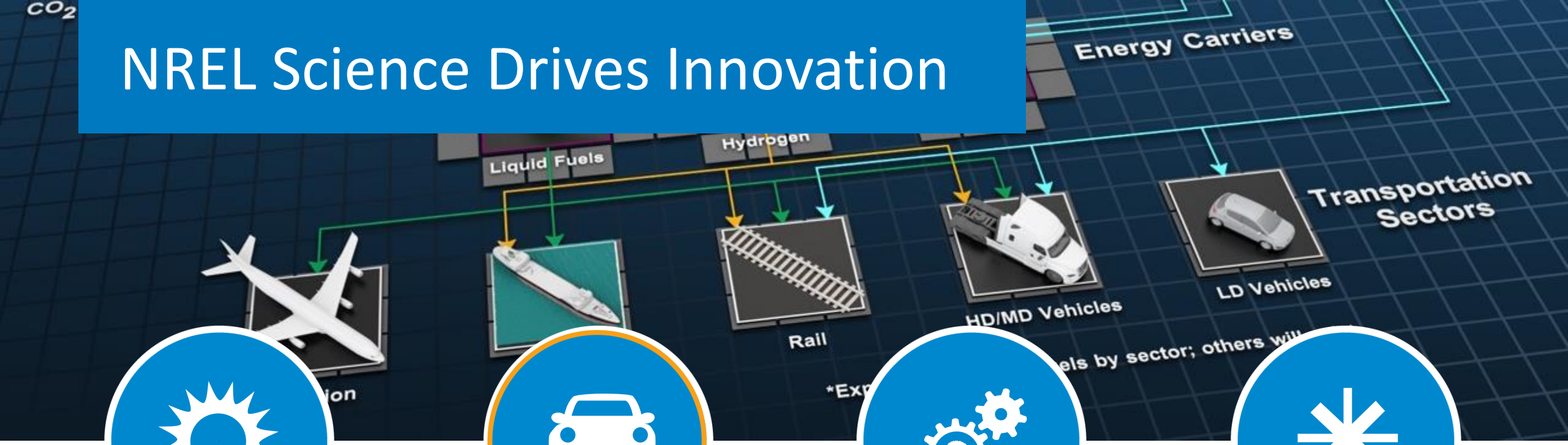
Bay Area EV Council, December 2023

Brennan Borlaug

Eric Wood, D-Y Lee, Yanbo Ge, Fan Yang, & Zhaocai Liu

U.S. DOE National Lab System

NREL Science Drives Innovation



Renewable Power

Solar

Wind

Water

Geothermal

Sustainable Transportation

Bioenergy

Electrification

Hydrogen

Energy Efficiency

Buildings

Advanced Manufacturing

Government Energy Management

Energy Systems Integration

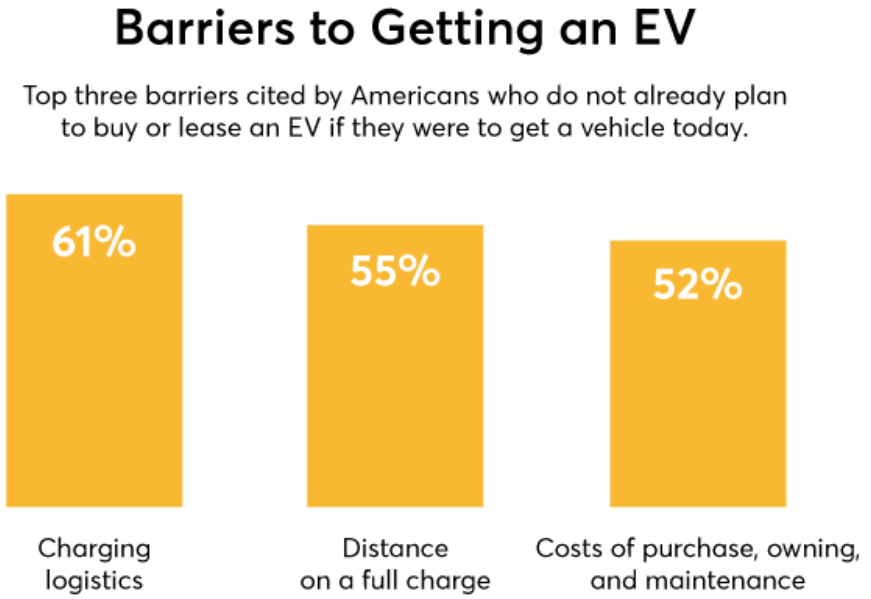
Grid Integration

Hybrid Systems

Security and Resilience

Charging a Major Concern for Potential EV Buyers

- Recent survey shows that **6 in 10 Americans who aren't yet sold on plug-in EVs were concerned about where and when they would charge** (61%) and how far that charge will take them (55%), i.e., "range anxiety".
- Early charging patterns are home-dominant (>80% of charging), but **many future EV owners may not have access to a home charger**.
- Recent study shows **EV "discontinuance" related to dissatisfaction with the convenience of charging** and not having level 2 (240-volt) charging at home.



Source: Consumer Reports survey of 8,027 U.S. adults in early 2022

nature energy

Understanding discontinuance among California's electric vehicle owners

Scott Hardman & Gil Tal

https://doi.org/10.1038/s41560-021-00814-9

EV Charging a Priority for Federal Government

Ambitious goals to **grow domestic EV and EV charging markets** through 2030:

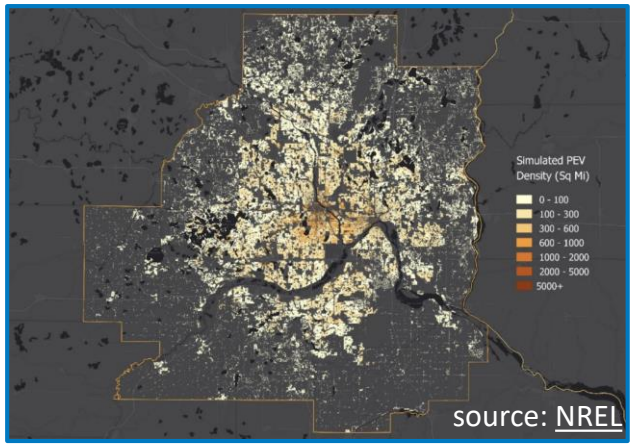
- 500,000 PEV chargers
- 50% of LDV sales as ZEV

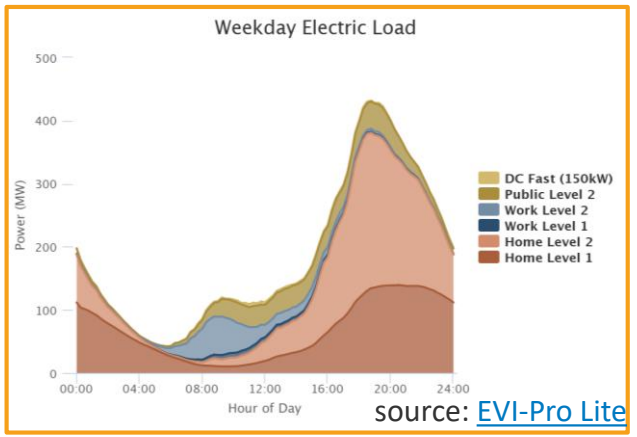
Backed by **new federal policies and support**:

- 2021 Bipartisan Infrastructure Law includes $7.5 billion to build out a national network of EV chargers.
- 2022 Inflation Reduction Act provides federal tax credits for EV infrastructure, EV purchases, and domestic mining and manufacturing.

Major Uncertainty: EV charging infrastructure requirements are hard to predict over time; challenging to plan for...

Preparing for EVs: not *if* but ***when***, ***where***, and ***how much?***





Where EVs are adopted

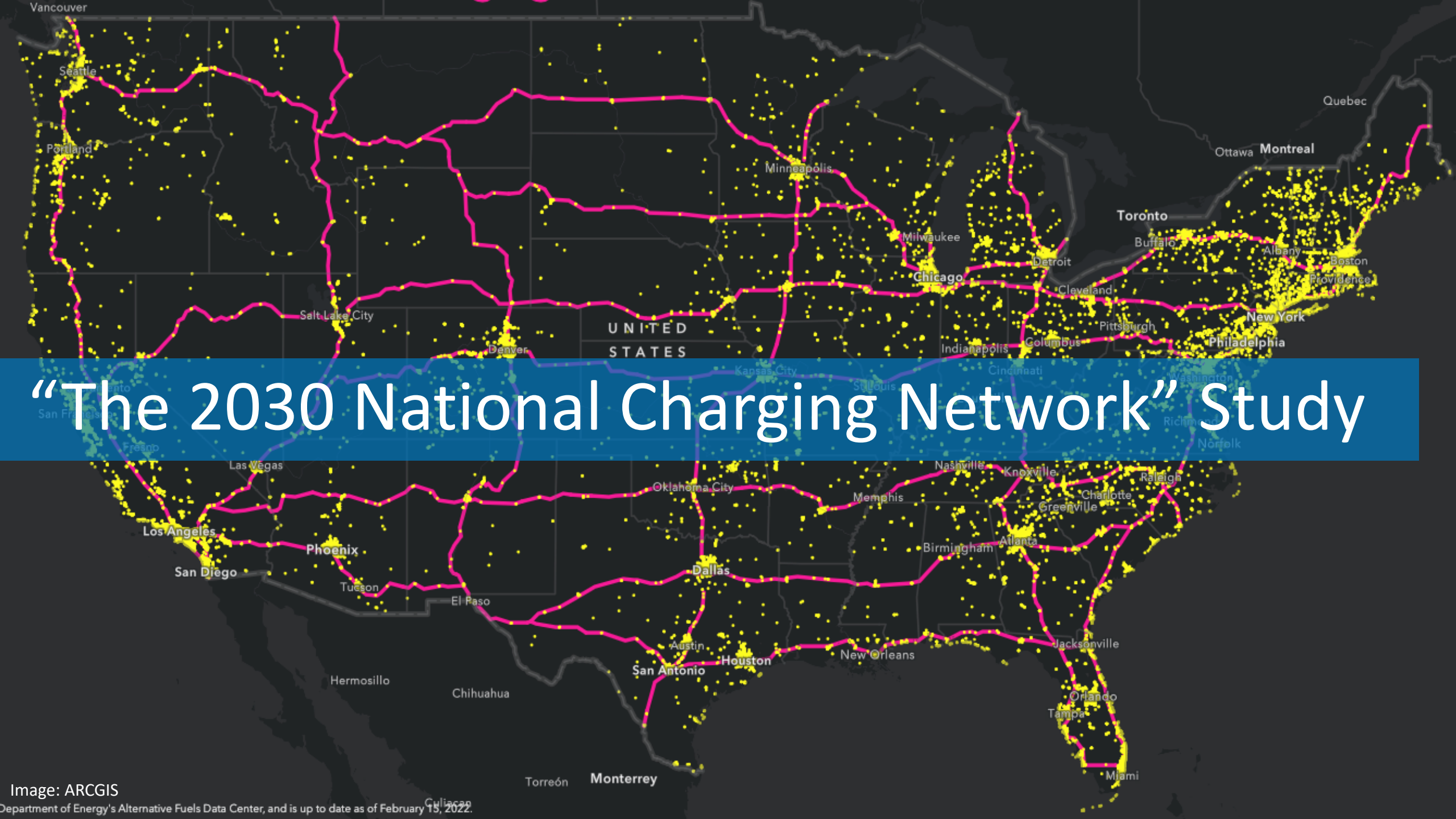
- Which regions, communities, households are likely to adopt EVs?
- What types of EVs will be adopted?
- How quickly will EVs be adopted?

How EVs are operated

- How do driving requirements vary by region or household?
- Where are EVs parked during the day?
- Do EV travel patterns differ from conventional vehicles?

How EVs are charged

- Can EVs charge while at home, work, or in public?
- How do EV drivers prefer to charge, and will this change over time?
- Can EVs shift (in time) or modulate their loads?



“The 2030 National Charging Network” Study

Image: ARCGIS

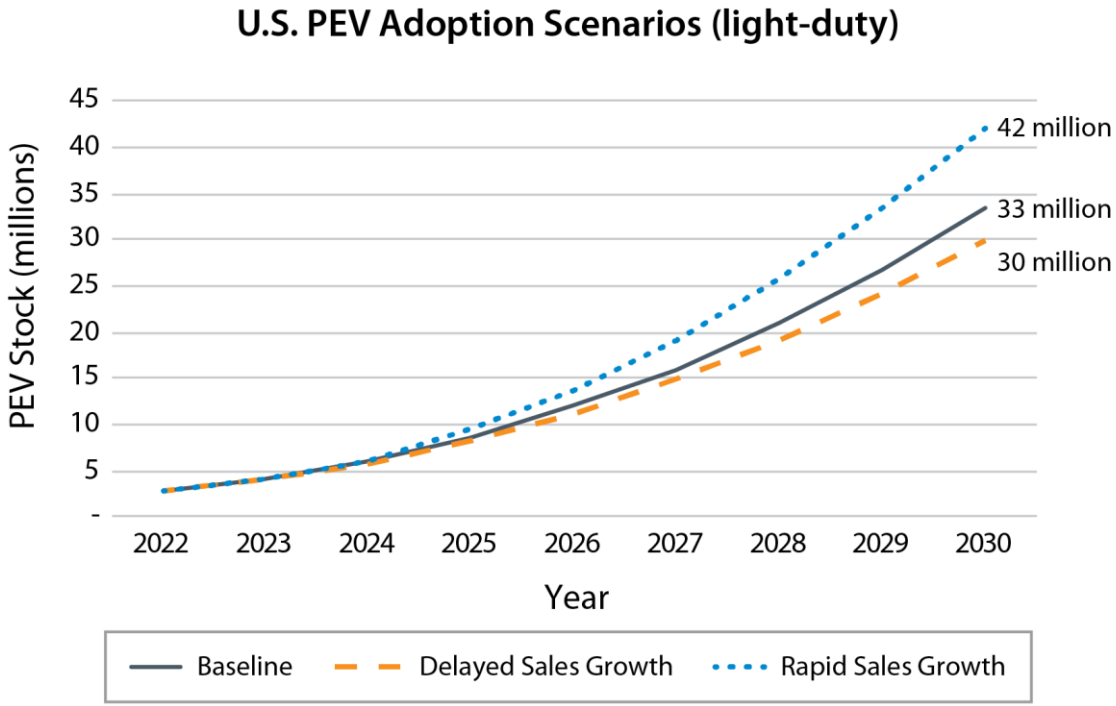
Department of Energy's Alternative Fuels Data Center, and is up to date as of February 15, 2022.

Study Objective

Major Uncertainty: EV charging infrastructure requirements are hard to predict over time; challenging to plan for...

Primary Research Questions:

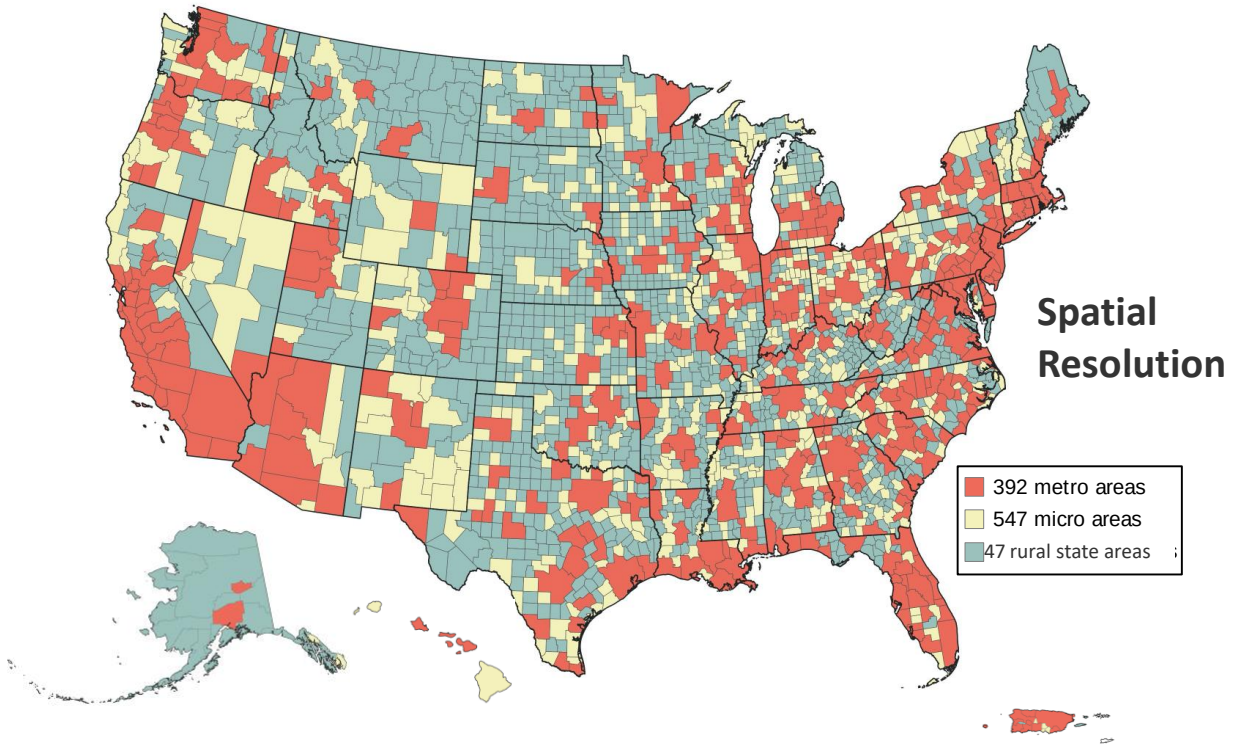
- What are the charging demands and how much charging infrastructure is needed to support **high levels of EV adoption by 2030**?
- Which types of EVSE should be prioritized and where?
- What will it cost to build out the EVSE network over time?



TEMPO-modeled national light-duty PEV adoption trajectories

Scope of Modeling

Outputs:	EVSE port counts and costs
Vehicle Segment:	Personally-owned light-duty vehicles
Timeframe:	2022 - 2030
Spatial Resolution:	986 CBSAs/rural-state areas (see below)
EVSE Types:	(see EVSE Taxonomy table)



Spatial Resolution

Outputs:

focus of this study

by...

EVSE Taxonomy

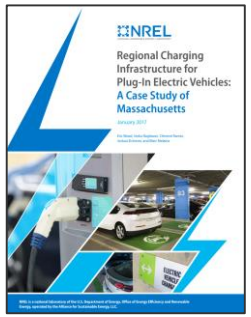
Access Type	Public	Private
Location Type	Home: SFH Home: MFH Neighborhood Workplace Office Retail	Recreational Healthcare School Community Center Transit Hub
EVSE Type	Level 1 Level 2 DC 50 kW	DC 150 kW DC 250 kW DC 350+ kW

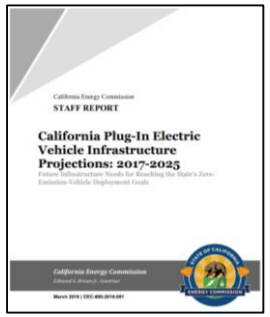
EVI-X: **Network Planning**

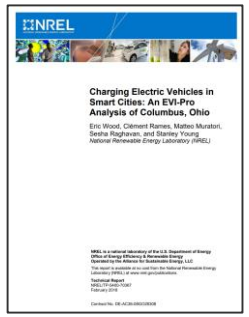
EVI-Pro is a simulation model that:

- Models **typical daily charging demands** for EVs
- Designs **supply of infrastructure** to meet demand

Models EV driver charging behaviors for a given set of assumptions around EVSE access and charging preferences.





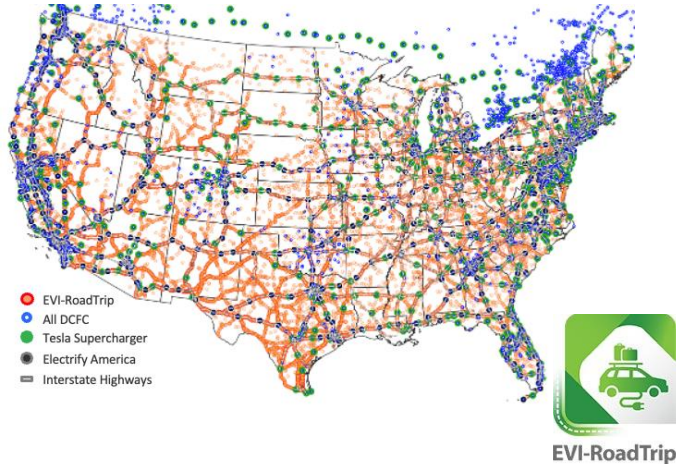


Originally developed through a collaboration with the California Energy Commission, EVI-Pro has been applied in multiple city-, state-, and national-level studies

EVI-Pro

https://www.nrel.gov/transportation/evi-pro.html

EVI-RoadTrip estimates EV charging demands along highway corridors for **long-distance travel** (road trips).

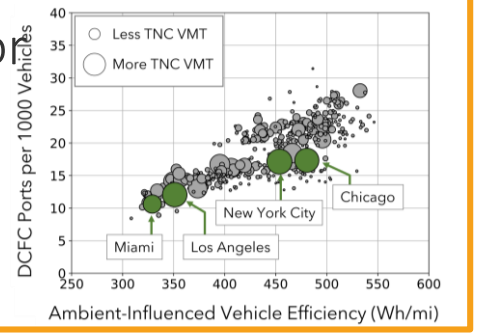


EVI-RoadTrip

https://www.nrel.gov/transportation/evi-roadtrip.html

EVI-OnDemand estimates DC fast charging infrastructure requirements for **ride-hail EVs** considering:

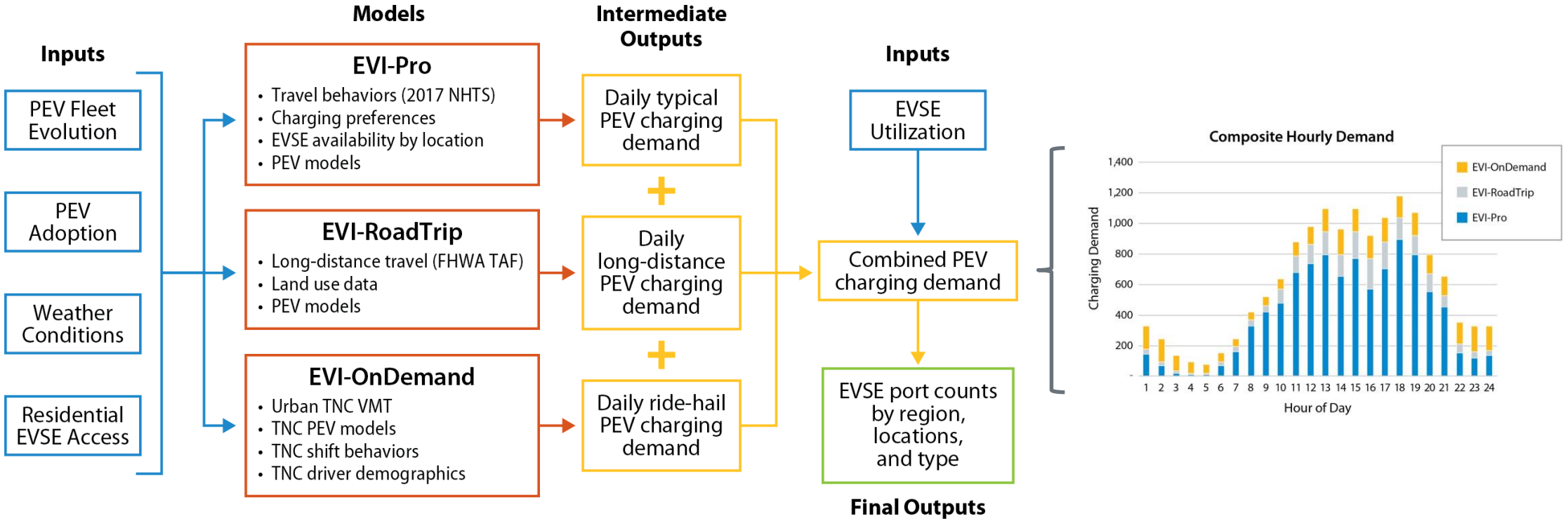
- Local weather/driving conditions
- Typical driver shift lengths
- Home charging access for ride-hail drivers



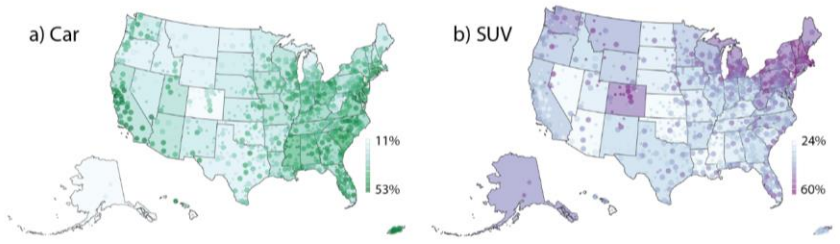
Modeling Approach

National modeling framework standardizes inputs and combines outputs for each of the light-duty EVI- demand models.

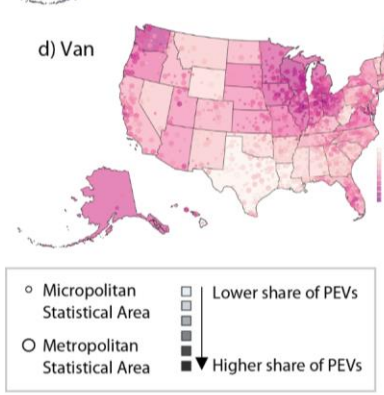
Captures regional differences in EV charging demands and port requirements due to differences in travel patterns, residential charging access, PEV adoption rates, vehicle type preferences, and weather conditions.



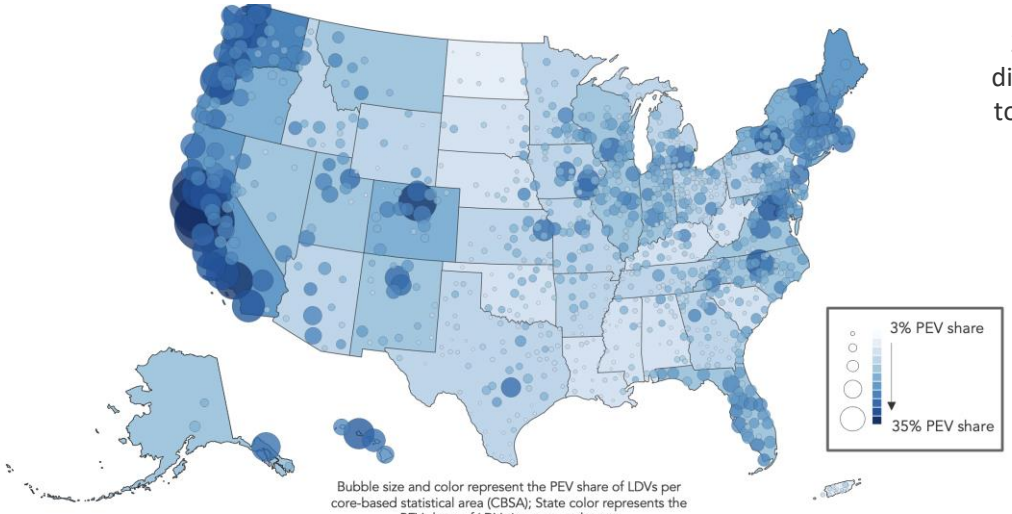
Baseline Assumptions



Bubble color represents the relative share of PEVs of a particular chassis type per core-based statistical area (CBSA); state color represents the relative share of PEVs of a particular chassis type in state rural areas



2030 PEV chassis mix = new LDVs (MY2019-22)



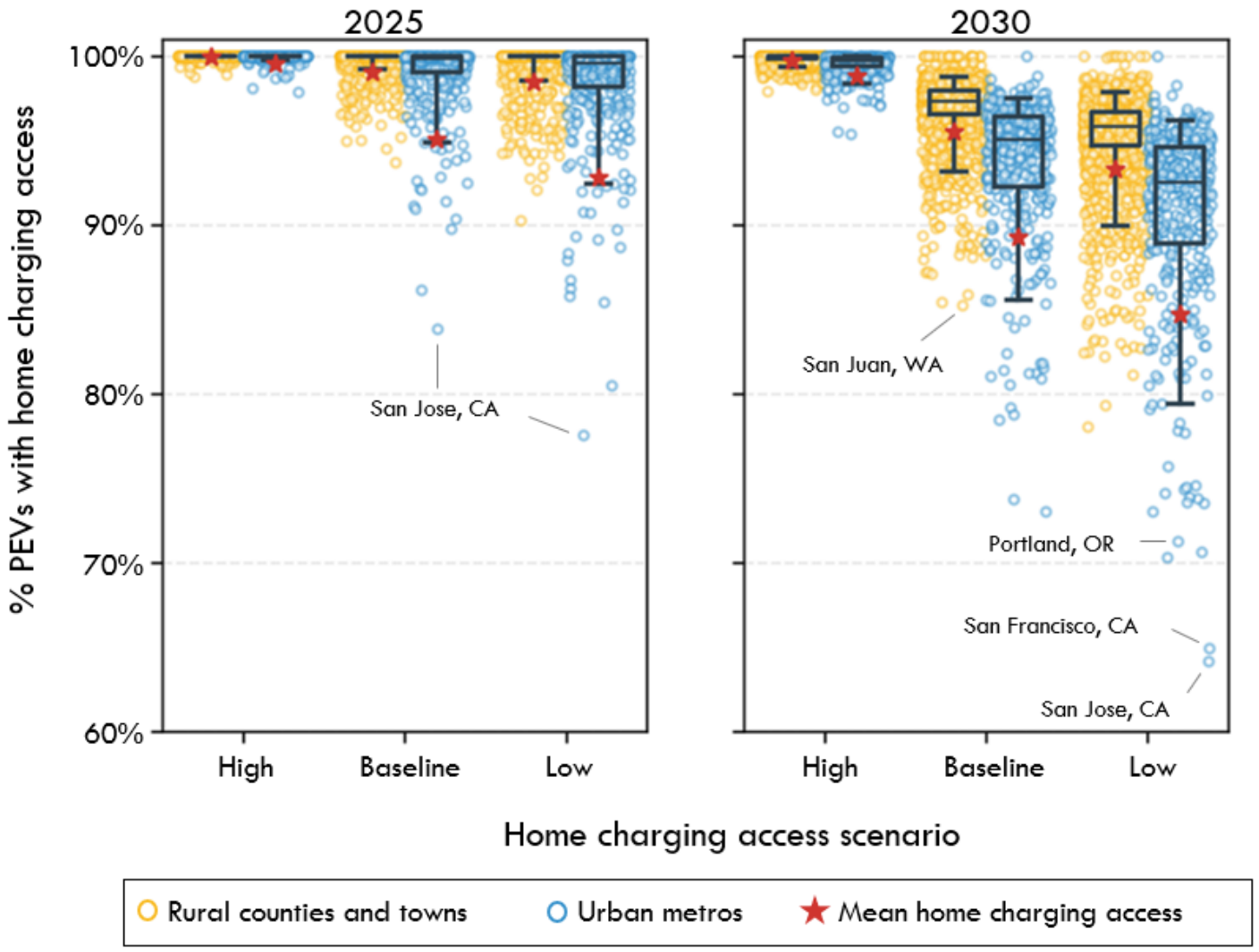
Bubble size and color represent the PEV share of LDVs per core-based statistical area (CBSA); State color represents the PEV share of LDVs in state rural areas

2030 PEV spatial distribution skewed toward 2022 PEV & HEV distribution

Demand-Side Assumptions: Baseline Scenario

Modeling Parameter	2030 Nominal Assumption
PEV fleet size (LDV only)	33 million (2.7 million registered as of 2022)
PEV powertrain shares	BEV = 90% (2022: 72%) PHEV = 10% (2022: 28%)
PEV body type distribution	Sedan = 24% (2022: 58%) C/SUV = 56% (2022: 40%) Pickup = 17% (2022: 0%) Van = 3% (2022: 2%)
Average PEV electric range (model year 2030)	BEV = 300 miles PHEV = 45 miles
BEV minimum DC charge time (model year 2030; 20%–80% state of charge [SOC])	20 minutes [a]
Maximum DC power rating (per port)	350+ kW
Geographical distribution	Scaled proportional to existing PEV and gasoline-hybrid registrations with a ceiling of 35% of LDVs on the road in 2030 as PEVs in high adoption areas and a floor of 3% in low adoption areas
PEVs with reliable access to residential charging	90%
Weather conditions	Typical ambient conditions are used for each simulated region, impacting electric range accordingly
Driving behavior	EVI-Pro: Consistent with Federal Highway Administration (FHWA) 2017 National Household Travel Survey (NHTS) EVI-RoadTrip: Directly applies FHWA Traveler Analysis Framework (TAF) EVI-On Demand: Consistent with Balding et al. (2019)
Charging behavior	All models attempt to maximize use of home charging (when available) and utilize charging away from home only as necessary. When fast charging is necessary, BEVs prefer the fastest option compatible with their vehicle, up to 350+ kW.

Home Charging Access



https://www.nrel.gov/docs/fy22osti/81065.pdf

Home Access Scenarios:

Low: Scenario 2 – only PEV drivers with existing electrical access where the vehicle is parked can charge at home (Ge et al.)

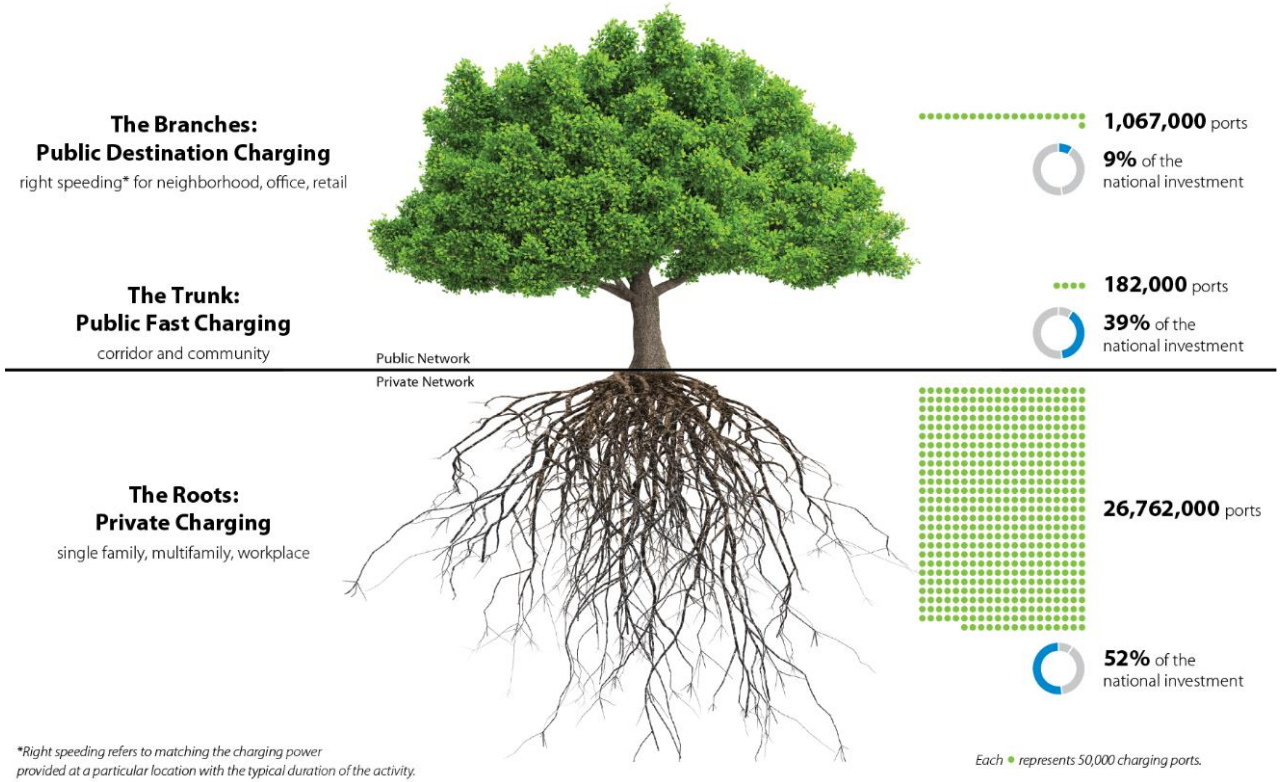
Baseline: 50% Scenario 2, 50% Scenario 3 (Ge et al.)

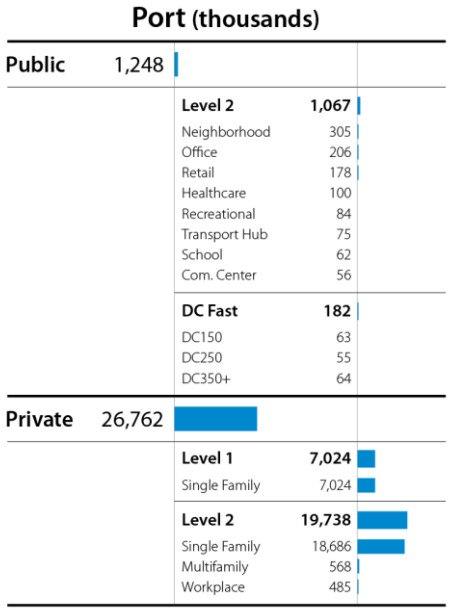
High: Scenario 5 – Assumes all PEV drivers who can park their vehicle in a location where electrical access can be installed can charge at home (Ge et al.)

Key Findings (1/5)

Convenient and affordable charging at/near home is core to the ecosystem but must be complemented by reliable public charging:

- **26.8 million Level 1 and Level 2 charging ports** in **privately accessible locations** [96% of ports, 52% of investment]
  (single-family homes, multifamily properties, and restricted access workplaces)
- **1 million Level 2 charging ports** in **publicly accessible locations** [4% of ports, 9% of investment]
  (near high-density neighborhoods, public access workplaces, and other long-dwell locations)
- **182,000 fast charging ports** in **publicly accessible locations** [<1% of ports, 39% of investment]
  (grocery stores, convenience stores, and other short-dwell locations)



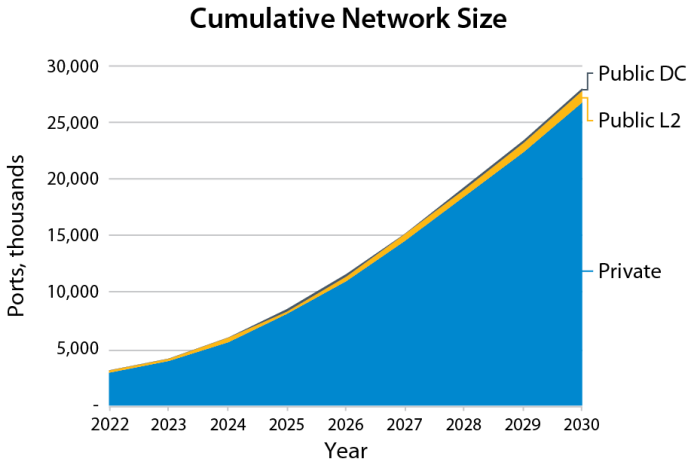


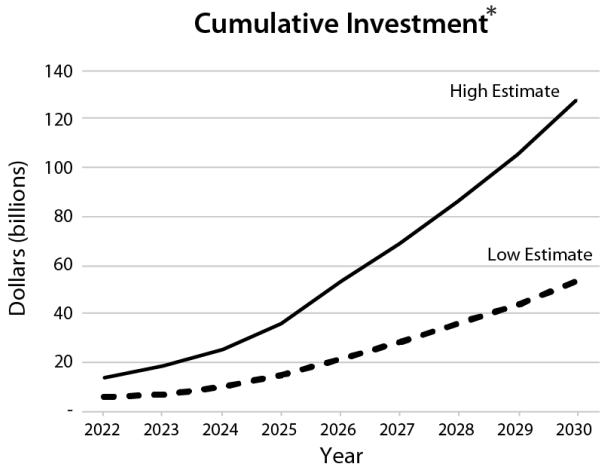
Key Findings (2/5)

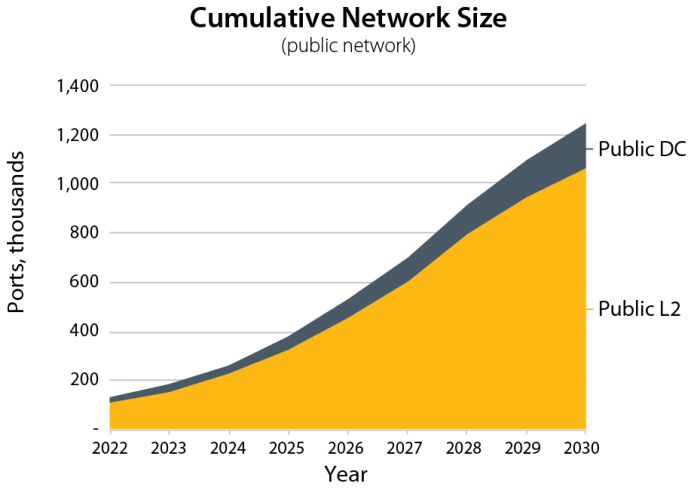
Continued growth and investment in the EV charging network will be required to meet 2030 sales targets.

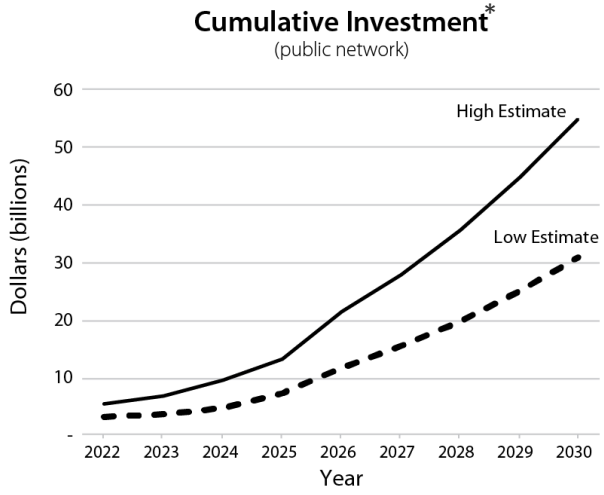
- High uncertainty around cost requirements due to significant site-level variability in EVSE equipment and installation costs.
- Significant public and private investments in EV charging have already been made and will need to continue through the end of the decade.

***Cumulative Investment** is defined as capital expenses for equipment and installation necessary to support EV charging. Costs of grid upgrades and distributed energy resources have been excluded from these estimates; however, these can be significant and will ultimately be critical for building out the national charging network.





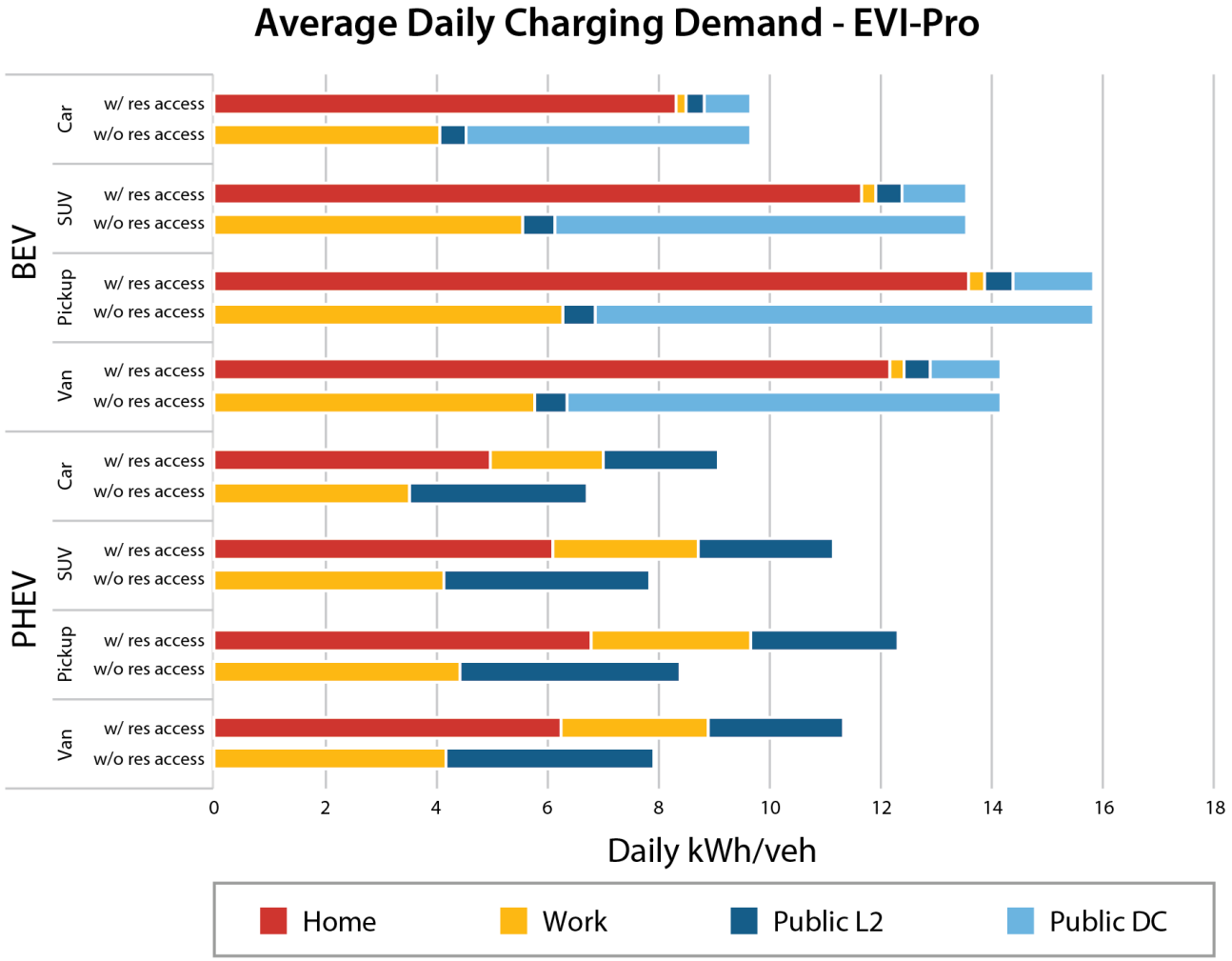




Key Findings (3/5)

Charging demands and infrastructure requirements vary by vehicle type and for those with/without home charging.

- Larger vehicles = higher energy demands
- PHEVs have lower electricity demands (smaller batteries) than BEVs and may rely more on public L2 charging*
- Without home charging, drivers rely more on workplace and public charging networks for daily travels.

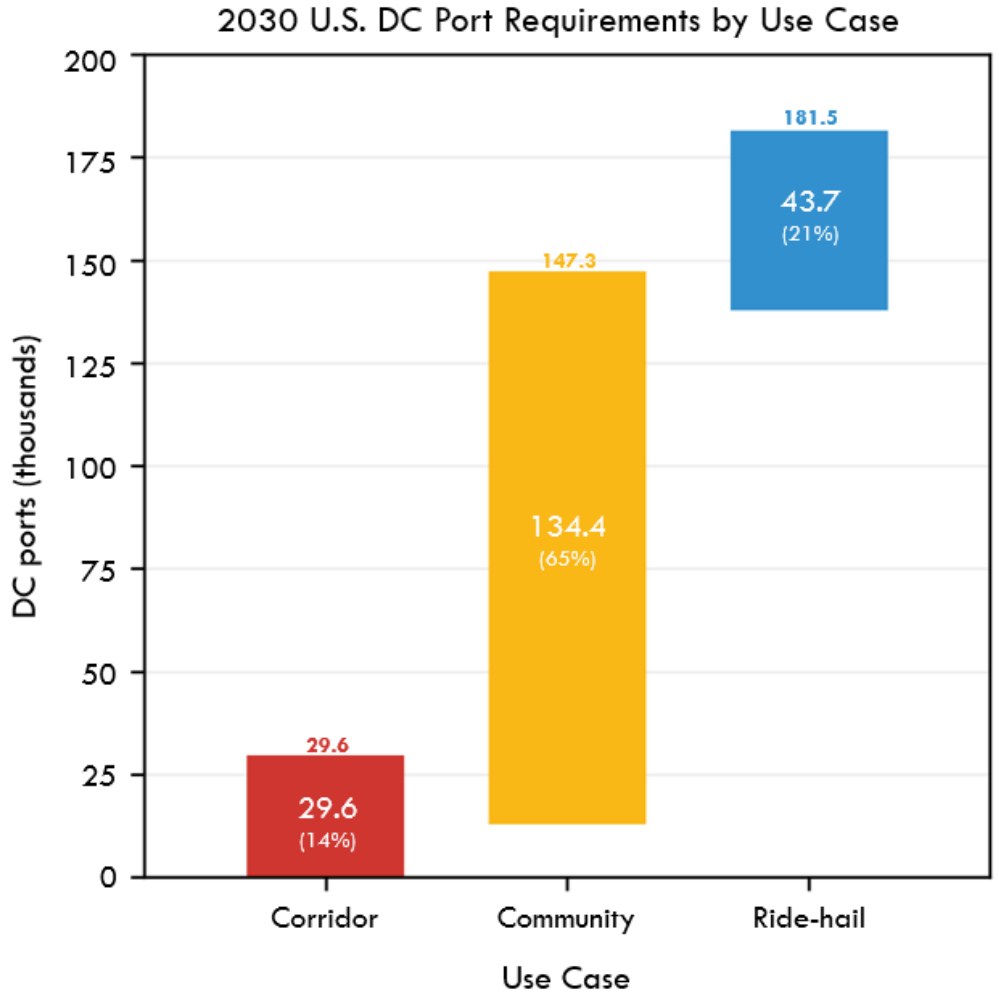


*this study assumes that PHEVs are incapable of DC fast charging

Key Findings (4/5)

The public DC fast charging network will serve multiple use cases:

- The majority (**65%**) of demand is in support of **daily travel (community charging)**, particularly for those without reliable home or workplace charging.
- **21%** of demand from **ride-hail** EVs, a disproportionate share compared to other LDVs.
- **14%** of demand from **long-distance travel (corridor charging)**, though these stations are critical for providing comprehensive national coverage (reducing ”range anxiety”).

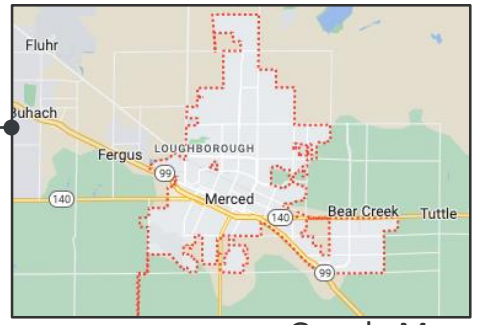


Key Findings (5/5)

The composition of the public charging network will vary regionally.

- Densely populated areas will require significant investments to support those in multi-family homes without a home charger and for ride-hailing electrification.
- More rural areas will require fast charging along highways to support long-distance travel for those passing through (see below).

CBSA	PEVs	DC Ports	DC Ports per 1,000 PEVs
Merced, CA	26,000	349	13.2
Redding, CA	24,000	236	9.7
Bakersfield, CA	83,000	639	7.7
El Paso, TX	50,000	365	7.3
Lafayette, LA	24,000	173	7.2
St. George, UT	27,000	191	7.1
Gainesville, FL	29,000	202	6.9
Duluth, MN	24,000	161	6.8
Green Bay, WI	27,000	177	6.6
Youngstown-Warren-Boardman, OH-PA	31,000	202	6.5
Top 200 CBSAs	**27,621,000**	**110,000**	**4.0**



Google Maps

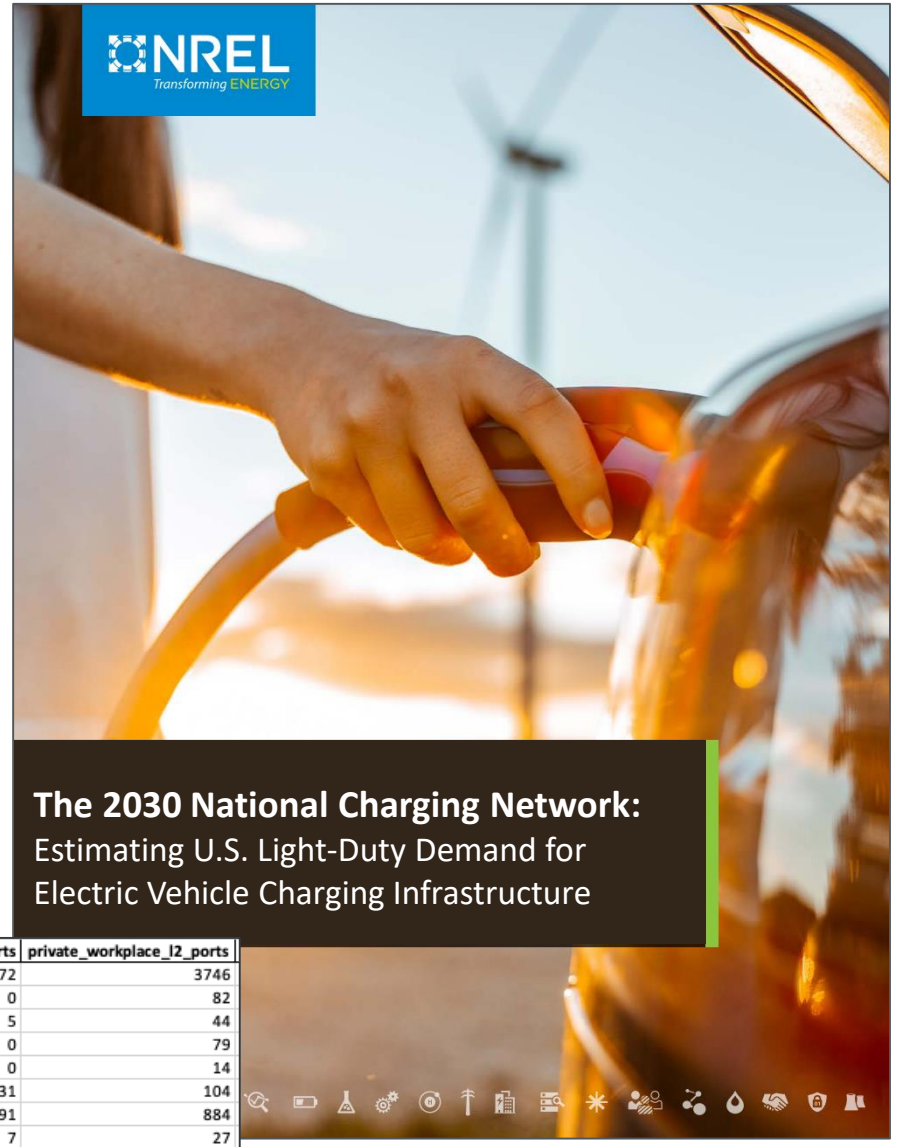
Higher share of charging demand from road-trippers passing through the region

Report Available Now!

https://www.nrel.gov/docs/fy23osti/85654.pdf

Also includes:

- Detailed results and discussion for baseline and 11 sensitivity scenarios.
- **Downloadable** data files containing detailed results (PEVs and port counts) at the state- or CBSA-level for all scenarios (2025 and 2030).



Example data file (2030 baseline – Alabama)

region_type	region_id	region_name	year	pevs	bevs	phevs	private_sfh_l2_ports	private_sfh_l1_ports	private_mud_l2_ports	private_workplace_l2_ports
State	1	Alabama	2030	312143	279339	32804	193417	72854	872	3746
Micropolitan Statistical Area	10700	Albertville, AL Micropolitan Statistical Area	2030	6232	5576	656	3858	1454	0	82
Micropolitan Statistical Area	10760	Alexander City, AL Micropolitan Statistical Area	2030	3390	3028	362	2120	800	5	44
Metropolitan Statistical Area	11500	Anniston-Oxford, AL Metropolitan Statistical Area	2030	6716	6000	716	4204	1586	0	79
Micropolitan Statistical Area	12120	Atmore, AL Micropolitan Statistical Area	2030	1591	1427	164	1011	380	0	14
Metropolitan Statistical Area	12220	Auburn-Opelika, AL Metropolitan Statistical Area	2030	10726	9588	1138	6692	2523	31	104
Metropolitan Statistical Area	13820	Birmingham-Hoover, AL Metropolitan Statistical Area	2030	70337	62978	7359	43589	16404	391	884
Metropolitan Statistical Area	17980	Columbus, GA-AL Metropolitan Statistical Area	2030	2892	2591	301	1779	669	7	27
Micropolitan Statistical Area	18980	Cullman, AL Micropolitan Statistical Area	2030	5618	5039	579	3523	1325	0	69
Metropolitan Statistical Area	19300	Daphne-Fairhope-Foley, AL Metropolitan Statistical Area	2030	20243	18065	2178	12258	4625	150	237
Metropolitan Statistical Area	19460	Decatur, AL Metropolitan Statistical Area	2030	9333	8334	999	5824	2200	16	110
Metropolitan Statistical Area	20020	Dothan, AL Metropolitan Statistical Area	2030	9394	8395	999	5848	2207	6	117
Micropolitan Statistical Area	21460	Enterprise, AL Micropolitan Statistical Area	2030	3698	3308	390	2309	870	0	44
Micropolitan Statistical Area	21640	Eufaula, AL-GA Micropolitan Statistical Area	2030	1165	1038	127	735	278	2	9
Metropolitan Statistical Area	22520	Florence-Muscle Shoals, AL Metropolitan Statistical Area	2030	8935	7992	943	5629	2122	3	97
Micropolitan Statistical Area	22840	Fort Payne, AL Micropolitan Statistical Area	2030	4405	3945	460	2799	1053	0	50

Thank You!

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Transforming ENERGY

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CEC AB 2127 Charging Infrastructure Assessment

Adam Davis, Air Pollution Specialist
Fuels and Transportation Division

Goals Used for AB 2127 Assessment

2025

1.5 MILLION
EV'S SOLD

INCLUDING 10,000 FAST CHARGERS

250,000
CHARGERS INSTALLED

200 OPEN
HYDROGEN STATIONS

2030

5 MILLION
EV'S SOLD

2035

100%
ELECTRIC SALES FOR NEW PASSENGER VEHICLES

100%
ELECTRIC OPERATIONS FOR DRAYAGE TRUCKS AND OFF-ROAD VEHICLES & EQUIPMENT

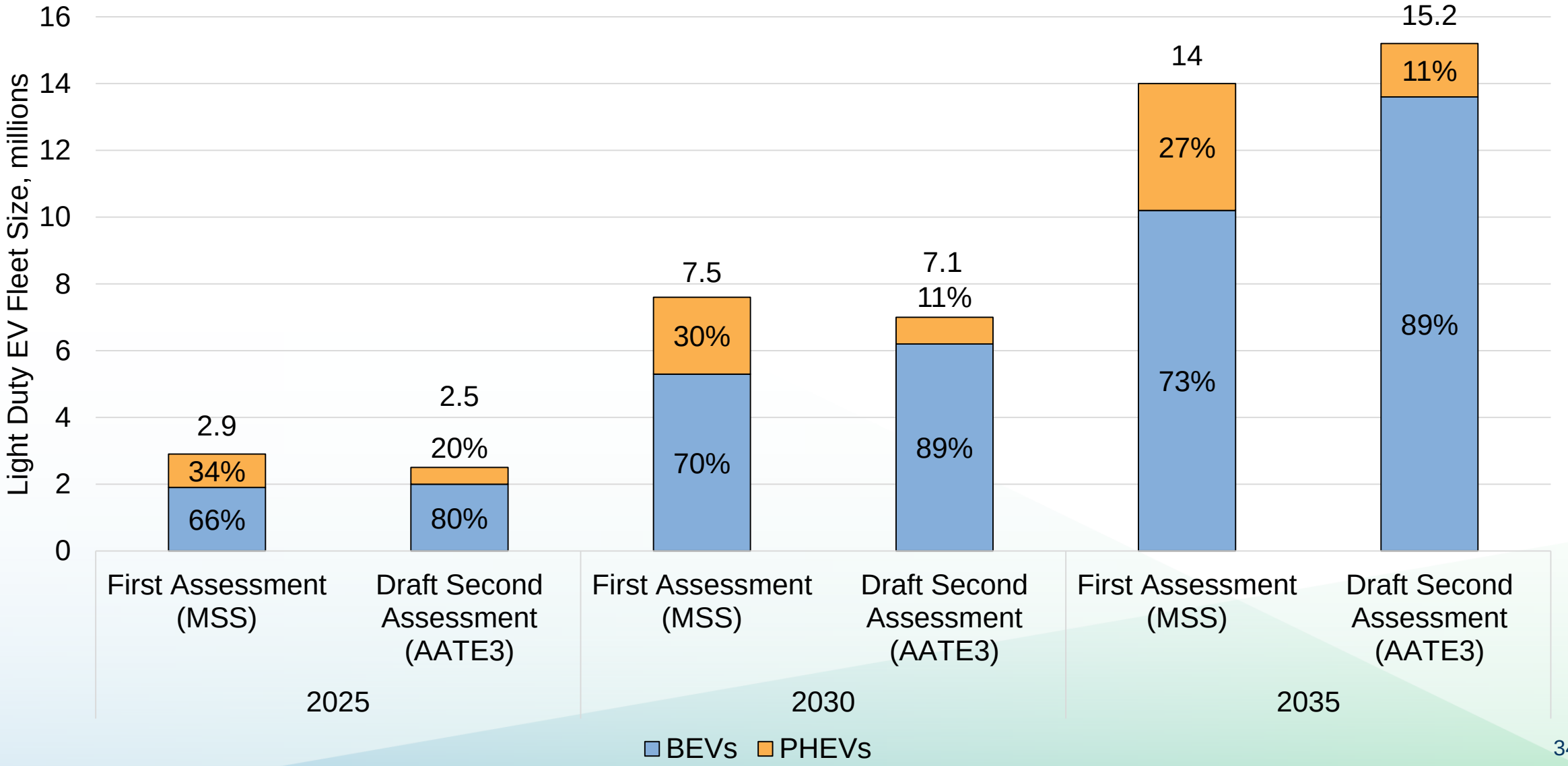
2045

100%
ELECTRIC OPERATIONS FOR MEDIUM- AND HEAVY-DUTY VEHICLES

Models

- EVI-Pro 3 (National Renewable Energy Lab) estimates charging needed by Battery Electric Vehicles (BEVs) and Plug-in Hybrid Electric Vehicles (PHEVs) for routine / intraregional travel:
  - Level 1 (L1) and Level 2 (L2) at single- and multi-family homes
  - L2 at public and work destinations
  - Direct Current Fast Charging (DCFC) at public destinations
- EVI-RoadTrip (National Renewable Energy Lab) estimates DCFC charging needed by BEVs for long distance travel (at least 100 miles)
- WIRED (UC Davis) estimates DCFC charging needed by BEVs operated by transportation network companies (Uber, Lyft)
- HEVI-Load (Lawrence Berkeley National Lab) estimates depot and en route charging needed by medium- and heavy-duty BEVs

Light-duty PEV adoption scenarios



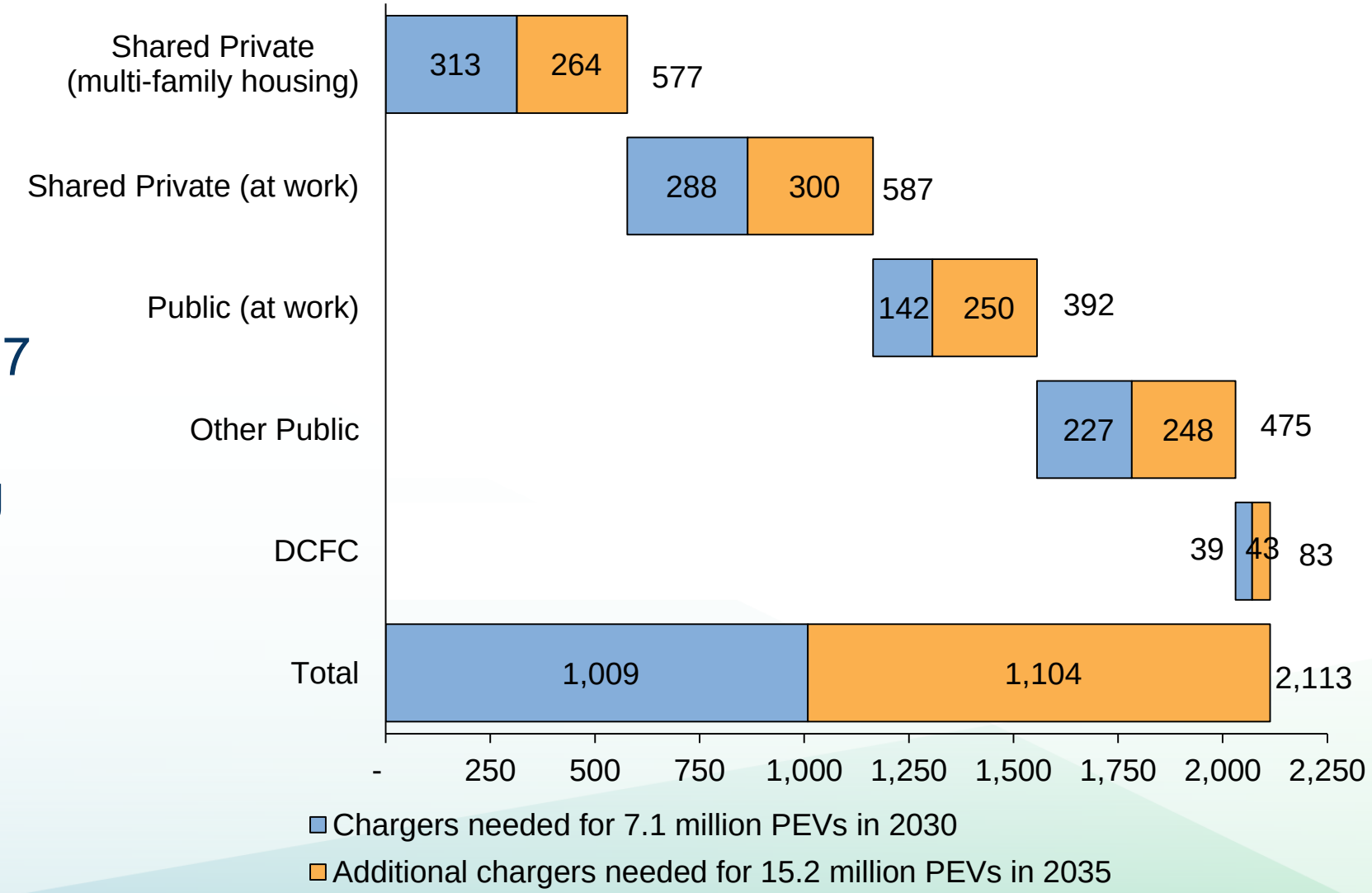
Draft light-duty vehicle charging needs

1.01 million chargers needed by 2030

2.11 million chargers needed by 2035

Compared to first AB 2127 report

- Less public L2 charging
- More DCFC



Draft fast charging needs

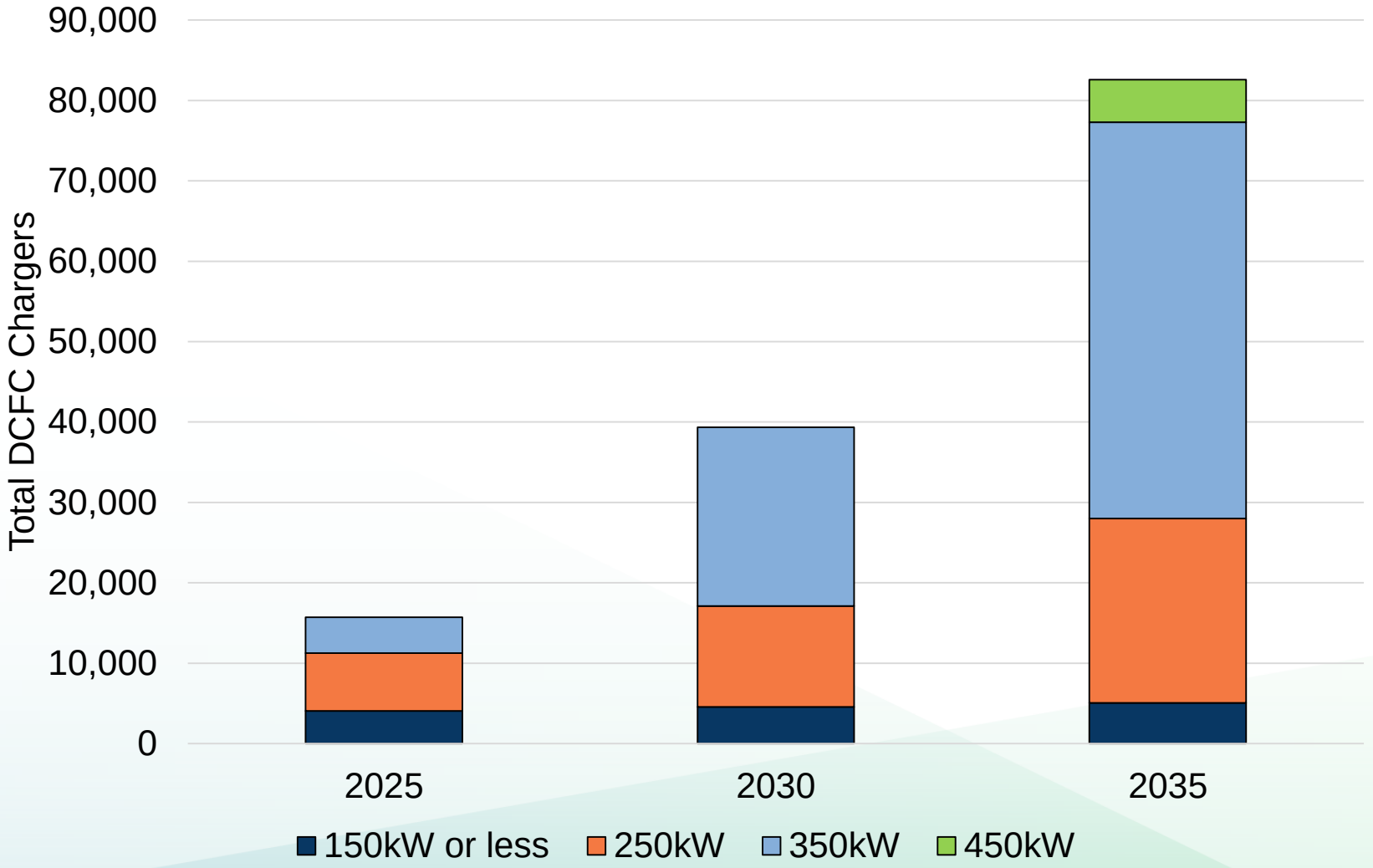
Fast charging needs combined from:

- Routine travel (EVI-Pro 3)
- Long-distance travel (EVI-RoadTrip)
- TNC vehicles (WIRED)

39,300 fast chargers in 2030

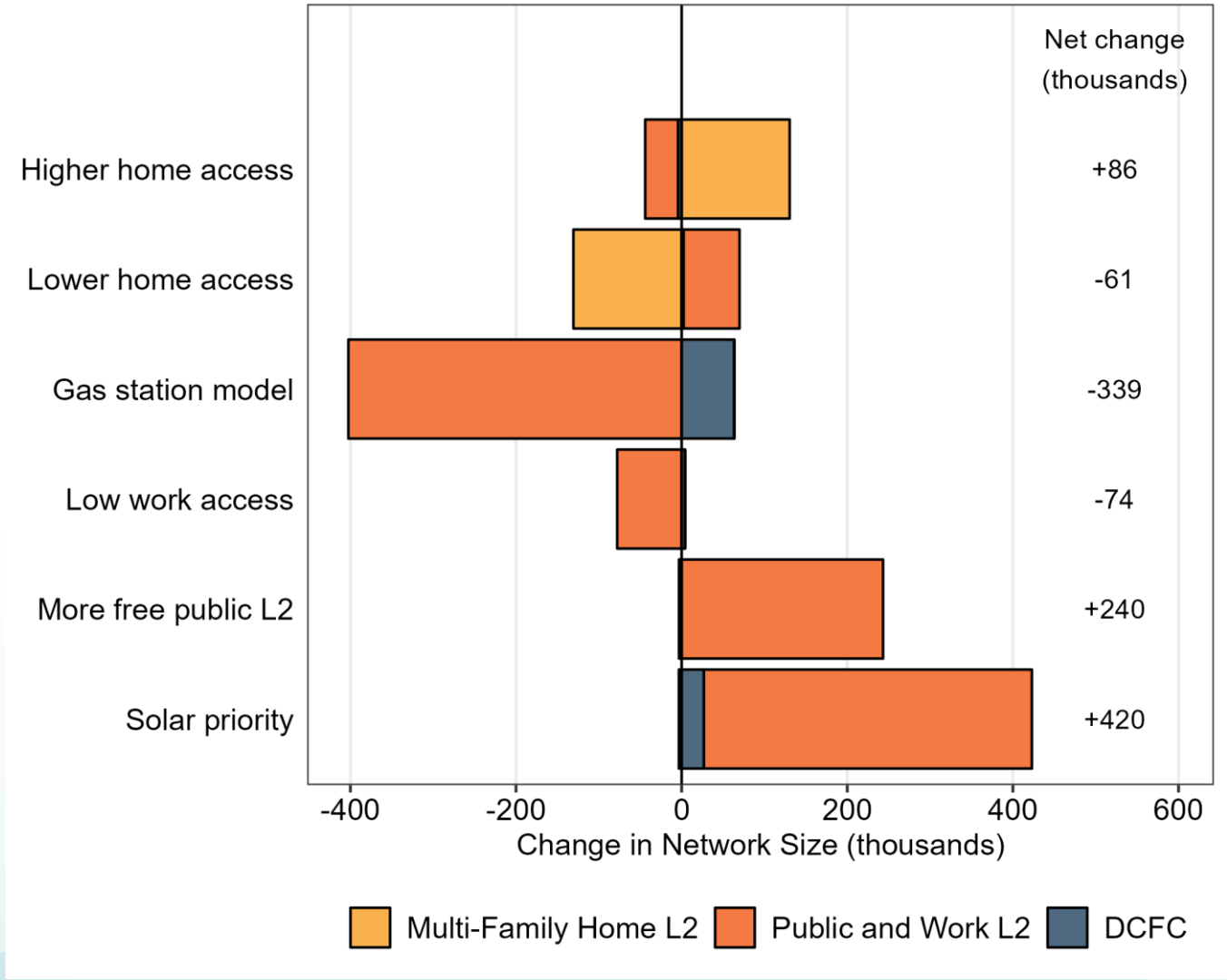
82,600 fast chargers in 2035

Demand shifts towards high speed DCFC as vehicle technology improves

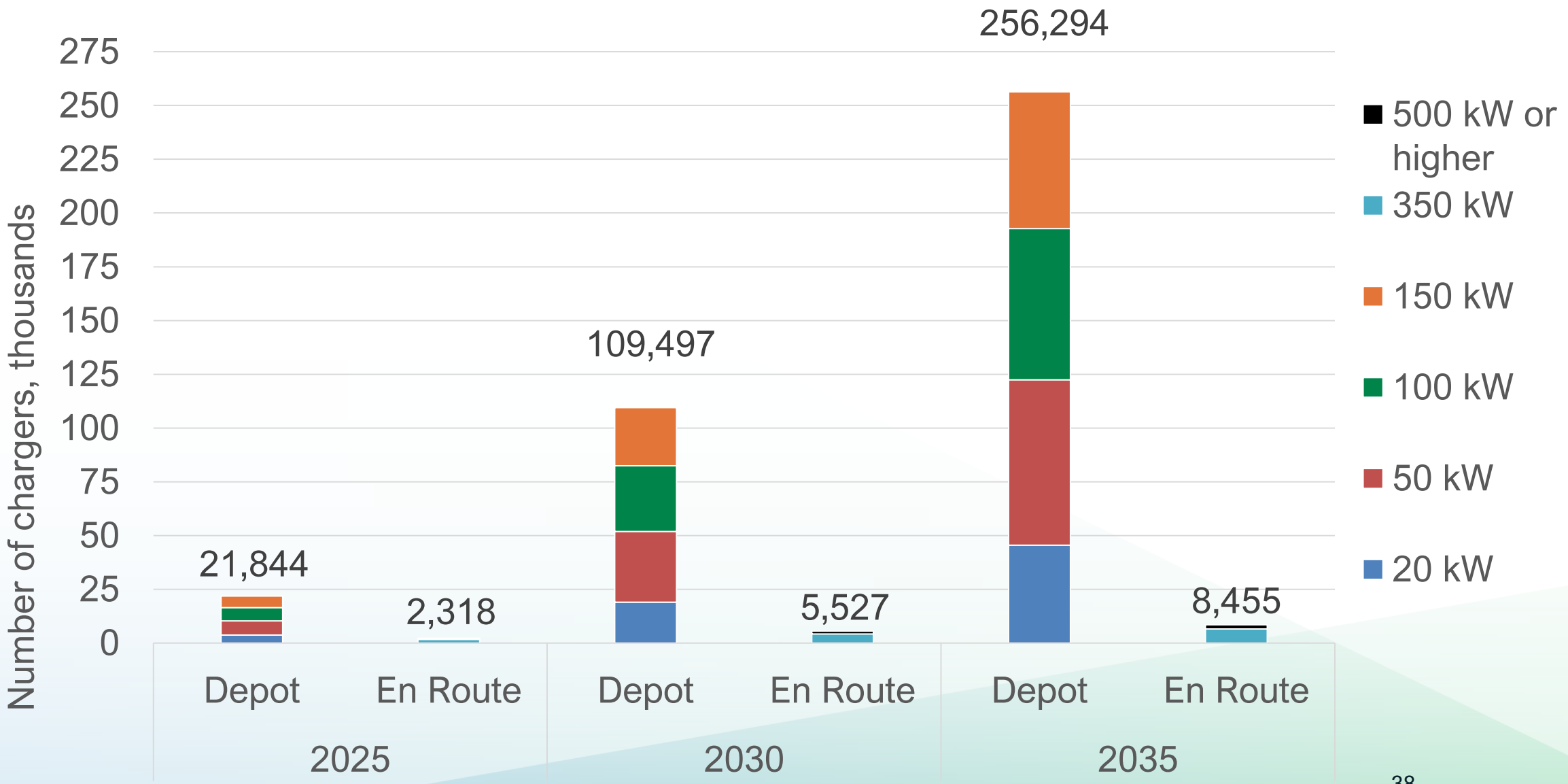


Draft alternative futures

- 2030 Alternative future scenarios explore changes to PEV charging priorities or policy
- Light duty charging needs could be met by a range of charging system designs



Draft medium-/heavy-duty charging needs



Zero-Emission Vehicle Infrastructure Plan (ZIP)

Level 1 and Level 2 Charging for Light-Duty PEVs

- Maximize home charging
- Continue to deploy charging infrastructure to support access, especially for priority populations
- Encourage private buildout of charging away from home and maximize benefits from public support

Fast Charging for Light-Duty PEVs

- Continue to deploy funding for charging infrastructure
- Understand and improve consumer benefits

Second ZIP under development; draft expected late summer 2024

Ava Community Energy

Using models and data to effectively deploy EV fast chargers

Ava's role in deploying EV chargers

Natural Partnership with Municipalities

- Municipalities (& County) are Joint Power Authority (Ava) members
  - Own publicly accessible parking lots & garages
- Ava brings budget capacity and flexibility, so projects come at no cost to the site owners
  - Can aggregate projects across multiple cities to achieve greater economies of scale
- Ava and property owners execute Master Site License Agreements

Innovative Financing Strategy

- As a not-for-profit public power agency, Ava can provide EV charging at a lower cost
  - Reinvests revenues from the sale of electricity into community benefit programs
  - Wholesale electricity prices
- Leveraging private equity by executing Master Services Agreements with EV charging developers
  - $/kW pricing structure across the portfolio of projects
- Can be replicated by other agencies

Using models and data to develop our deployment strategy

Quantitative Analysis

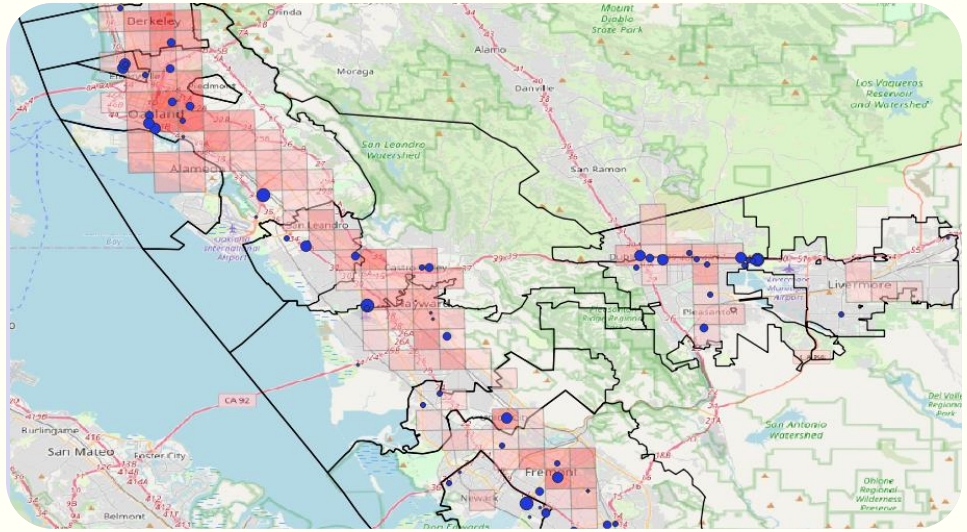
- DMV Registration Data
  - How many EVs are there and where?
- Alternative Fuel Data Center
  - How many fast chargers are there and where?
- EVI-Pro 2025 Model
  - How many EVs will there be?
  - How many fast chargers will be needed?
- County Assessor & CoStar Data
  - What does the housing population look like?

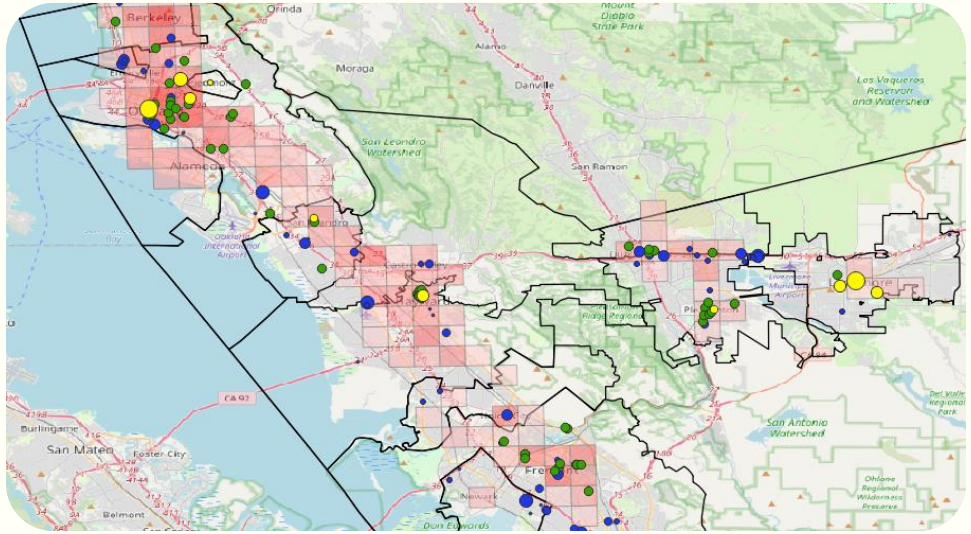
Qualitative Analysis

- Filling Gaps
  - What areas are underserved by fast charging?
- Serving Multi-family Housing Residents
  - Where is there a density of renters?
- Proximity to Amenities
  - What is conveniently accessible to drivers while their cars charge?

Results

- First Portfolio Projects (yellow dots)
  - 11 projects, >150 ports, 6 cities
- Target Sites for Future Portfolios (green dots)
  - Goal of 40-50 projects (400-500 ports) across service area
- Filling gaps in existing public fast charging network (blue dots)
- Making charging more accessible, reliable, and affordable for renters (red squares are “multi-family housing hot spots”)





Thank you!

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