DOCKETED	
Docket Number:	19-AB-2127
Project Title:	Implementation of AB 2127 Electric Vehicle Charging Infrastructure Assessments
TN #:	252159
Document Title:	Slides from AB 2127 Staff Draft Workshop
Description:	Presentation slides from the workshop on the Staff Draft Report of the second AB 2127 assessment
Filer:	Adam Davis
Organization:	California Energy Commission
Submitter Role:	Commission Staff
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Docketed Date:	9/7/2023

AB 2127 Second Assessment Draft Staff Report Workshop

California Energy Commission, Fuels and Transportation Division

September 7, 2023

Housekeeping

- Workshop is being recorded
- Workshop Event Webpage:

  https://www.energy.ca.gov/event/workshop/2023-09/assembly-bill-ab-2127-assessment-workshop-staff-draft-report

- Written Comments to Docket # 19-AB-2127:
  https://efiling.energy.ca.gov/Ecomment/Ecomment.aspx?docketnumber=19-AB-2127

Deadline for Written Comments: Wednesday, September 20, 2023

Commitment to diversity

The CEC adopted a resolution strengthening its commitment to diversity in our funding programs. The CEC continues to encourage disadvantaged and underrepresented businesses and communities to engage in and benefit from our many programs.

To meet this comment, CEC staff conducts outreach efforts and activities to:

- Engage with disadvantaged and underrepresented groups throughout the state;
- Notify potential new applicants about the CEC's funding opportunities;
- Assist applicants in understanding how to apply for funding from the CEC's programs;
- Survey participants to measure progress in diversity outreach efforts

Diversity survey

Scan the code on a phone or tablet with a QR reader to access the survey.

One Minute Survey

The information supplied will be used for public reporting purposes to display anonymous overall attendance demographics

Zoom Participants, please use the link in the chat to access the survey or scan the QR code on the left of the screen with a phone or tablet to access the survey

Survey will be closed at the end of the day

Survey Link:

https://forms.office.com/Pages/ResponsePage.aspx?id=RBI6rPQT9k6NG7qicUgZTqEU3EeANX9DvlX_on7oPclUNlRYOFVYTVJIQzlIUTFQSjgyVkhaOVRXQS4u

Agenda

1. Opening remarks by Commissioner Monahan
2. Introduction to the draft staff report for the second AB 2127 Assessment
3. Charging infrastructure draft modeling results
   - Light-duty vehicles
   - Medium- and heavy-duty vehicles
4. Q&A and Public Comment
5. Related aspects of charging infrastructure deployment
   - Mapping grid capacity and potential demand
   - Vehicle Grid Integration
   - Labor and Workforce
6. Q&A and Public Comment

Opening Remarks

Commissioner Patricia Monahan

Introduction to the draft staff report for the AB 2127 assessment

Adam Davis, Air Pollution Specialist

AB 2127 Assessment goals

Electric vehicle charging infrastructure needed to support:

- Assembly Bill 2127
  - By 2030, at least 5 million zero-emission vehicles (ZEVs)
  - By 2030, reduce greenhouse gas emissions to 40% below 1990 levels
- Executive Order N-79-20
  - By 2035, 100 percent ZEV sales for new passenger vehicles and 100% ZEV operations for drayage trucks and off-road vehicles and equipment
  - By 2045, 100 percent ZEV operations for medium- and heavy-duty vehicles, where feasible

Draft results

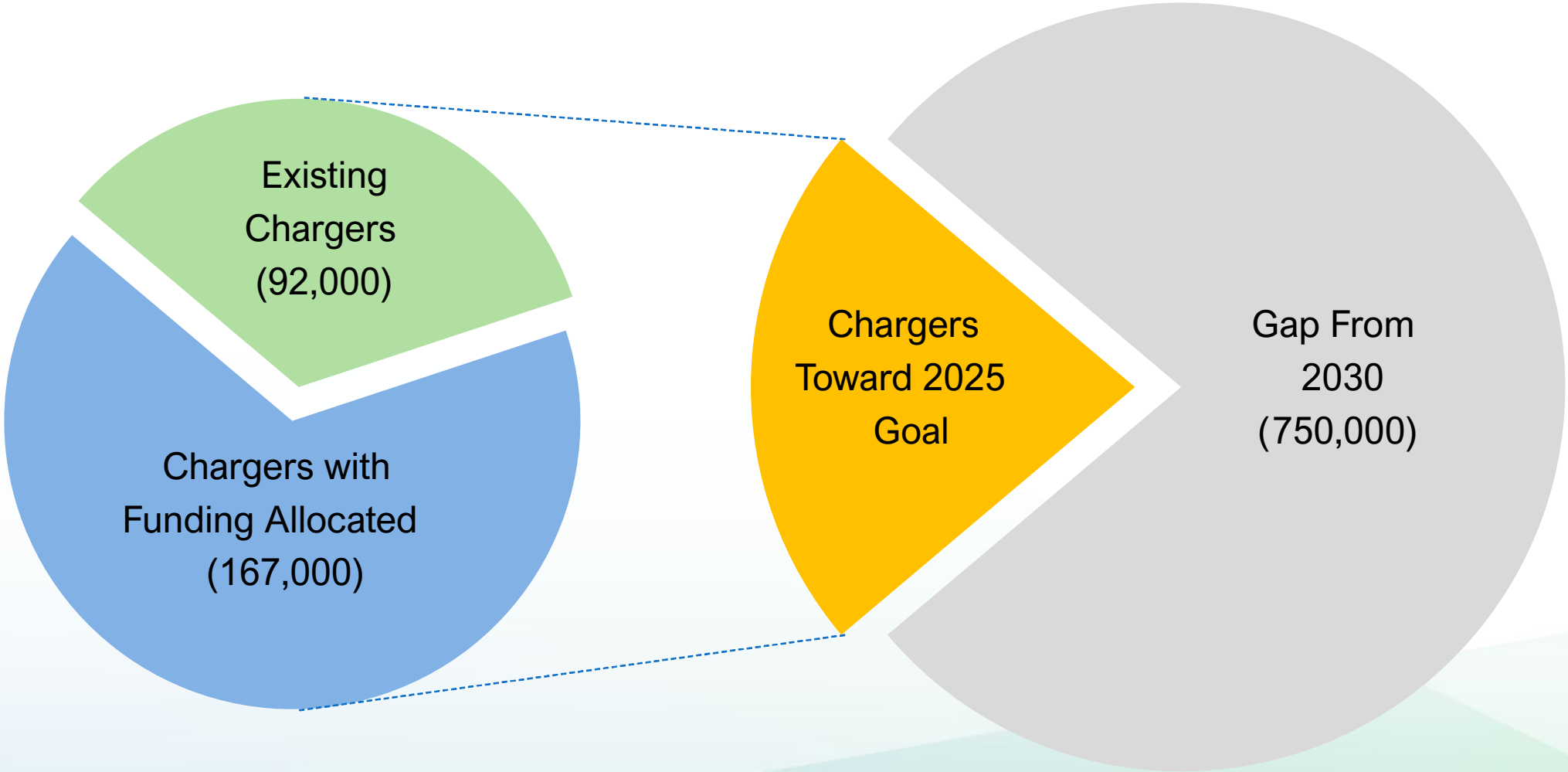
In 2030:

- 7.1 million light-duty electric vehicles (EVs) will need 1.01 million chargers (including 39,000 direct current fast chargers).
- 155,000 medium- and heavy-duty EVs will need 109,000 depot chargers and 5,500 public chargers.

In 2035:

- 15.2 million light-duty EVs will need 2.11 million chargers (including 83,000 direct current fast chargers).
- 377,000 medium- and heavy-duty EVs will need 256,000 depot chargers and 8,500 public chargers.

Progress towards infrastructure goals



Charging infrastructure for light-duty vehicles

Models

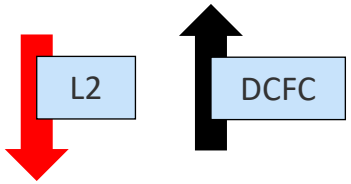
- EVI-Pro 3 (National Renewable Energy Lab) estimates charging needed by Battery Electric Vehicles (BEVs) and Plug-in Hybrid Electric Vehicles (PHEVs) for routine / intraregional travel:
  - Level 1 (L1) and Level 2 (L2) at single- and multi-family homes
  - L2 at public and work destinations
  - Direct 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)

Draft changes from first AB 2127 Assessment

Relative effect of modeling changes on demand for a non-residential charging type

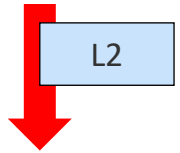
Changes in fleet composition

- Market trend towards long-range BEVs
- Advanced Clean Cars II regulation allows fewer PHEVs, requires longer PHEV range



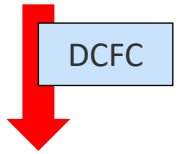
Changes in fleet size

- Fewer total PEVs in 2030 under Additional Achievable Transportation Electrification 3 (AATE3) scenario than under Mobile Source Strategy (MSS)
- More BEVs than under MSS



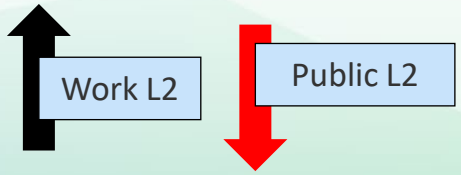
Changes in charger / vehicle technology

- Higher-speed DCFC chargers + cars able to use them

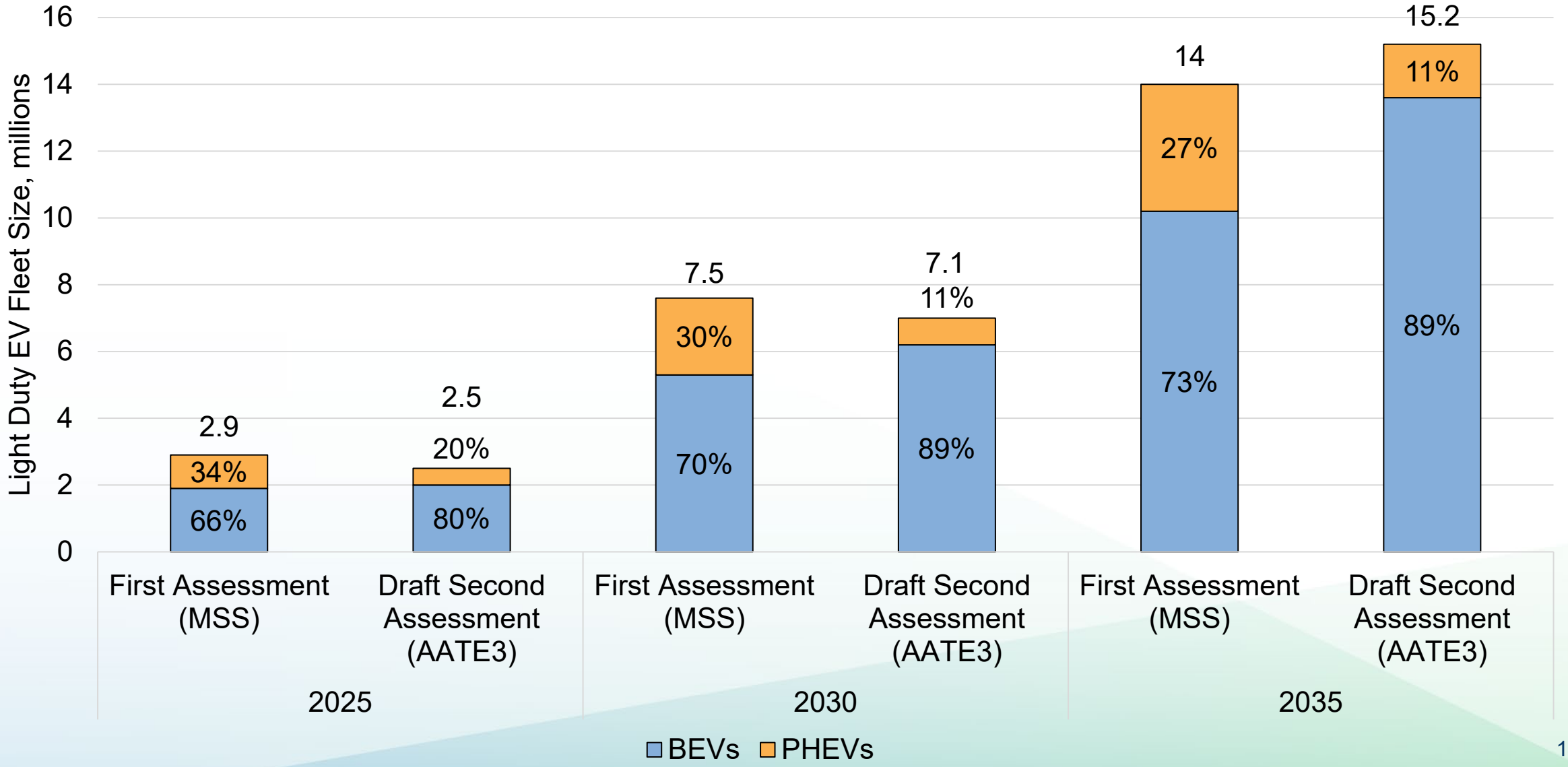


Modeling changes

- Models improved to better reflect observed charging behavior
- Assembly Bill (AB) 2127 Assessment Workshop on September 19, 2022



Light-duty PEV adoption scenarios



Assumptions

- EV ownership patterns match current ownership patterns of all vehicles by 2030
- As more households own EVs, residential charging access will decline
- Drivers prioritize low-cost and convenient charging when available, use high speed charging when necessary
  - Home L1 / L2
  - Work L2
  - Public L2
  - DCFC

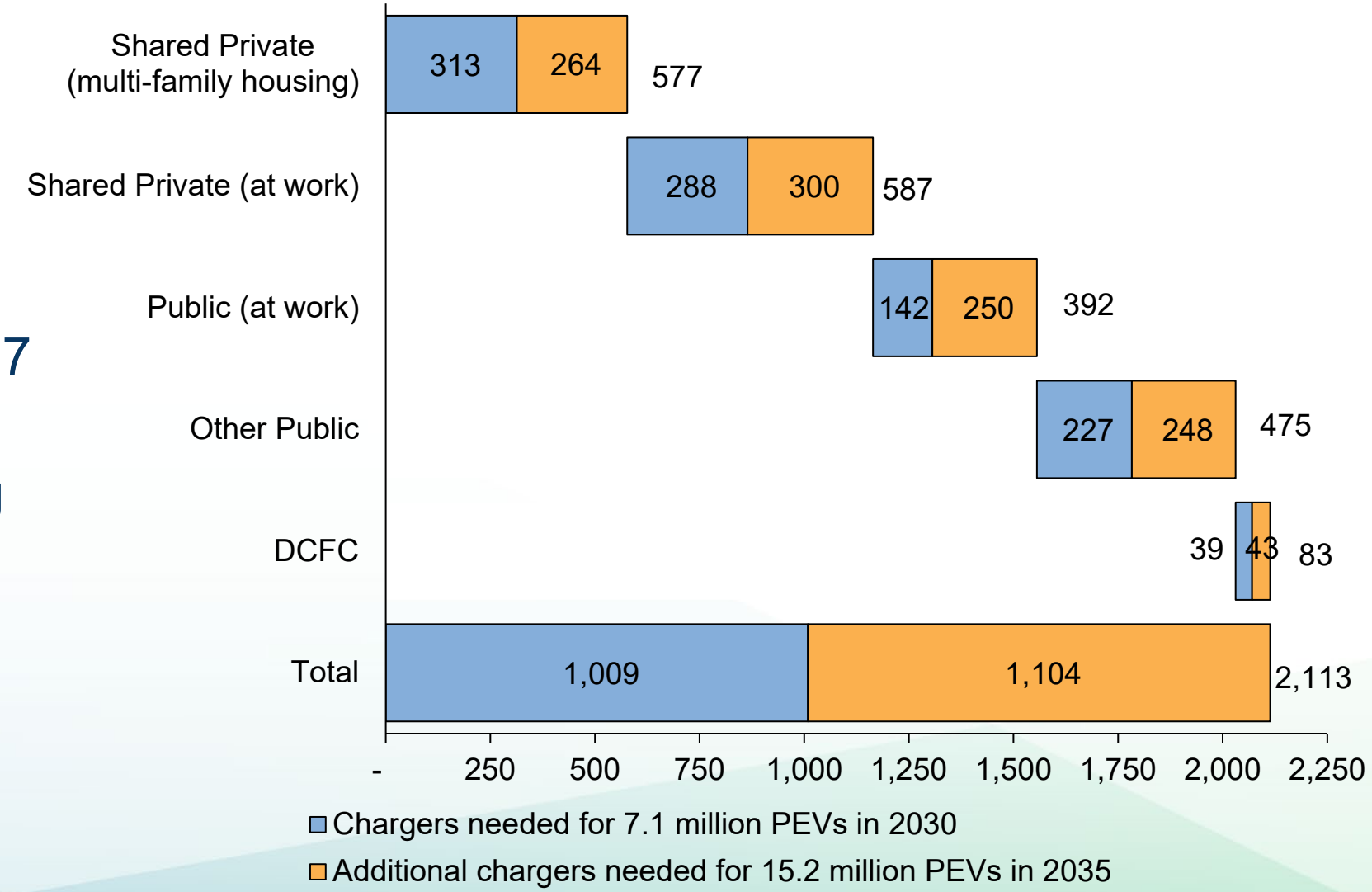
Draft light-duty vehicle charging needs

1.01 million chargers needed by 2030

2.11 million chargers needed by 2035

Compared to first AB 2127 report

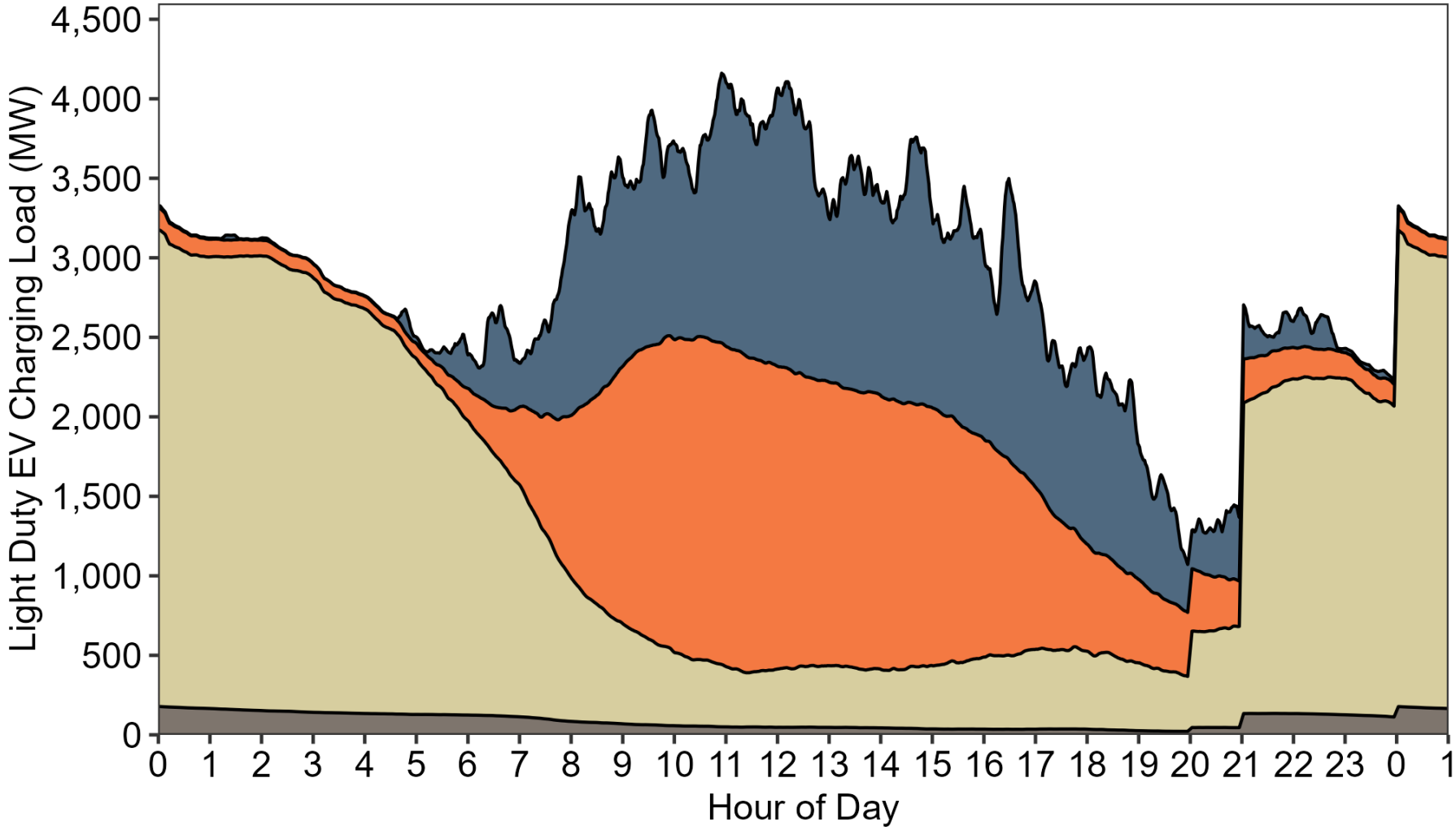
- Less public L2 charging
- More DCFC



Draft light-duty vehicle charging load

Weekday charging load for 7.1 million PEVs in 2030

Alternative future scenarios explore shifting load between locations / times



Draft fast charging needs

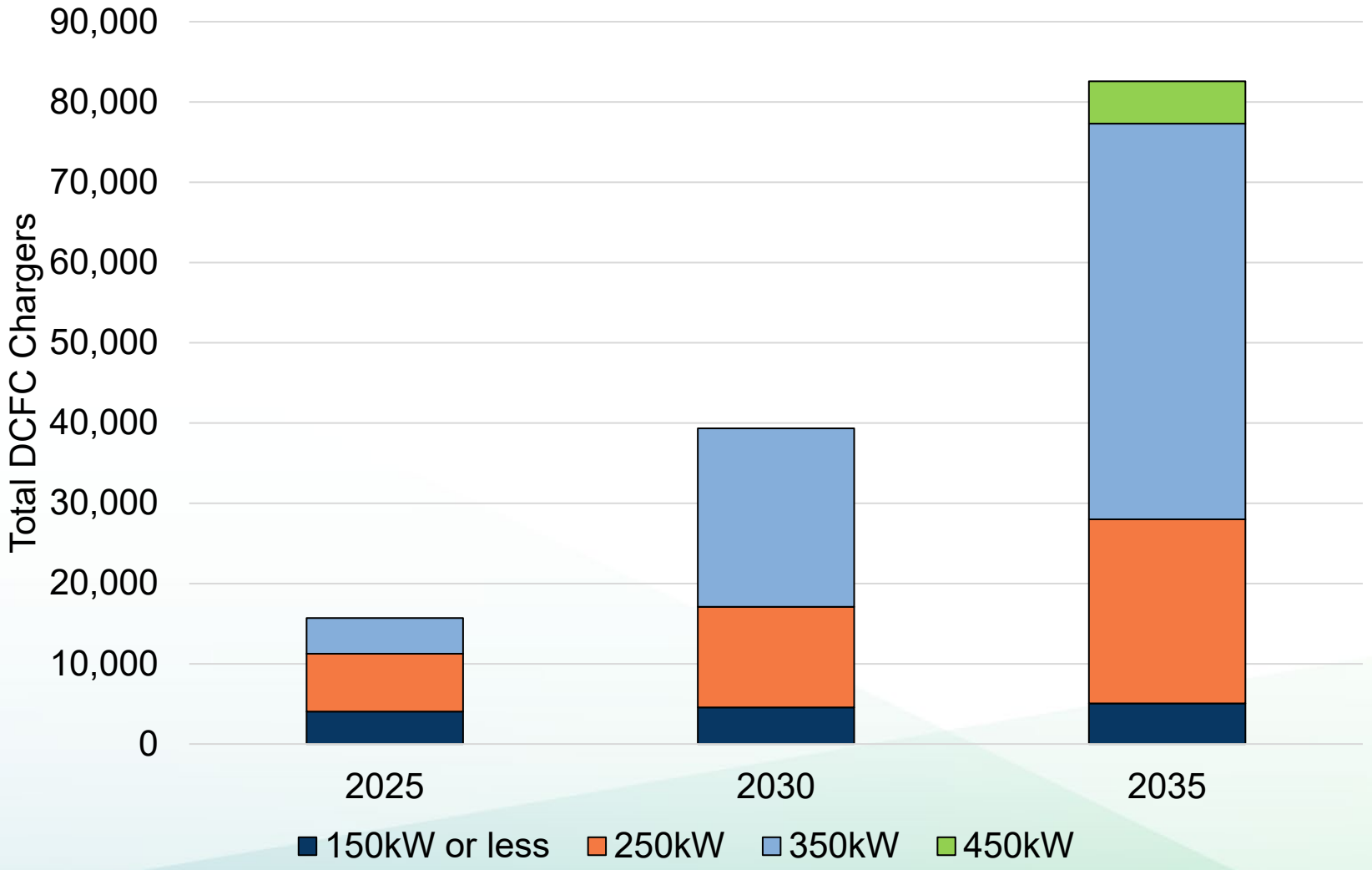
Fast charging needs combined from:

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

39,300 fast chargers in 2030

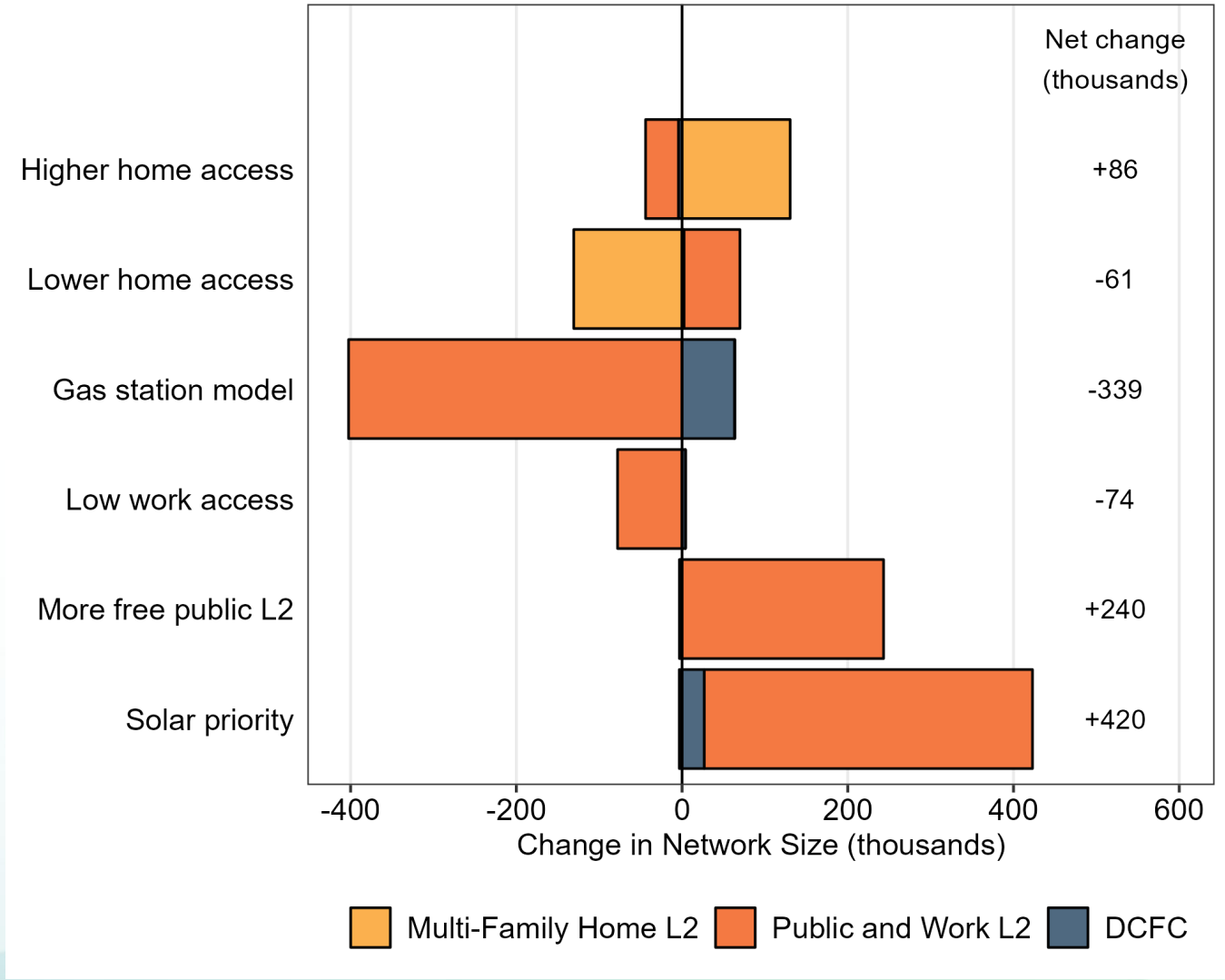
82,600 fast chargers in 2035

Demand shifts towards high speed DCFC as vehicle technology improves



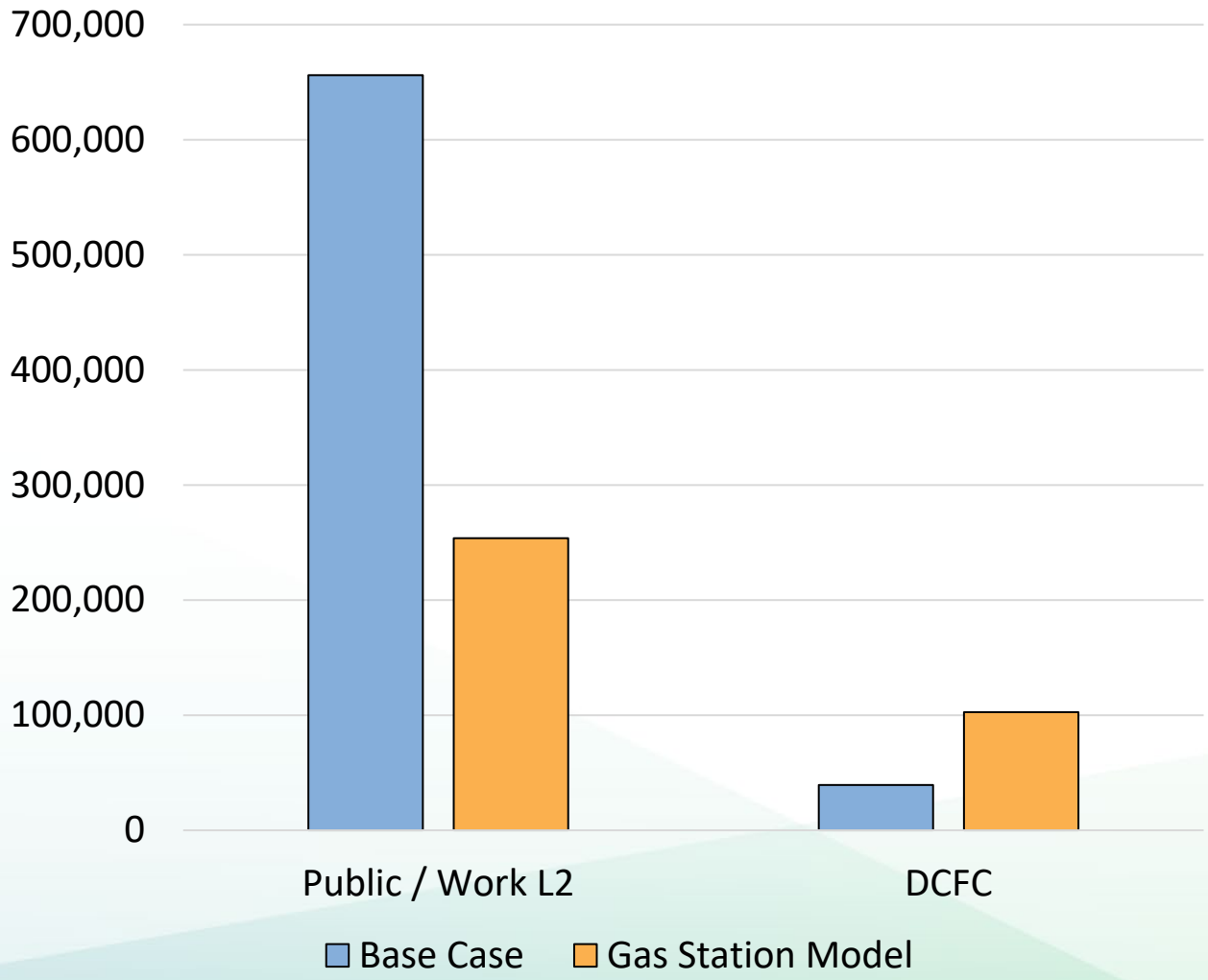
Draft alternative futures

- 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



Gas station model

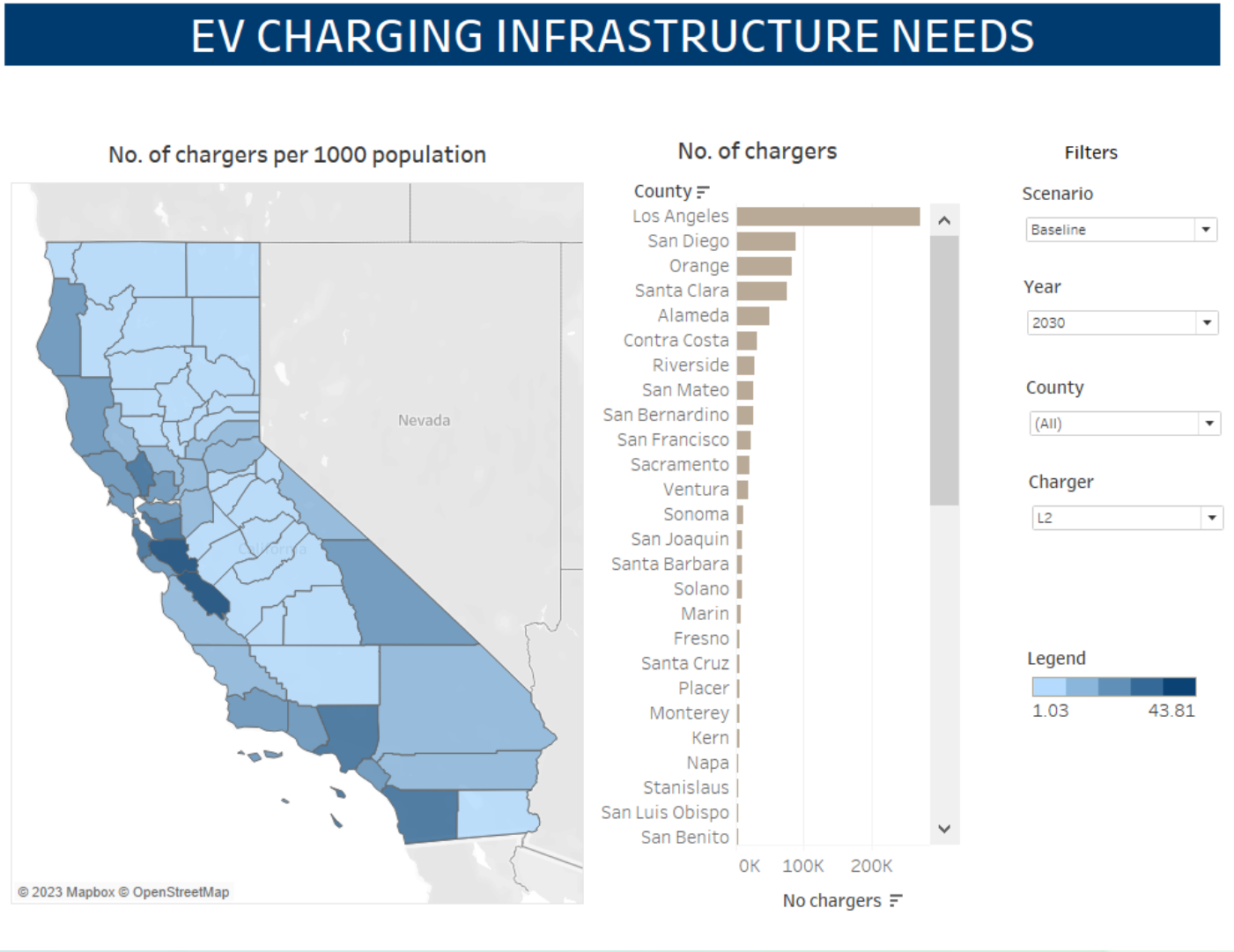
- Expanded DCFC installation could substitute for public and work L2 and some home charging
- Charging done at DCFC
  - Base case: 23%
  - Gas station model: 65%



Interactive charger visualization

Users can filter the dashboard based on:

- Scenario (Baseline, Alternative future scenarios)
- Year
- County
- Charger



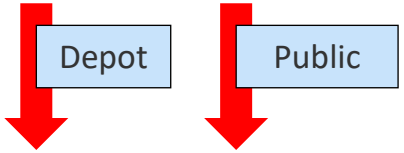
Charging infrastructure for medium- and heavy-duty vehicles

Draft changes from first AB 2127 Assessment

Relative effect of modeling changes on the number of chargers needed

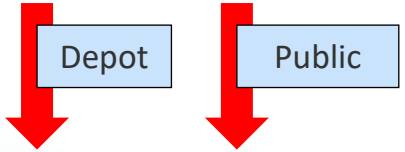
Change in fleet size and composition

- Fewer total EVs
- Larger proportion of smaller and lower-mileage vehicles
- Higher energy efficiency for MDHD EVs



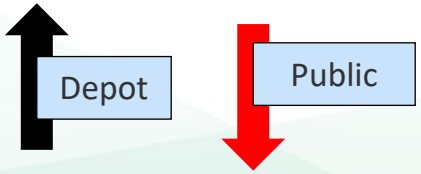
Changes in charger / vehicle technology

- Higher-speed chargers at all location types



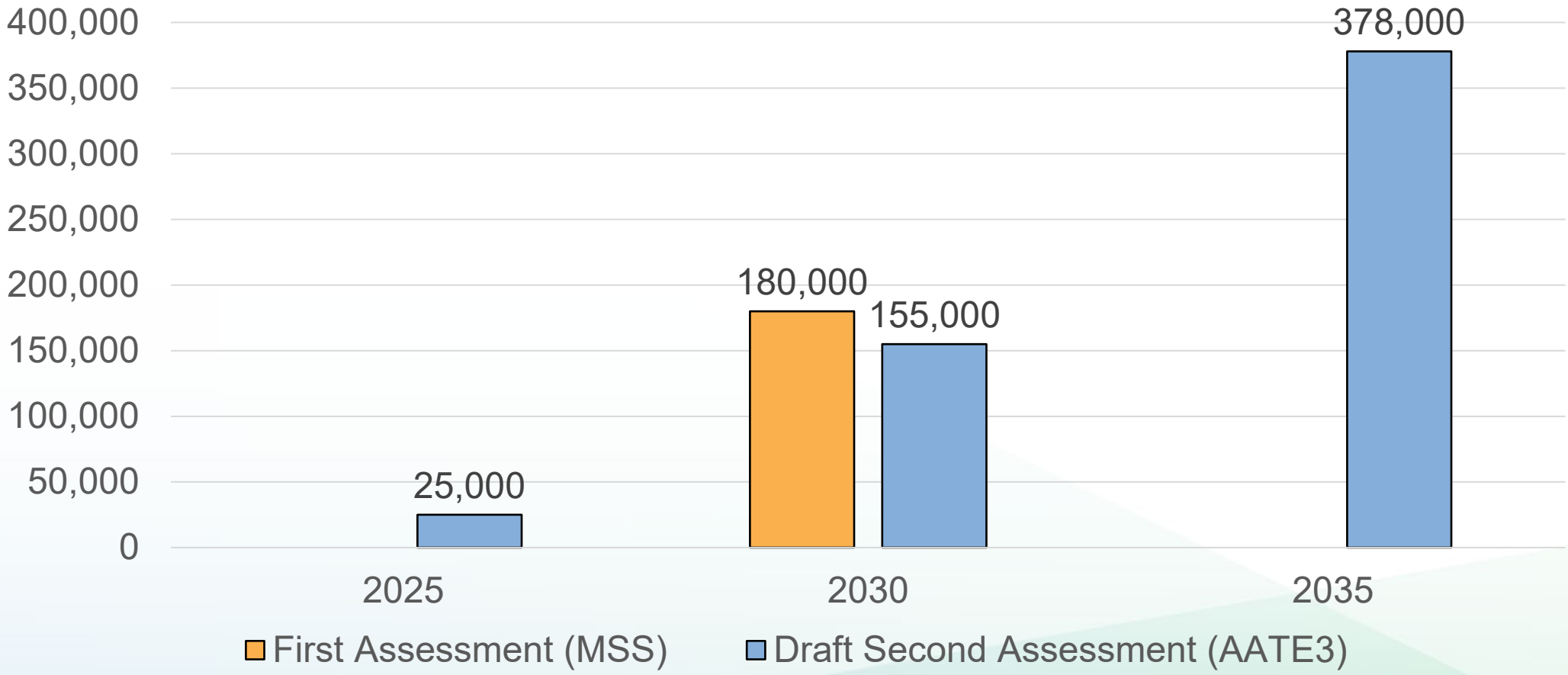
Modeling changes

- Definition of depot charging expanded
- Travel patterns differentiated by vehicle type
- “Bottom-up approach” starts with travel patterns



- Workshop on Medium- and Heavy-duty and Ride-hailing Electric Vehicle Infrastructure Analysis on November 9, 2022

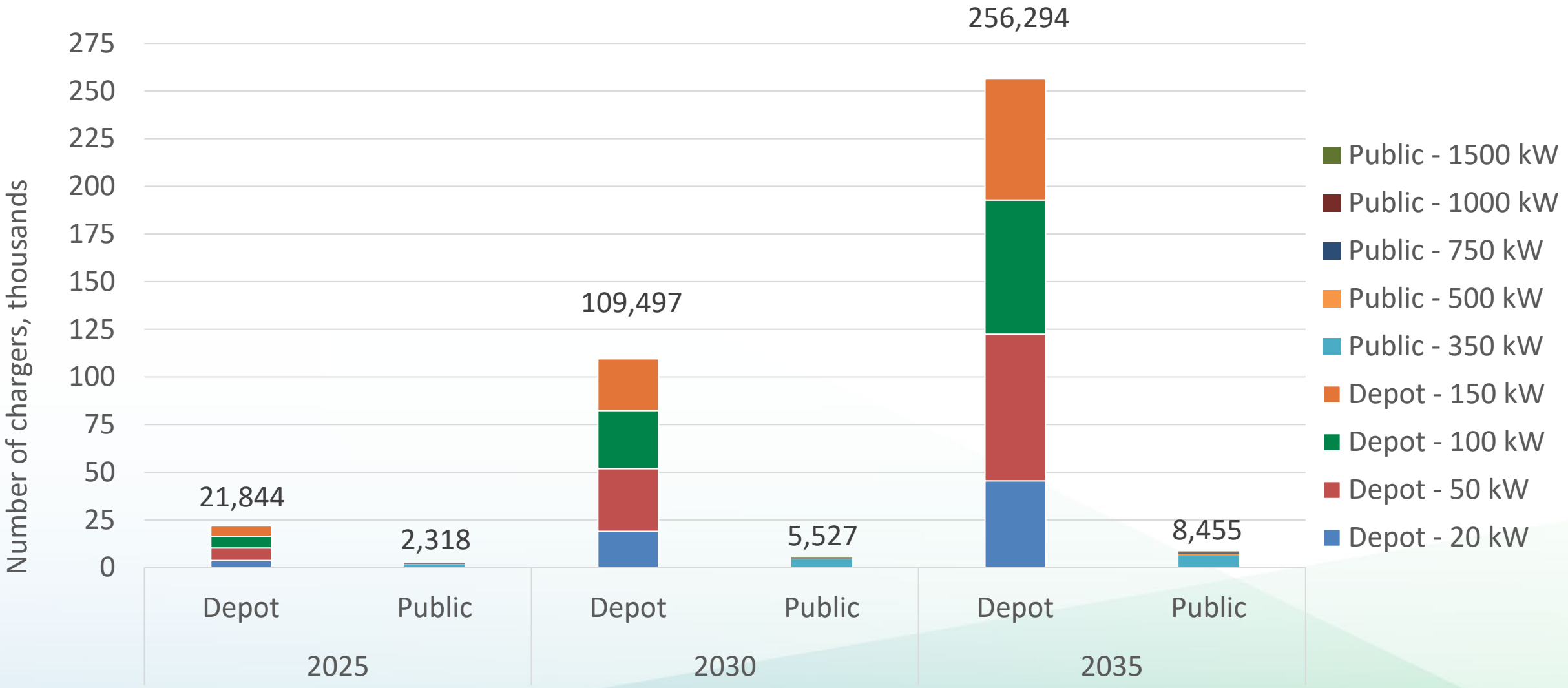
Medium-/heavy-duty EV adoption scenario



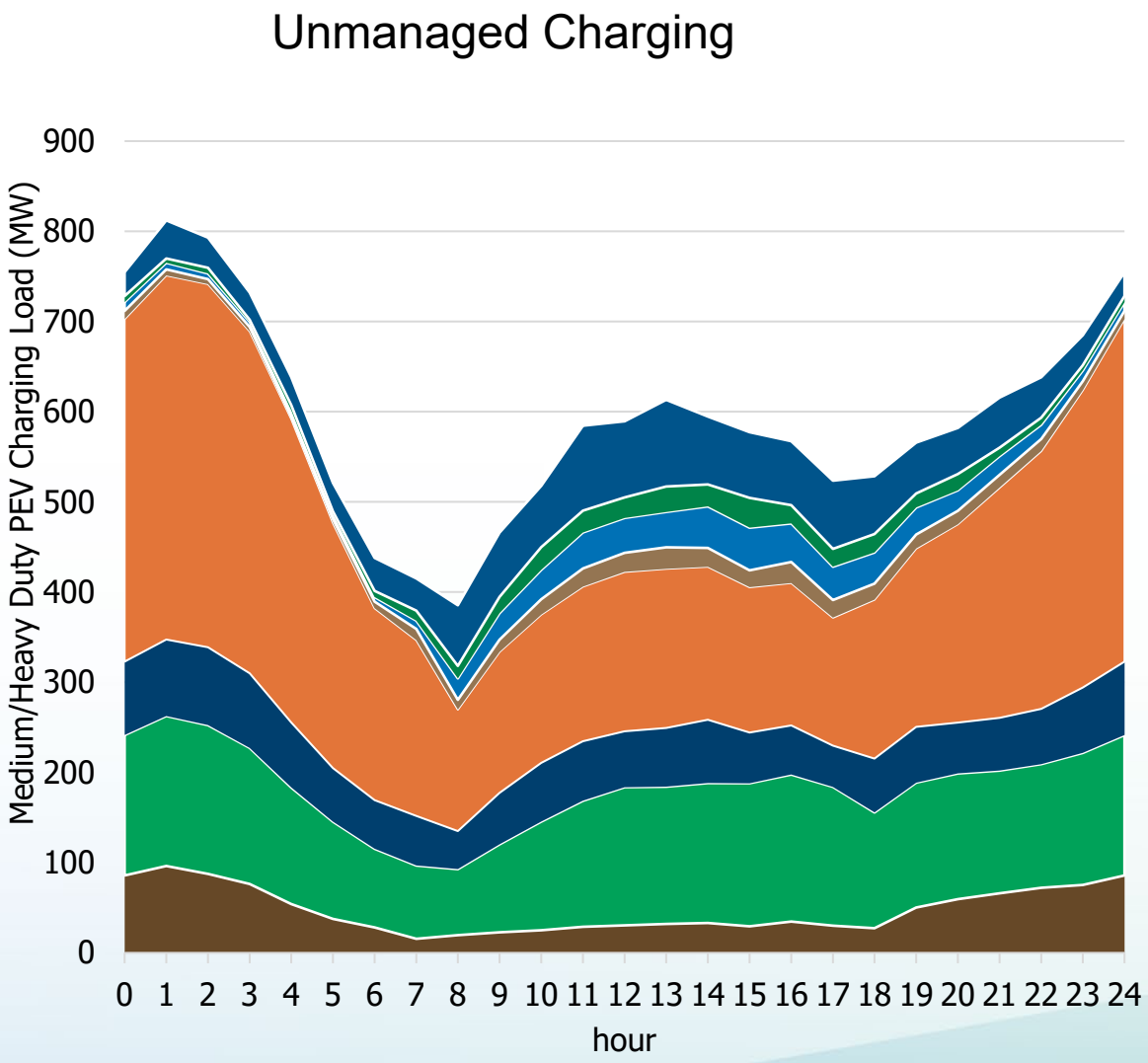
Draft assumptions

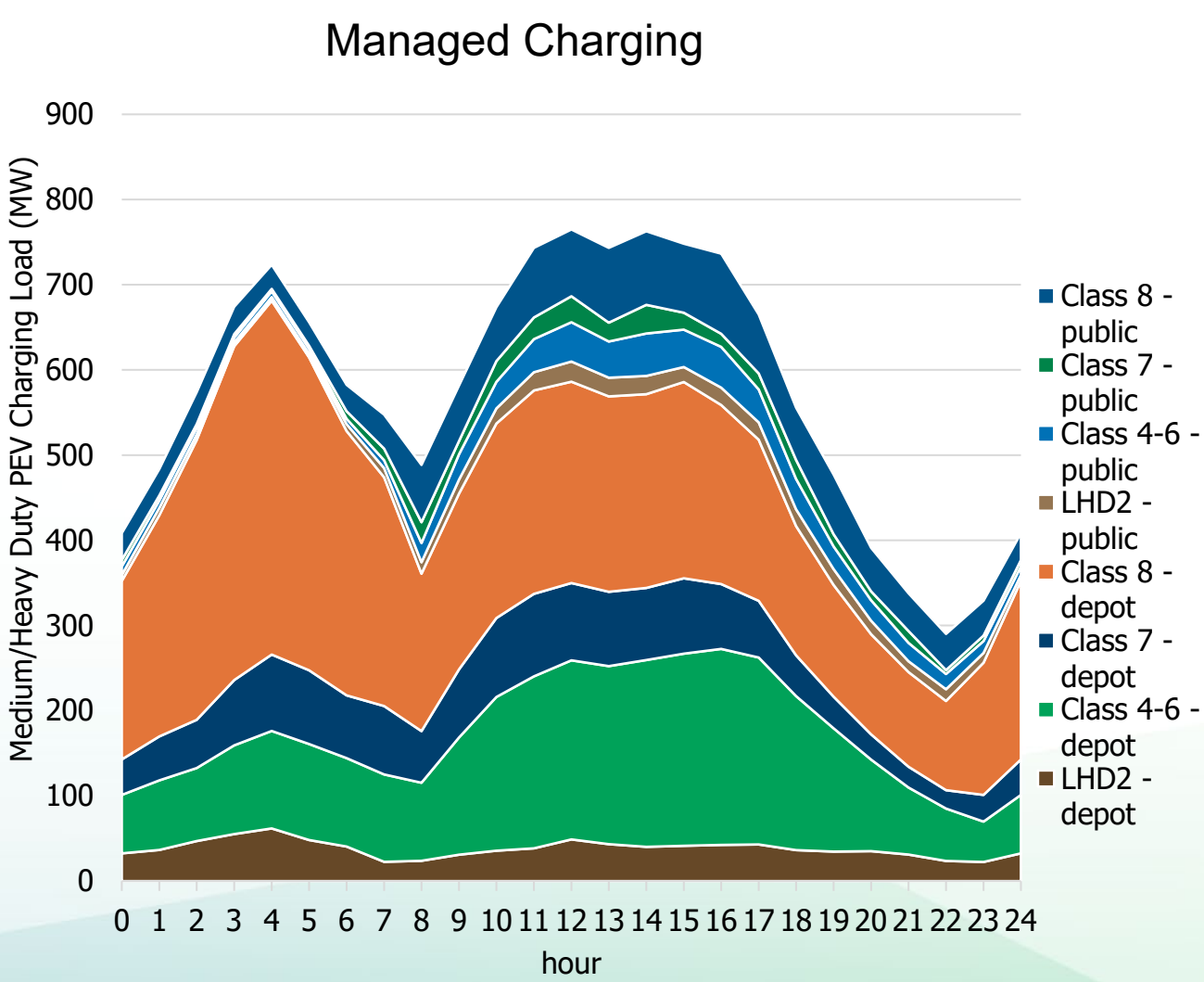
- All vehicles assumed to have depot charging access.
- Vehicles will charge at depot locations when possible and use public charging only when needed.
- Batteries are scaled so that vehicles in most classes need to charge at a depot every 1-3 days and use public charging rarely.
- Vehicles in heavier classes that drive long distances each day may rely more on public charging.
- Battery capacity changes 2023-2035
  - stays the same for 50% of the vehicles
  - increases at 2.5% per year for 30% of the vehicles
  - increases at 5% per year for 20% of the vehicles

Draft medium-/heavy-duty charging needs



Draft MDHD vehicle charging load





Q&A and Public Comment

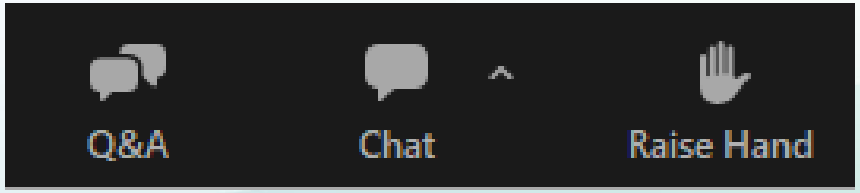
Public discussion

Zoom Participants:

- Use the "raise hand" feature to make verbal comments
- Use the Q&A feature to type in your question

Telephone Participants:

- Dial *9 to raise your hand
- Dial *6 to mute/unmute your phone line.



Discussion topics

- Light duty vehicle DCFC power and preference
  - Gas station model
- MDHD charging behavior / preference for depot vs public
- MDHD power levels at depot and public chargers

Written comments

Electronic commenting system

Visit the comment page for this docket at:
https://efiling.energy.ca.gov/Ecomment/Ecomment.aspx?docketnumber=19-AB-2127

Comment by e-mail

Email: docket@energy.ca.gov

Subject Line: "Second AB 2127 Assessment"

All comments due by 5:00pm on Wednesday September 20, 2023

Break

EDGE / Local grid constraints

Micah Wofford, Energy Commission Specialist

What is EDGE?

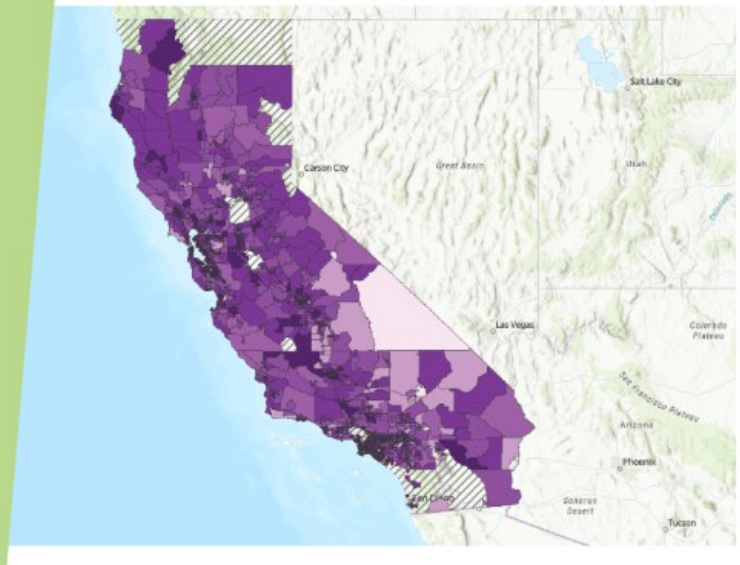
- Ability to assess charger deployment feasibility in context of local grid constraints
- Highlight areas where EV load will likely grow
- Deferral of expected load to more suitable locations (“low hanging fruit” opportunities)
- Facilitate proactive planning conversations – address long lead times for distribution system upgrades

EVSE Deployment and Grid Evaluation (EDGE) Tool

EDGE helps users identify regions of the grid that could suitably host EV chargers or may need capacity upgrades. It is recommended to view the EDGE tool on a desktop computer for best experience.

Download data

ACCESS THE TOOL >



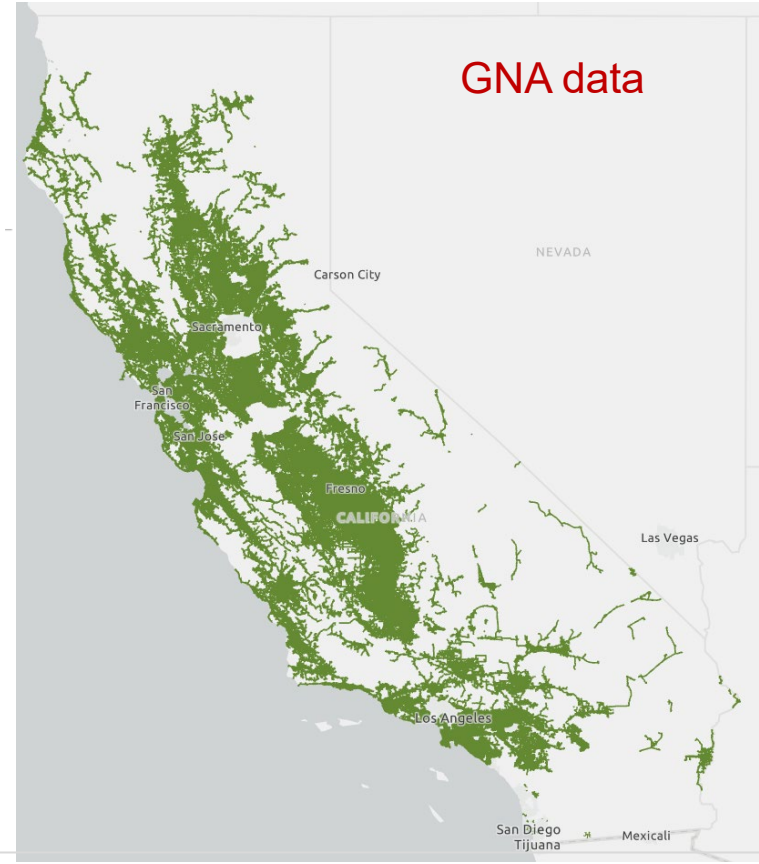
Data Inputs

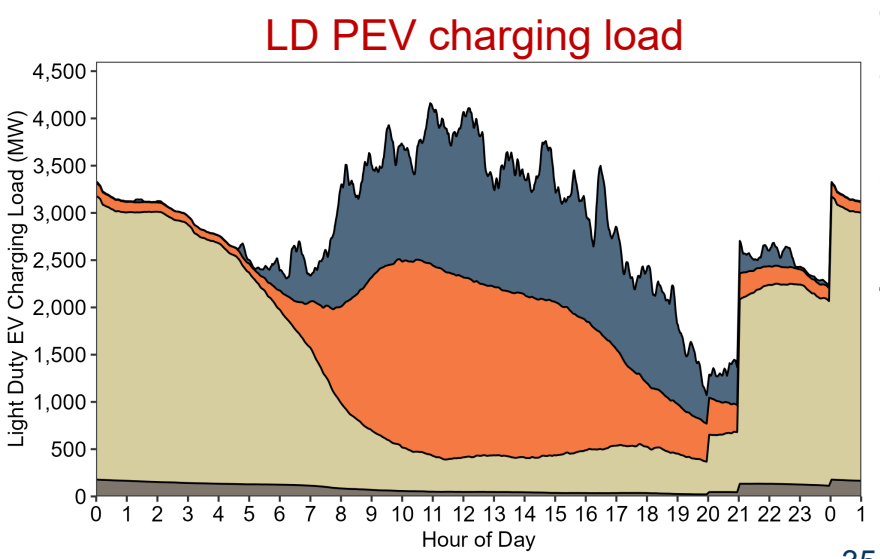
Distribution grid data

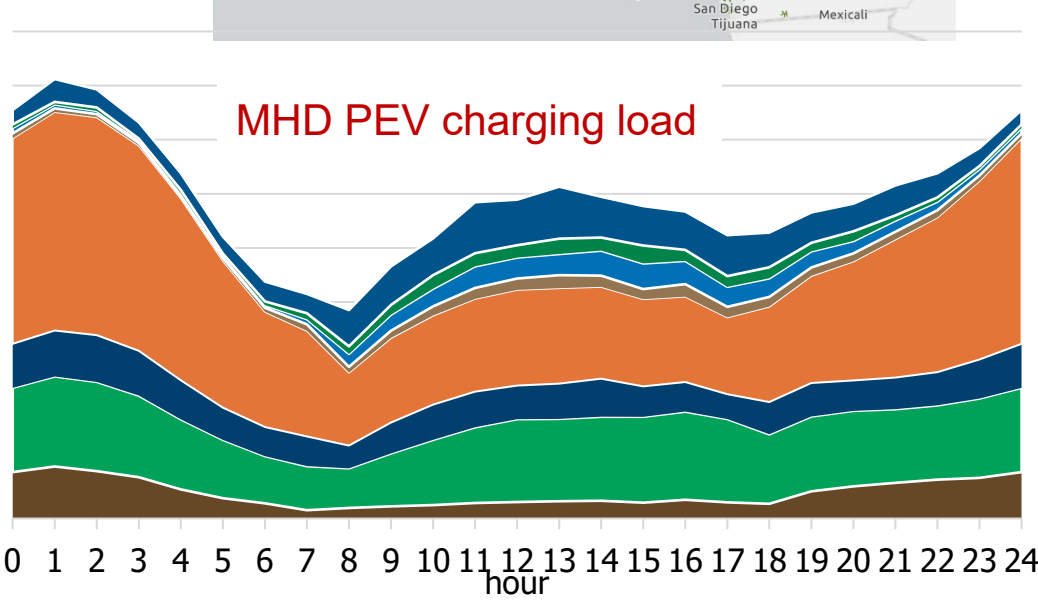
- Grid Needs Assessment (**GNA**) datasets – primary circuit and substation capacity

Electric vehicle charging infrastructure projection results

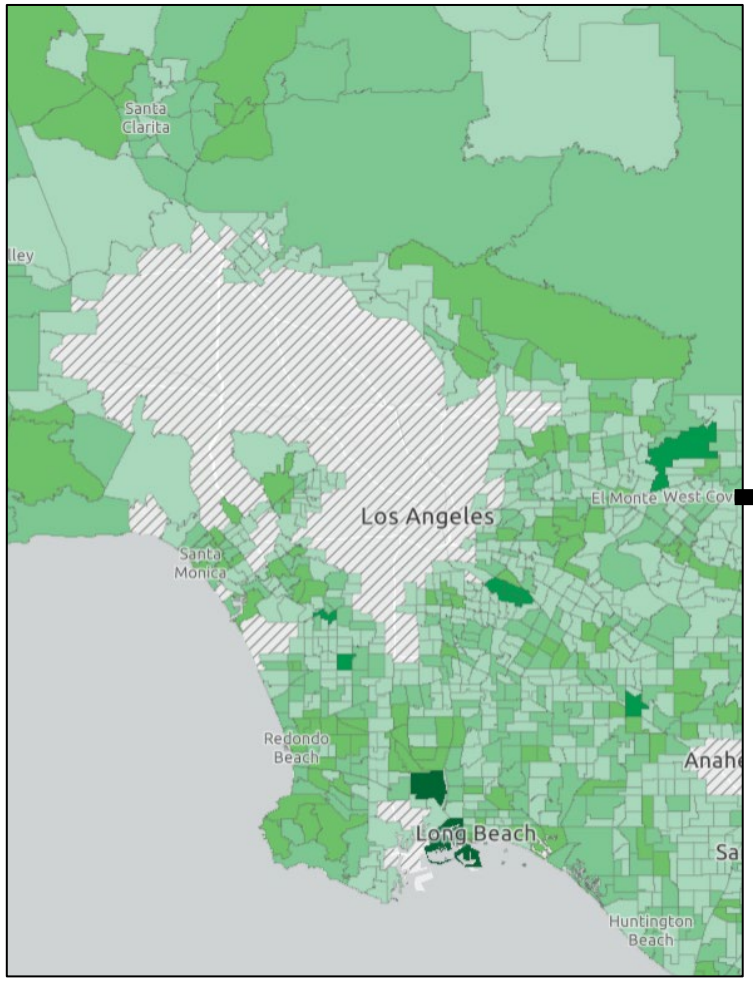
- Electric Vehicle Infrastructure Projections (EVI-Pro) – LD PEV load
- Medium- and Heavy-duty Electric Vehicle Infrastructure Load, Operations, and Deployment (HEVI-LOAD) – MHD PEV load



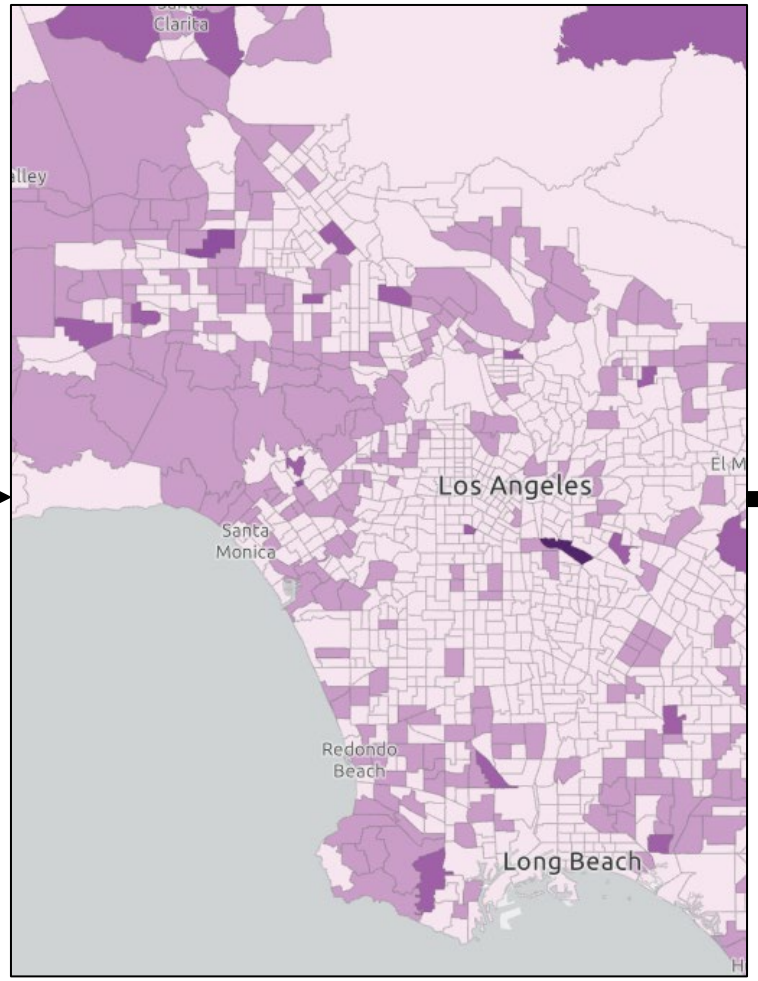




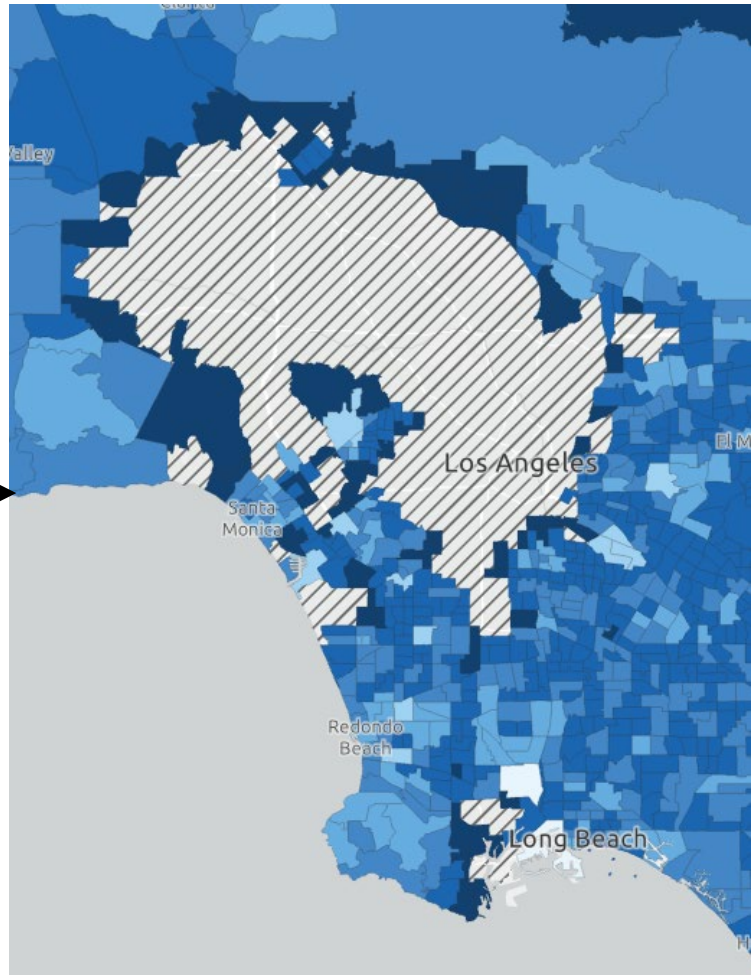
Draft Capacity Indication



Aggregated Circuit Capacity



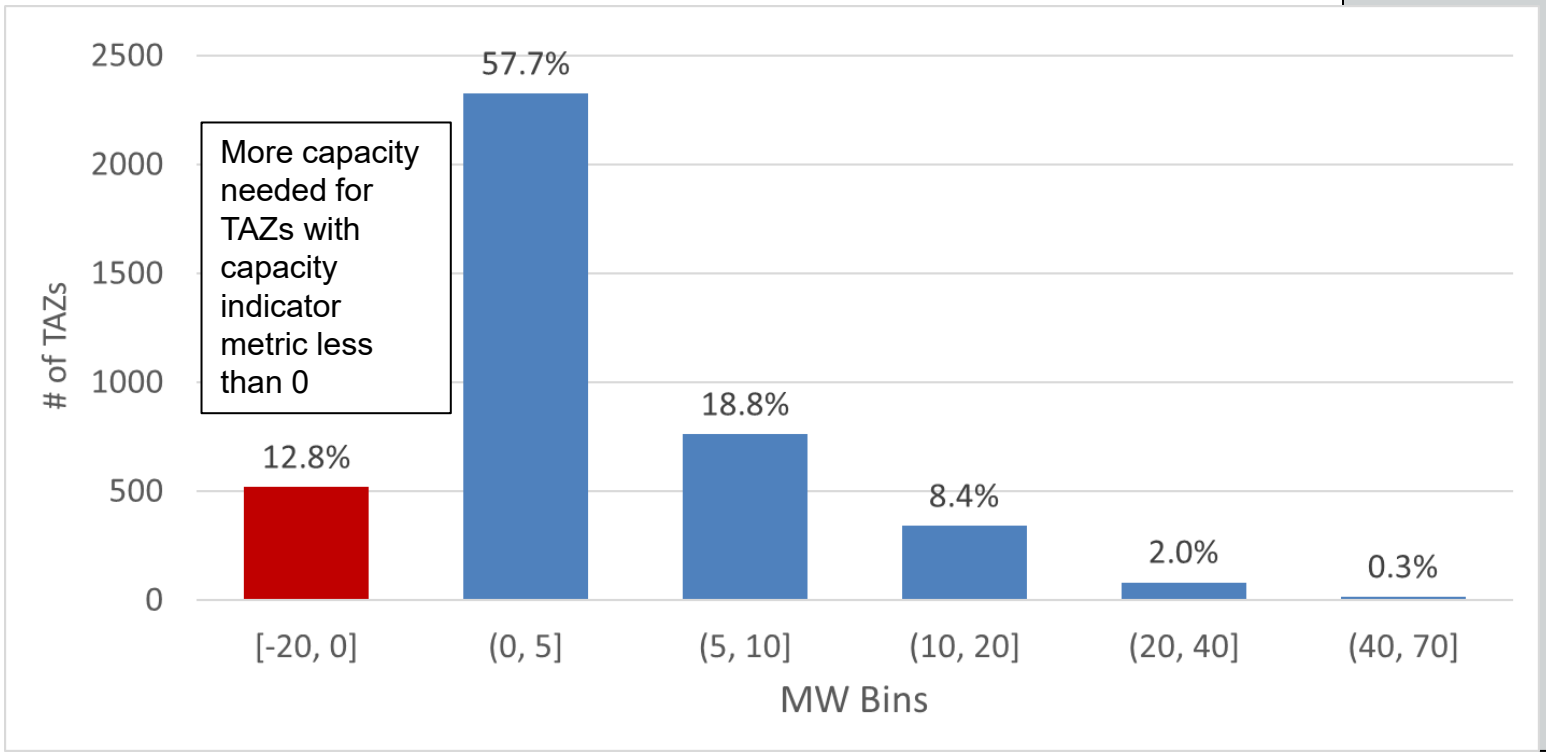
Peak EV Charging Load

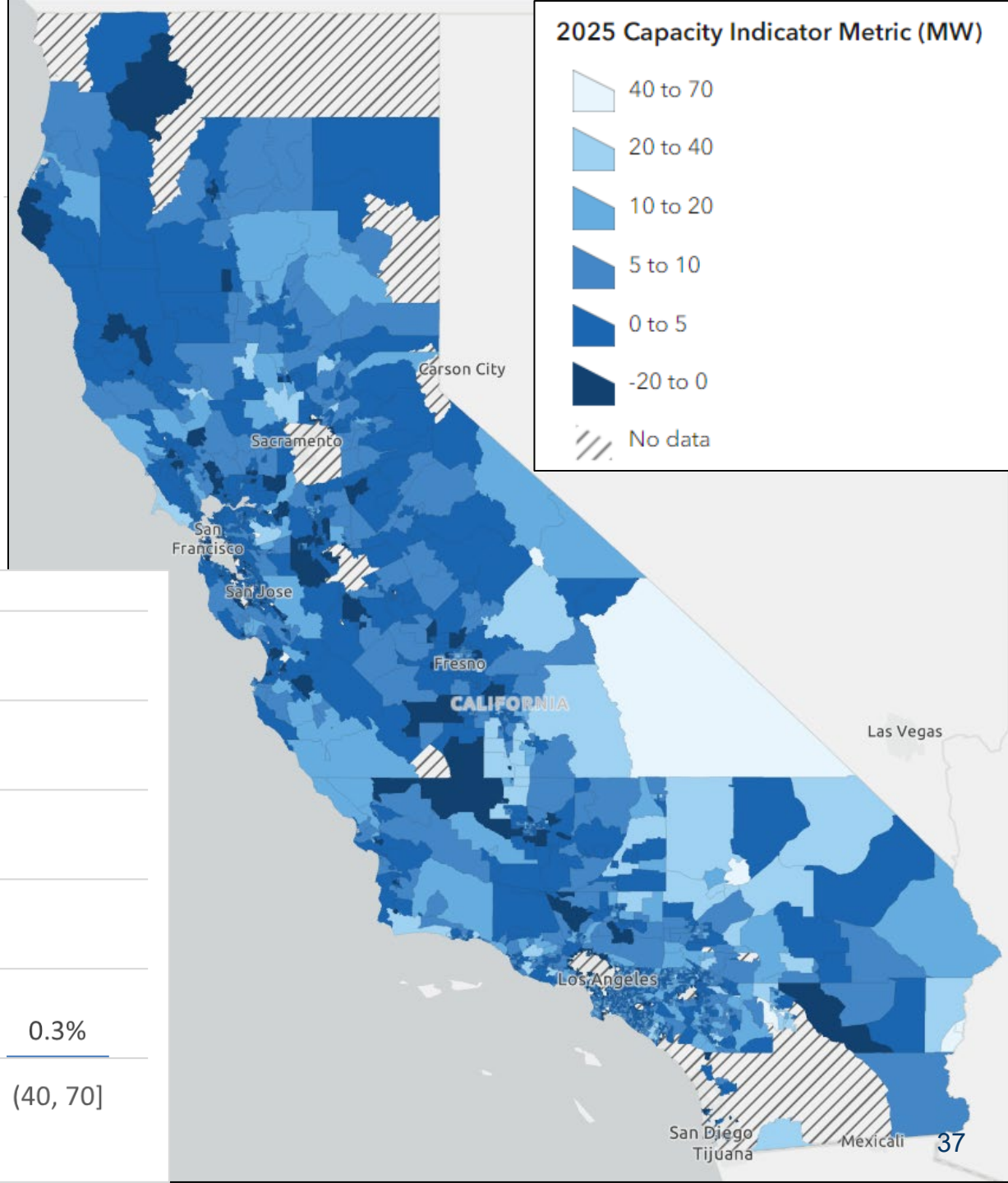


Capacity Indicator Metric (CIM)

Draft Results – CIM Values

- 2025 GNA data + 2025 modeled EV peak load
- 5,454 TAZs in California
  - 12.8% (516) would need upgrade
  - 57.7% (2,323) more are within 5 MW of needing upgrade
  - 26.1% (1,425) do not have grid data
- High density clustering of TAZs with CIM < 0



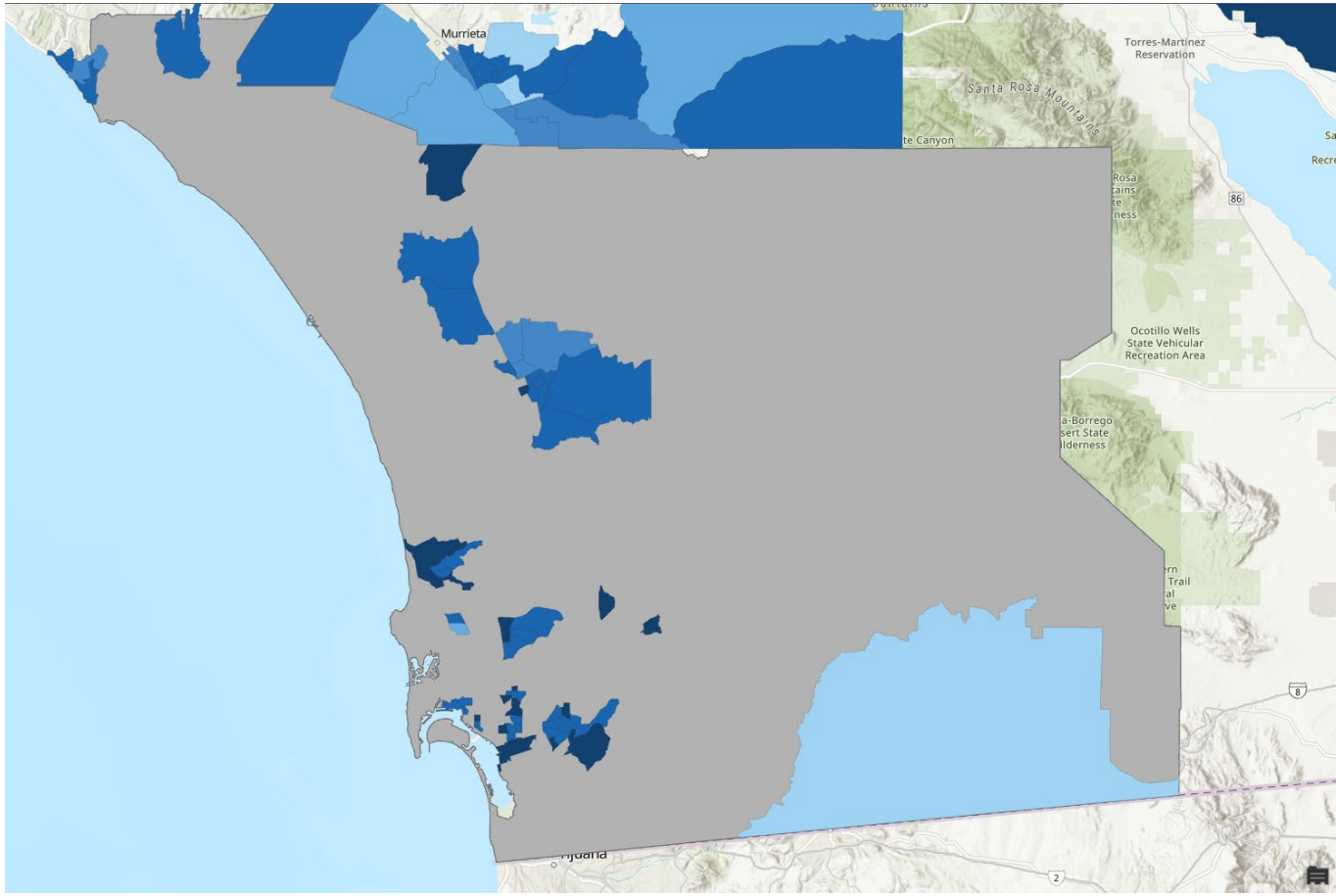


How Can EDGE Results Be Used?

- Provide preliminary information to project developers
- Assist in customer application development, engaging with utilities early
- Help guide behind-the-meter equipment investments
- Alert utilities regarding areas where large EV load growth is projected based on CEC models

Barriers and Limitations

- Uncertainty in when circuit load peaks
- Unable to identify impact of individual circuits
- Cannot assess conditions at specific sites
- Lack of data



Sparse grid data (blue) in SDG&E territory (grey)

Ongoing and Future Work

- Upcoming national laboratory contract to supplement data gaps in EDGE
- Additional potential use cases and datasets
- Public release and workshop
- Improving existing functionality/adding new features (based on feedback from May 2023 beta test):
  - Scenario selection based on different data years
  - Adding substation information
  - Exploring other geographies (e.g. city boundaries)
  - Designing EDGE for mobile devices (i.e. smartphones and tablets)

Vehicle Grid Integration

Jeffrey Lu, Air Pollution Specialist

VGI can prepare California's grid to reliably and cost effectively absorb increased charging load

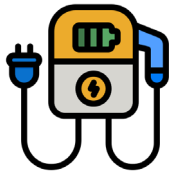
Vehicle-grid integration (**VGI**) describes technologies and strategies that adjust the charging behavior of PEVs in a manner that benefits the grid while ensuring driver needs are met. Examples include:

- Smart charging
- Bidirectional charging
- Automated load management (ALM) systems
- Distributed energy resource (DER) supported charging systems
- *Note:* "VGI" does not necessarily imply bidirectional charging

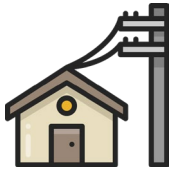
→ VGI helps us make **smarter use of the grid** and is crucial to achieving decarbonization in California

Widespread VGI requires advancements in five key areas

Compensation structures and programs



Customer products and services



Site-level electrical readiness

EV and grid planning

Customer confidence and enrollment

This slide includes visuals from Flaticon.com

VGI Advancement 1:
Compensation structures

A menu of compensation structures is foundational to VGI.

- Customers (and their devices) need a time varying “grid signal” that indicates when charging / discharging is optimal
- Customer should be compensated based on response to grid signal

State policies and industry are offering more menu options, such as:

- Time varying rates (time of use and dynamic rates)
- Grid emergency programs (Emergency Load Reduction, Demand Side Grid Support)
- Other rewards or points (gamification)

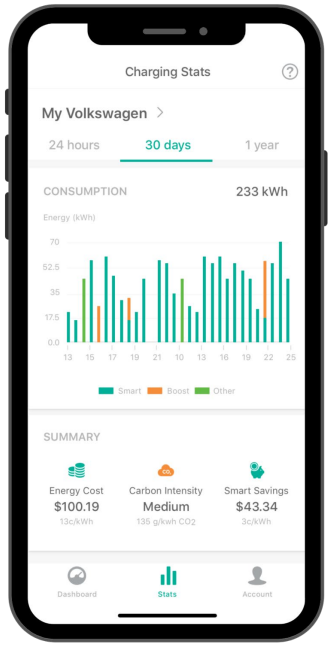
VGI Advancement 2:
Customer products and services

Californians need interoperable VGI products and services to help them generate value from VGI.

- Products should make it easy to fulfill charging needs, respond to grid signals, and be rewarded (see previous slide on compensation)

Products are often clunky and lack VGI capability.

- For example: Some chargers and vehicles have no way of looking up grid signals, bidirectional charging capabilities are uncommon, and so on
- CEC funding, technical requirements, and coordination will help address existing gaps



Programs such as GridShift from a Bay Area CCA help customers save money by automating charging in response to electricity rates and other grid signals.

Products and images shown for illustrative purposes only. Image source: Silicon Valley Clean Energy GridShift.

VGI Advancement 3:
Site-level electrical readiness

Splitters (such as this one from NeoCharge) and other retrofits may enable added charging without a panel upgrade.

Battery storage at this Sysco facility provides additional capacity and "buffers" against surges in charging demand

Widespread site-level electrical readiness to support installation of charging infrastructure is a prerequisite to widespread VGI.

- Drivers cannot respond to grid signals if they cannot plug in

Appropriate electrical preparation may vary by site type:

- Building codes require new construction to be EV ready
- Panel upgrades or other retrofits may be appropriate for existing buildings
- Software or integration with onsite DERs can also help manage electrical capacity (sometimes, DERs may be integrated into the charger directly)

Products and images shown for illustrative purposes only. Image sources: NeoCharge and Sysco

VGI Advancement 4:
EV and Grid Planning Processes

Better capturing VGI in CEC's modeling will help ensure it is appropriately accounted and planned for by utilities

- CEC is aligning various modeling efforts and ensuring results are appropriately shared with the CPUC to inform utility planning.
- AB 2127 modeling (such as EVI-Pro) projects charger needs and informs CEC investments in charging infrastructure
- Modeling for the Integrated Energy Policy Report's energy demand forecasts projects state electrical load and supports utility planning

VGI Advancement 5:
Customer confidence and enrollment

Customers must be confident that VGI is beneficial to them, is easy, and does not compromise their mobility needs.

- Several state policies aim to simplify VGI
- Industry – with its customer facing products and services – plays a crucial role realizing customer participation

Customer outreach, such as through Energy Upgrade California (supported by CPUC and CEC), can help build confidence in VGI.

Labor and Workforce

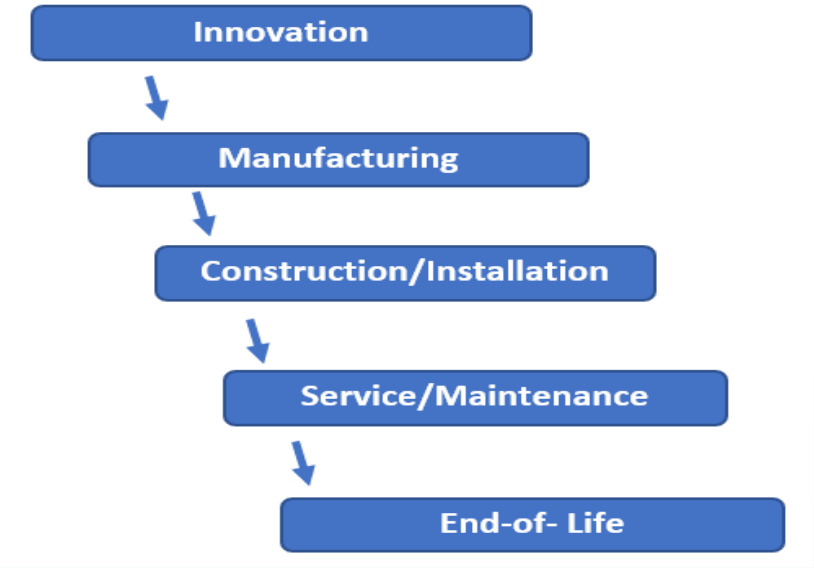
Larry Rillera, Air Pollution Specialist

Background

- Workforce Context
- Labor and Workforce Workshop
- Chapter Structure and Discussion

Introduction

EV Charger Industry and Workforce Segments



- Consider range of workforce issues
- Charger workforce framework
- Estimating job quantity
- Ensuring skills and workforce development

SB 589 (Hueso, Ch. 372, Stats. 2021)

- Identify workforce training and development resources needed to meet the state's ZEV and climate goals
- Resources shall include qualified apprenticeships, on-the-job training programs, and other training opportunities
- Include in second AB 2127 assessment

Statewide Registered Apprenticeship Programs

Occupation	Count
Sheet Metal	14
Manufacturing	41
Electrical and Electronics	41
Inspector/Tester	2
Laborers	12
Operating Engineer	15
Plumbing and Pipefitting	71
Surveyor	5
TOTAL	**201**

Estimating workforce need

*Workforce Projections to Support Battery Electric Vehicle Charging Infrastructure Installation**

- Workforce needs associated with LDV and MDHD EV charger build-out to meet first AB 2127 assessment goals
- Provides framework and analysis of labor for L2 and DCFC installations
- Bottom-up, survey-derived estimates
- Notable findings:
  - LDV charging infrastructure goals would generate workforce needs of approximately 38,200 to 62,400 job-years** from 2021 to 2031
  - Job-years include electricians (21%), general contractors (21%), planning and design (20%), and electrical contractors (15%)
  - MDHD charging infrastructure goals would require 9,100 additional job-years

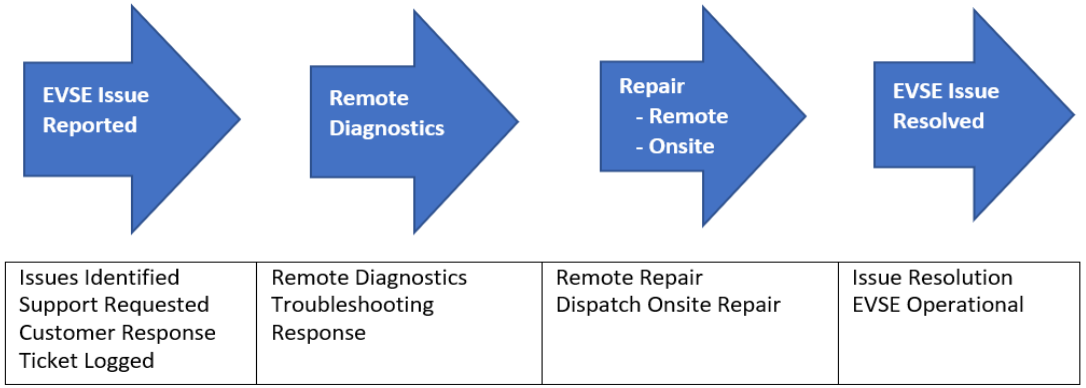
*Source: "Workforce Projections to Support Battery Electric Vehicle Charging Infrastructure Installation." Energy and Environmental Research Associates for Electric Transportation Community Development Corporation, June 8, 2021

*Job-years: Workforce needs are estimated based on analysis of survey responses, provided in person-days, and converted to job-years assuming a full time equivalent (FTE) of 2080 hours and 8-hour workdays. One job-year is equivalent to one person performing a job for one year, or two people performing the same job for half a year, etc. Note that job-years cannot always be directly translated into a number of jobs created, but instead help to describe the demand for work.

Electric Vehicle Infrastructure Training Program

- Assembly Bill 841 (2020) requires EVITP training and certification to install EV charging infrastructure and equipment on the customer side of the electrical meter if funded or authorized by certain state entities (including CEC)
- EVITP provides 20 hours of proprietary training and certification to eligible electricians for a $275 fee
- EVITP training and certification fully on-demand and online (August 2022)
- 230 electrical contractors that have EVITP certified electricians on staff (August 2023)
- 2,300 California EVITP certified electricians (compared to 38,000 certified general electricians [C-10 licensees] plus 7,000 registered electrical apprentices)
- 40% growth in EVITP certifications since AB 841 passed

Service, Maintenance, and Repair



Source: Automotive News

- Reliable chargers are critical to the ZEV transition
- Operational chargers are paramount especially in underserved communities
- Restoring chargers to full operational status requires timely actions by skilled and trained personnel

A high road workforce

- High Road Training Partnerships (HRTP) developed by the California Workforce Development Board (CWDB)
- Support good paying jobs, job quality, jobs access, strengthen local economies, and economic equity
- Workforce and industry partnerships
- Structured career pathways with standard core curricula through state-certified apprenticeships
- Expanding access to quality jobs to diverse and underrepresented populations, women, and persons of color
- CEC incorporates high road principles into ZEV infrastructure policies and investments

Source: County of Los Angeles

(Source: California Workforce Development Board "High road Training Partnerships,")

Training and development

- Many employers and workers will enter EV charger workforce via adjacent clean energy industries and existing technology sectors
- Monitor and account for the net migration of jobs between industries and sectors adjacent to EVCI markets (e.g. equitable building decarbonization)
- Support apprenticeship programs, HRTP, and innovative projects that accelerate new skills development, on-the-job training, and career acquisition
- Examples of innovation and replication include CTP-funded projects:
  - South Valley San Joaquin Valley ZEV Talent Pipeline Project (Kern Community College)
  - Los Angeles County EV Charger Training Project (County of Los Angeles)
  - Transportation Electrification Training Project (California Conservation Corp)

Source: ChargerHelp!

Q&A and Public Comment

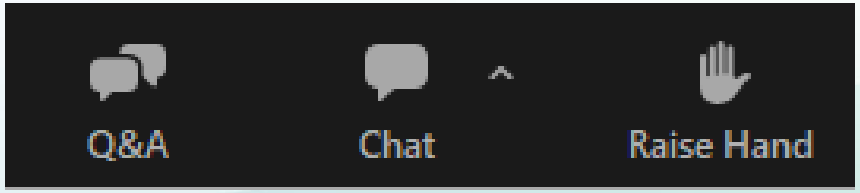
Public discussion

Zoom Participants:

- Use the "raise hand" feature to make verbal comments
- Use the Q&A feature to type in your question

Telephone Participants:

- Dial *9 to raise your hand
- Dial *6 to mute/unmute your phone line.



Discussion topics

- What is your experience with VGI and what steps are needed?
- How can the state achieve high-road jobs in ZEV infrastructure?

Written comments

Electronic Commenting System

Visit the comment page for this docket at:
https://efiling.energy.ca.gov/Ecomment/Ecomment.aspx?docketnumber=19-AB-2127

Comment by E-mail

Email: docket@energy.ca.gov

Subject Line: "Second AB 2127 Assessment"

All comments due by Wednesday, September 20, 2023