



→ Pennsylvania Zero-Emission Vehicle (ZEV) Roadmap

DEPA Coalition Meeting

2/28/2024



Agenda

- 01** Pennsylvania ZEV Fleet Modeling Results
- 02** Preliminary Strategies to Support ZEV Adoption (Growth Strategies)
- 03** Discussion on Strategies





Fleet Modeling

ZEV Adoption Modeling Scenarios in PA

Three scenarios are considered

Light Duty Regulations

70% Plug-in Electric Vehicle Sales by 2032



Same as Reference but with FCEV



High ZEV Adoption (100% ZEV Sales by 2035)

Scenario 1 – In line with national proposed standards

Scenario 2 – Same as scenario 1 but with higher FCEV adoption

Scenario 3 – An aggressive bookend scenario

Electricity and hydrogen demand from ZEV adoption

Medium- and Heavy-Duty Regulations

Between 25 – 50% ZEV sales



Between 40 – 75% ZEV sales



High ZEV Adoption (100% ZEV Sales by 2036)

Scenario 1 – Consistent with national proposed standards

Scenario 2 – Mid ZEV Adoption

Scenario 3 – An aggressive bookend scenario

“Business-as-usual” vehicle stock and sales

ZEV adoption scenarios, aligned with the EPA regulatory requirements or other regional programs

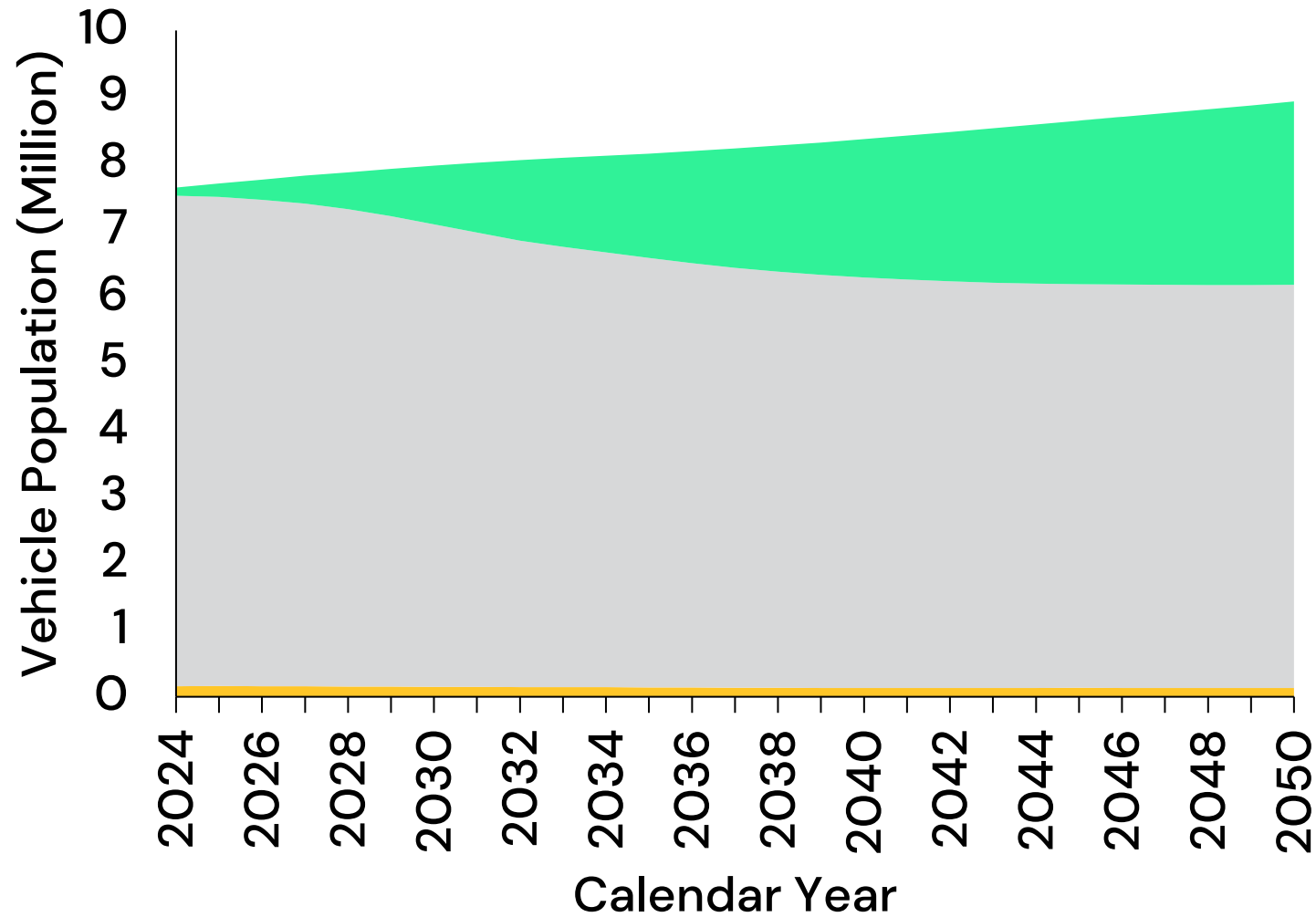
MOVES and Mobile Source Emissions Research



EPA's Motor Vehicle Emission Simulator (MOVES) is a state-of-the-science emission modeling system that estimates emissions for mobile sources at the national, county, and project level for criteria air pollutants, greenhouse gases, and air toxics.

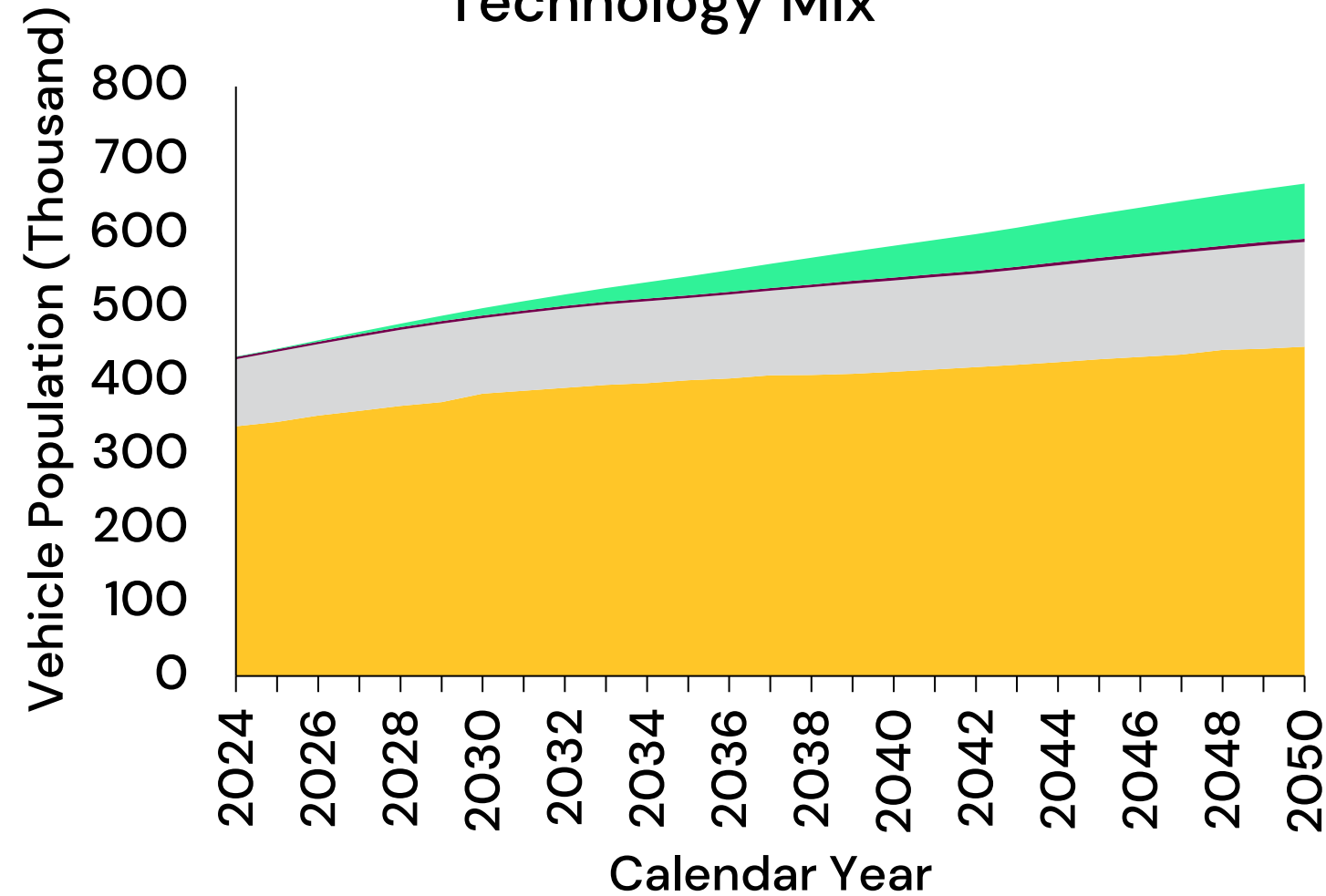
Fleet Modeling – Business-As-Usual

Light-Duty Vehicle Technology Mix



■ Diesel
 ■ Gasoline
 ■ Electricity

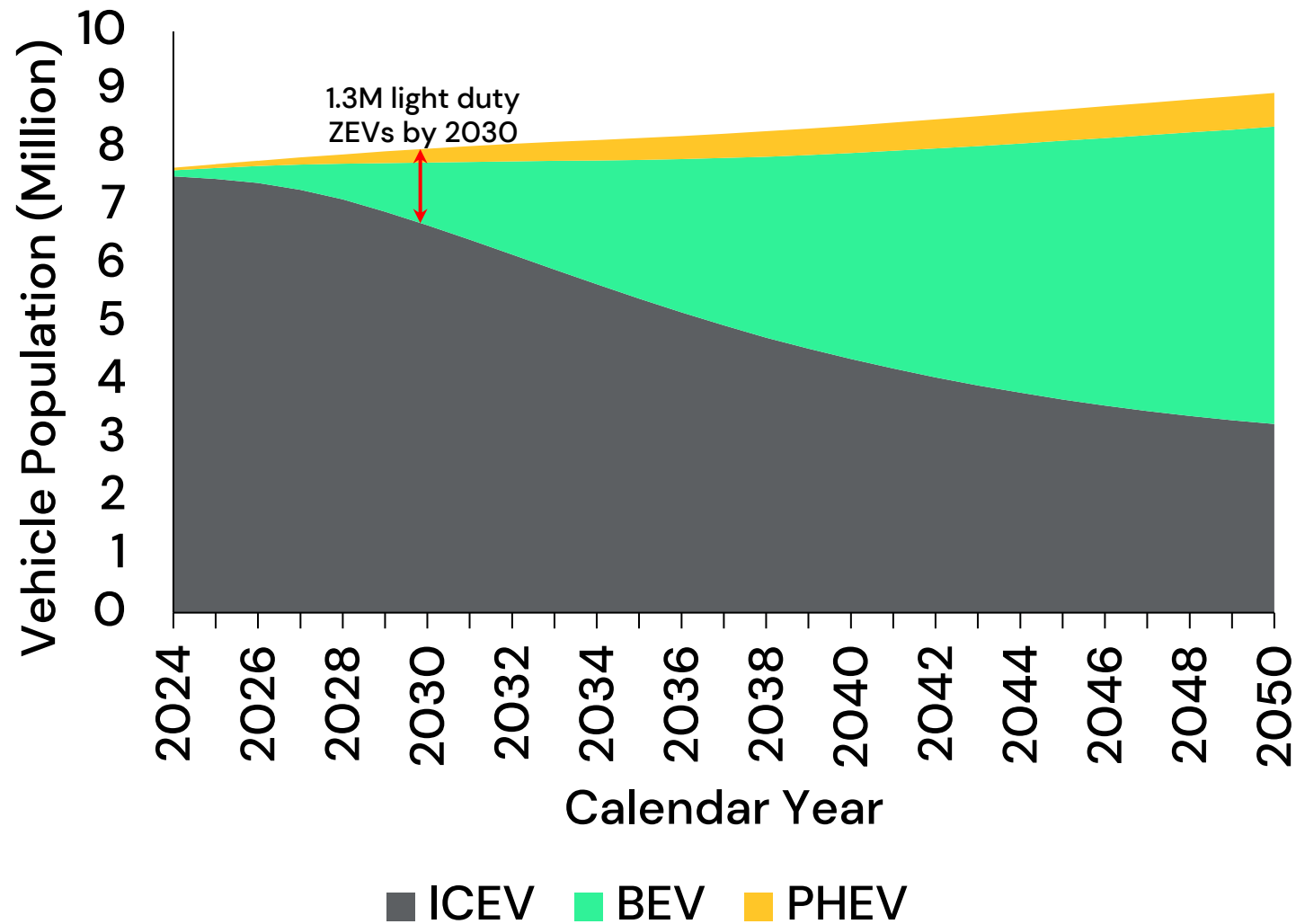
Medium-Duty & Heavy-Duty Vehicle Technology Mix



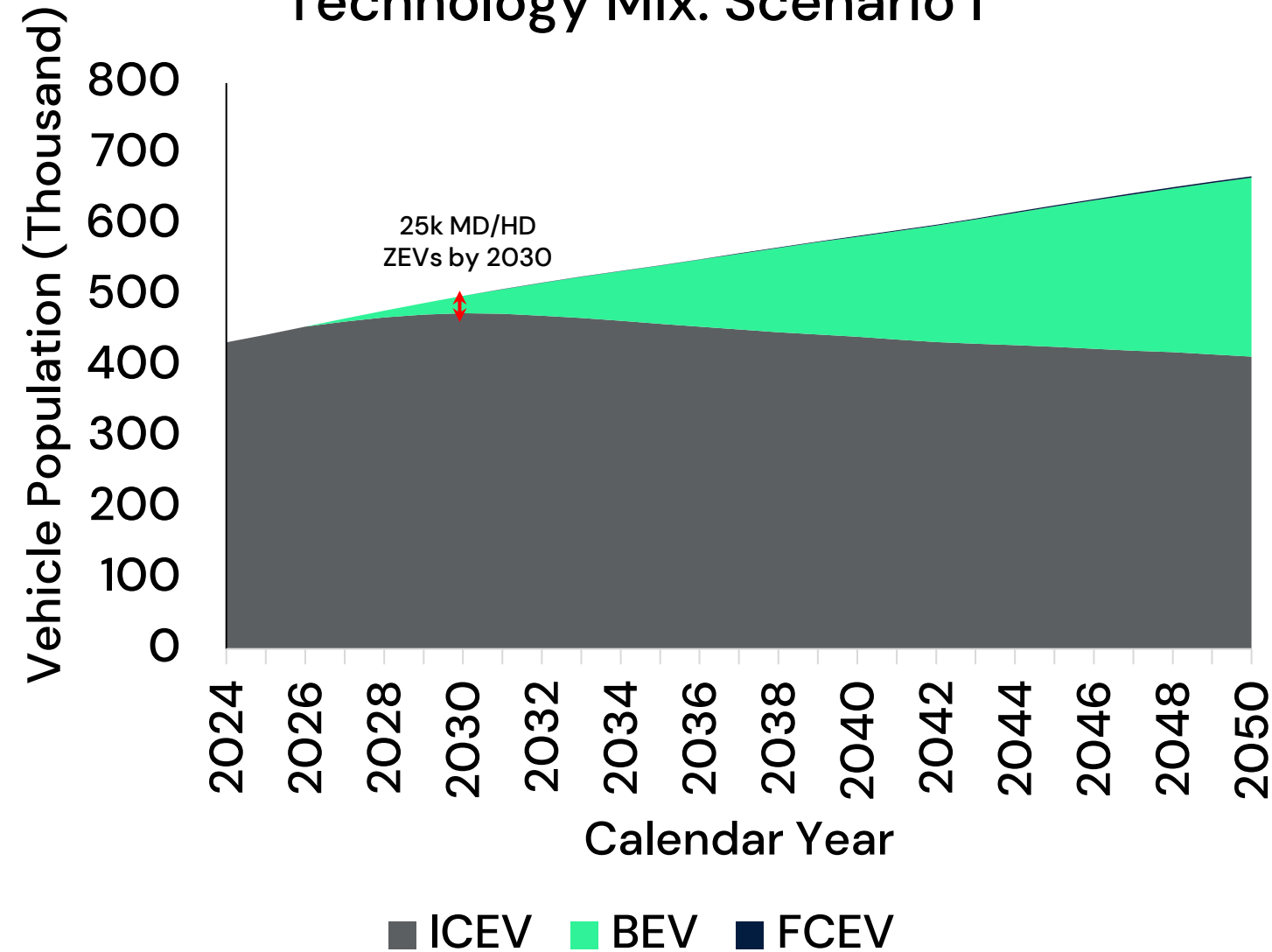
■ Diesel
 ■ Gasoline
 ■ CNG
 ■ Electricity

Fleet Modeling – Scenario 1

Light-Duty Vehicle Technology Mix: Scenario I

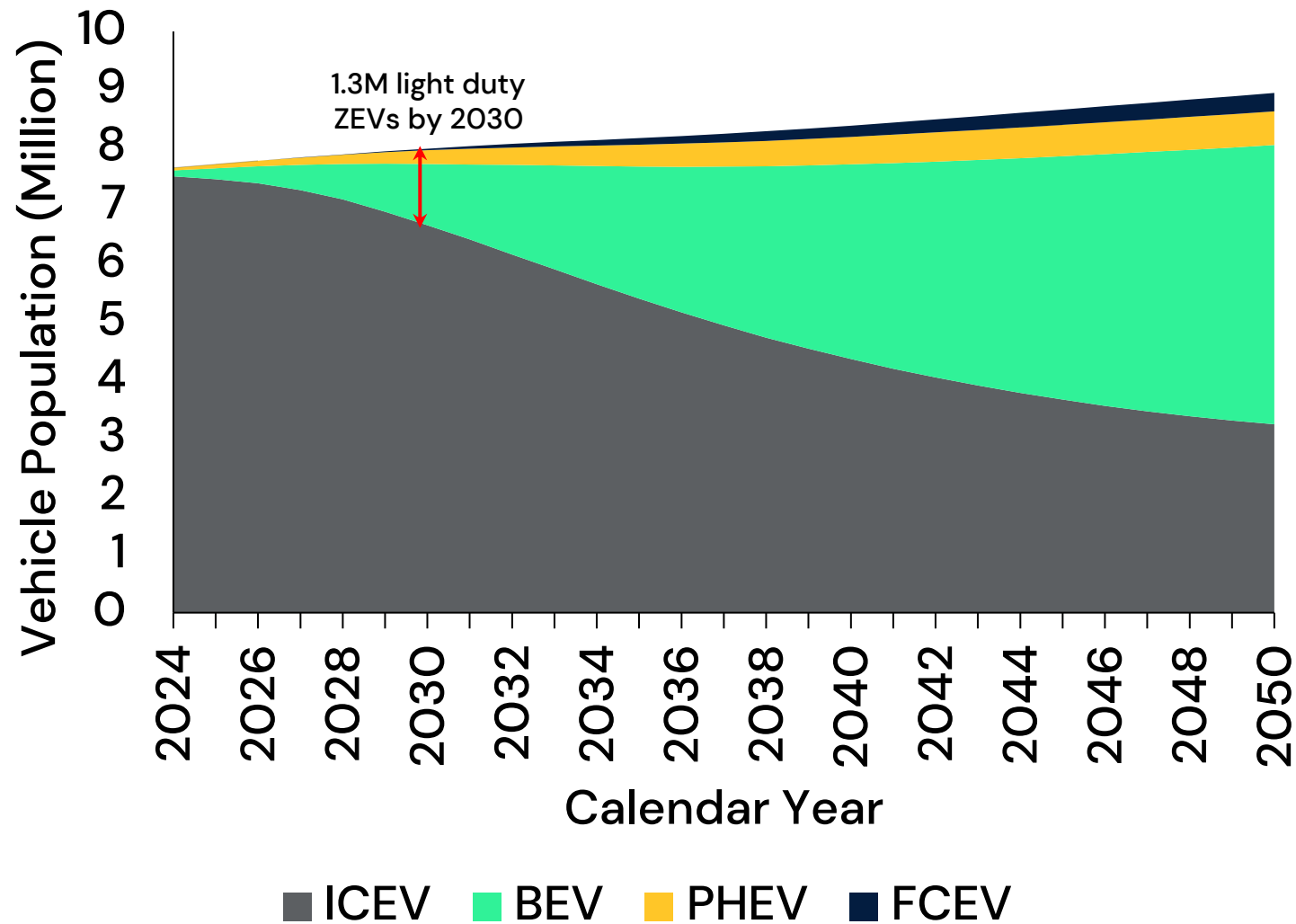


Medium-Duty & Heavy-Duty Vehicle Technology Mix: Scenario I

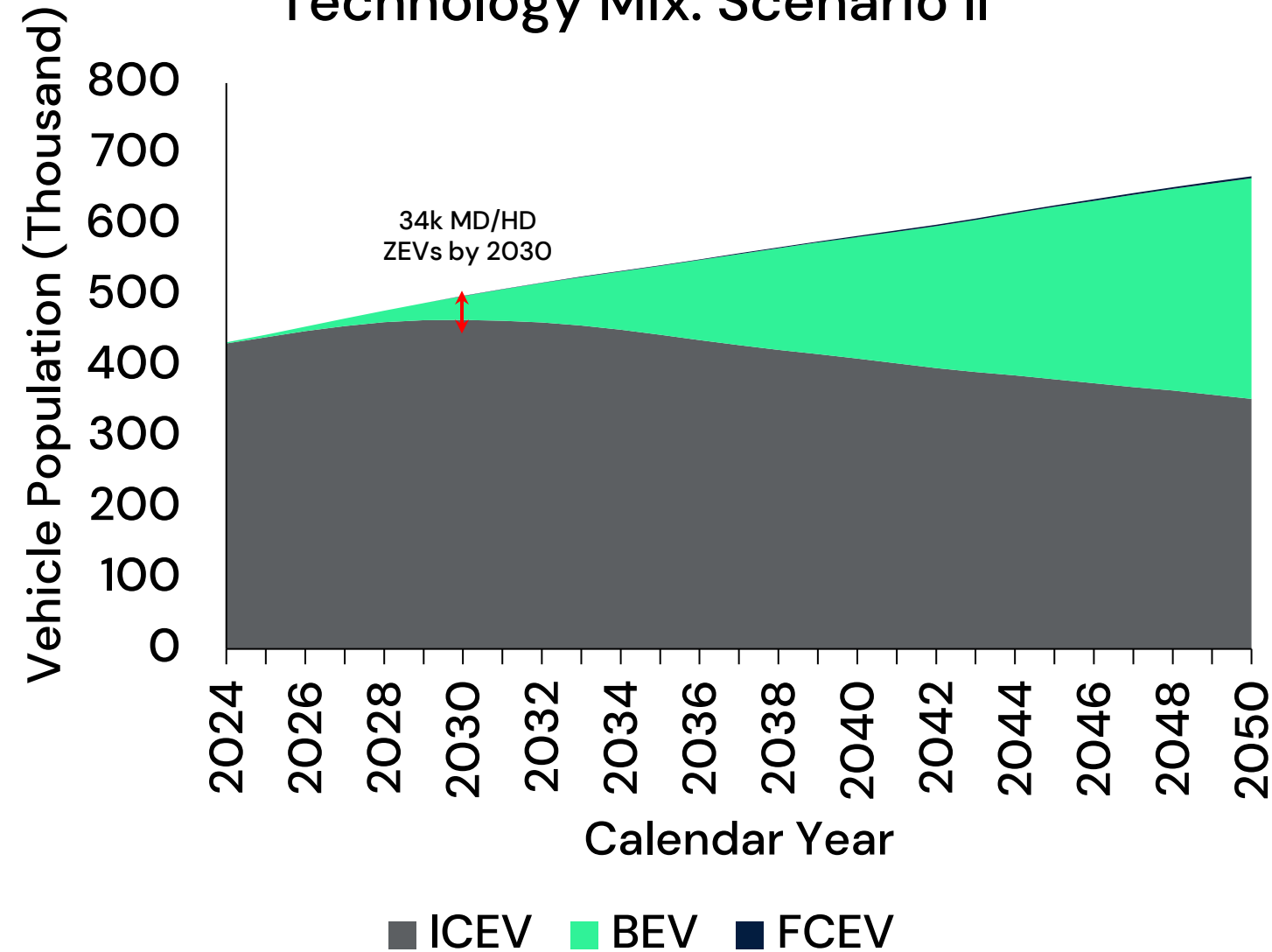


Fleet Modeling – Scenario 2

Light-Duty Vehicle Technology Mix: Scenario II

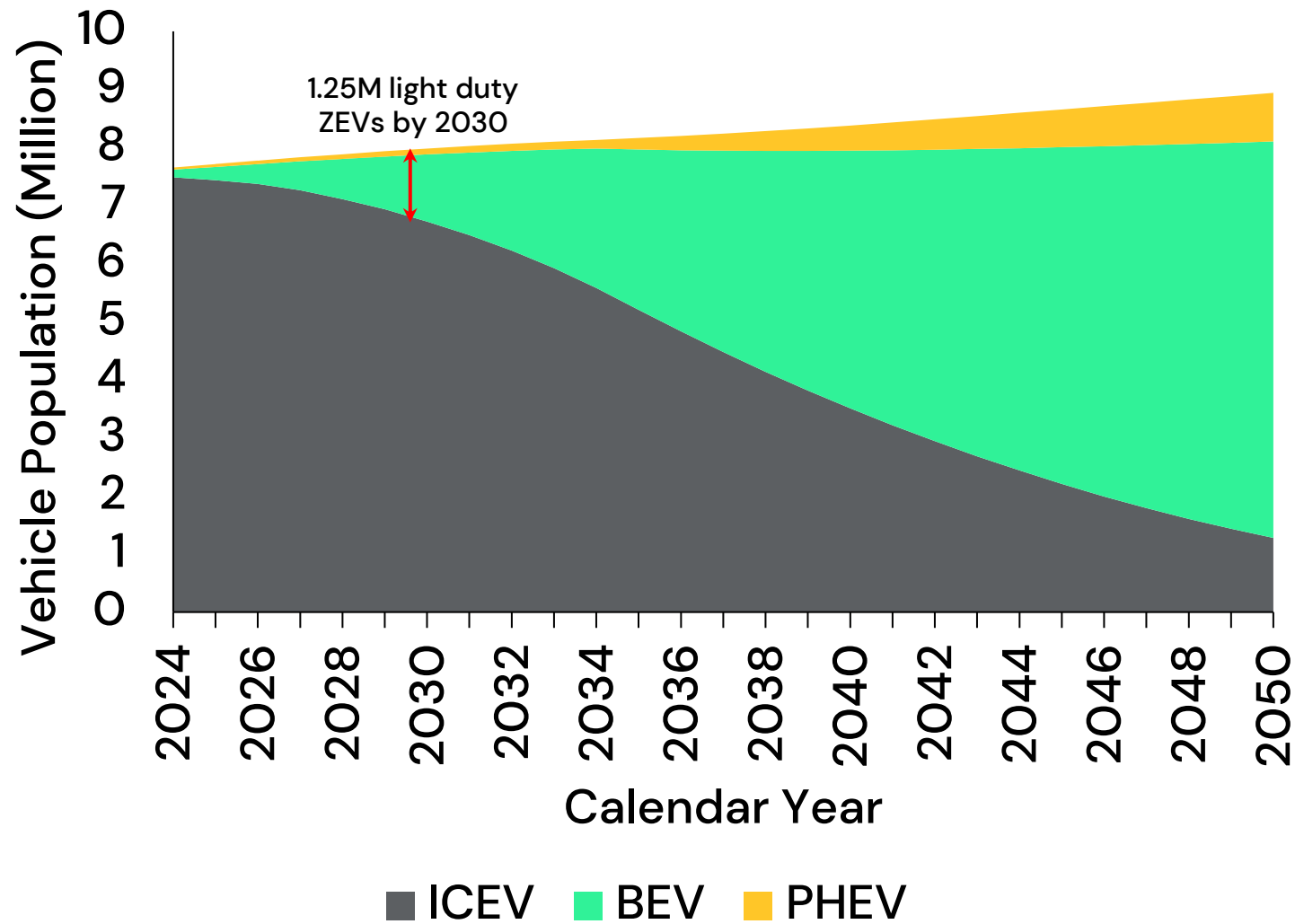


Medium-Duty & Heavy-Duty Vehicle Technology Mix: Scenario II

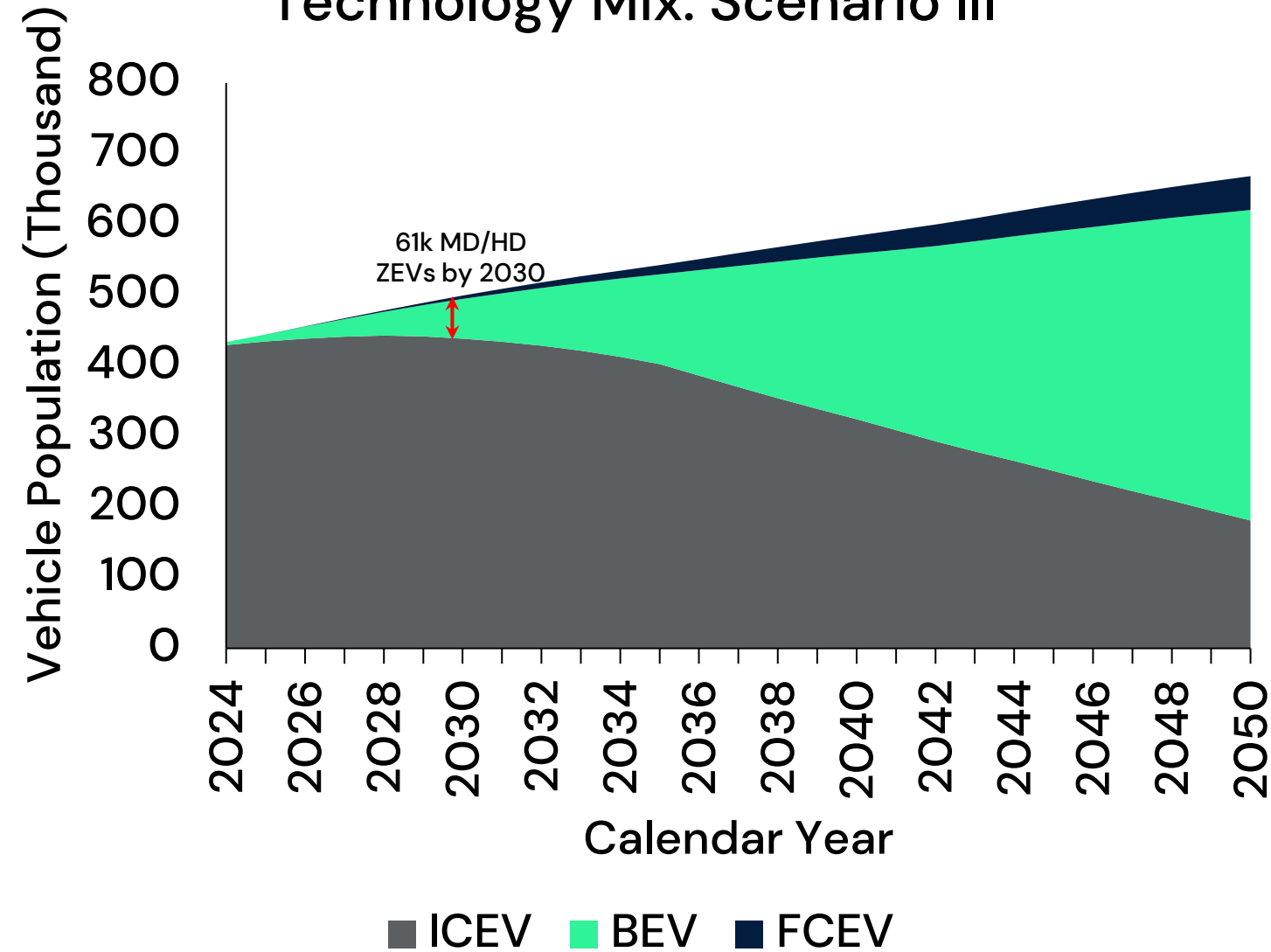


Fleet Modeling – Scenario 3

Light-Duty Vehicle Technology Mix: Scenario III



Medium-Duty & Heavy-Duty Vehicle Technology Mix: Scenario III



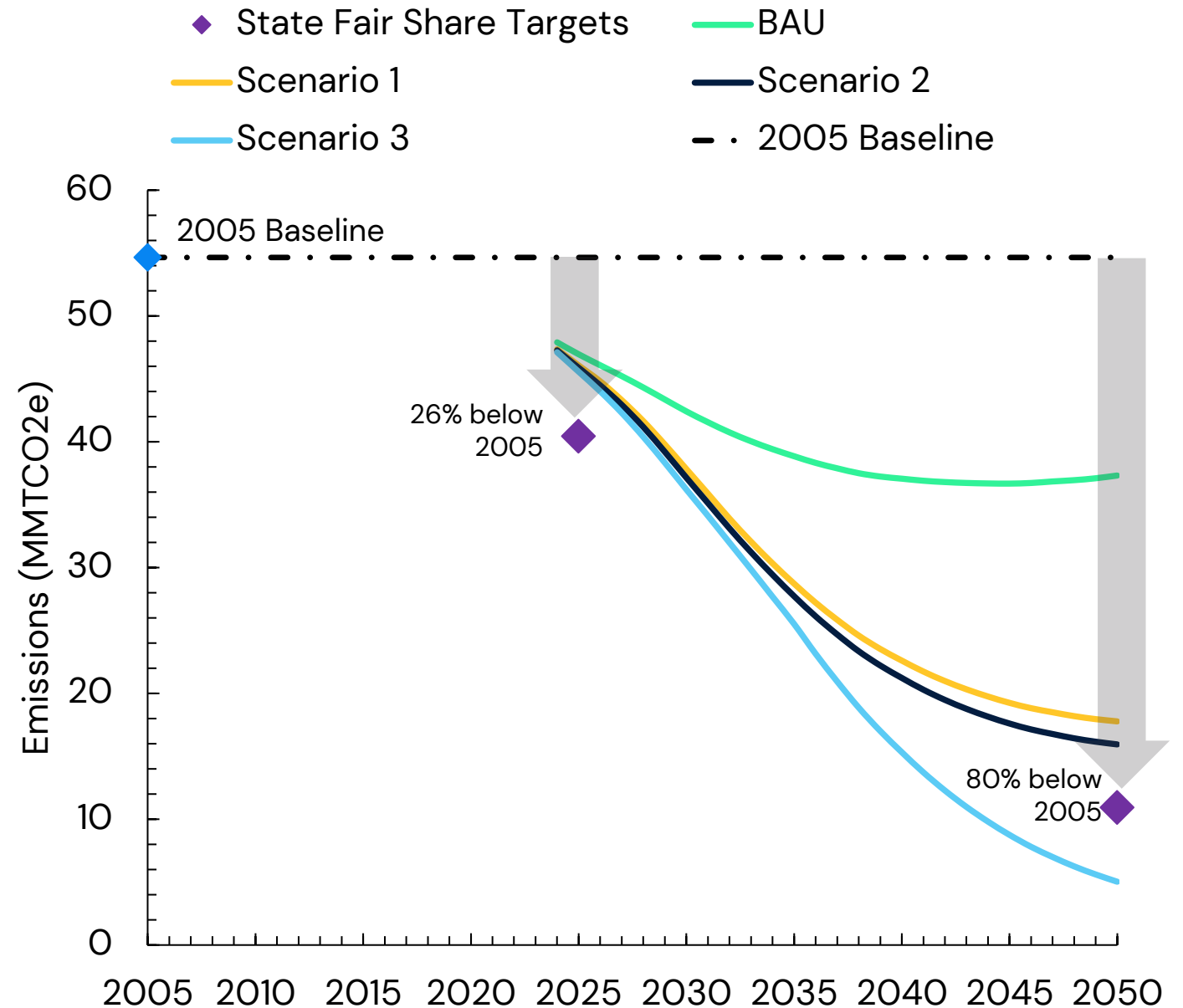
GHG Emission Reductions

- By 2050, the most aggressive scenario (Scenario 3) results in more than 70 percent reduction in GHG emissions from on-road cars and truck as compared to BAU (difference between green and light blue)
- Scenario 1 and Scenario 2 will result in 44 and 48 percent reduction from BAU by 2050

Pennsylvania's Economywide GHG Emissions Reduction Goals

26% reduction from 2005 to 2025

80% reduction from 2005 to 2050

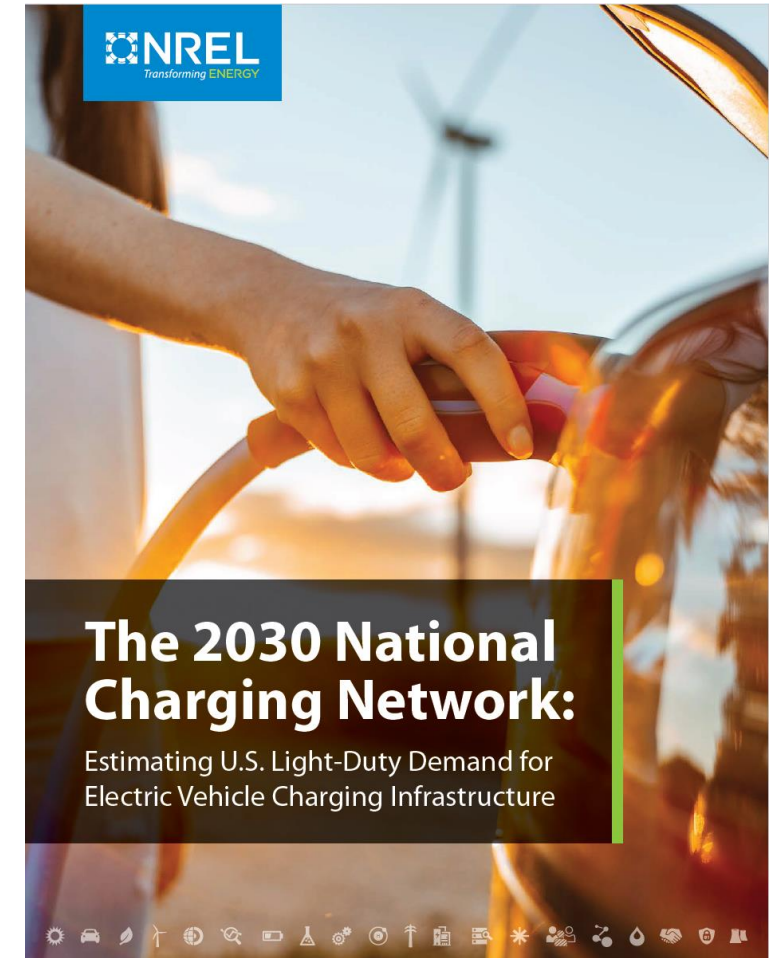
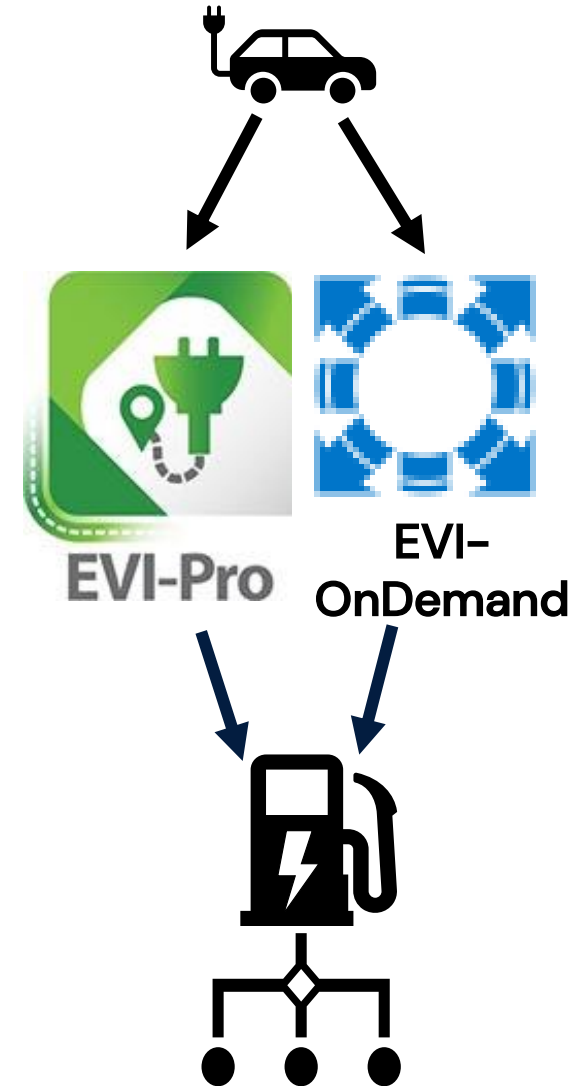




Infrastructure Needs Assessment

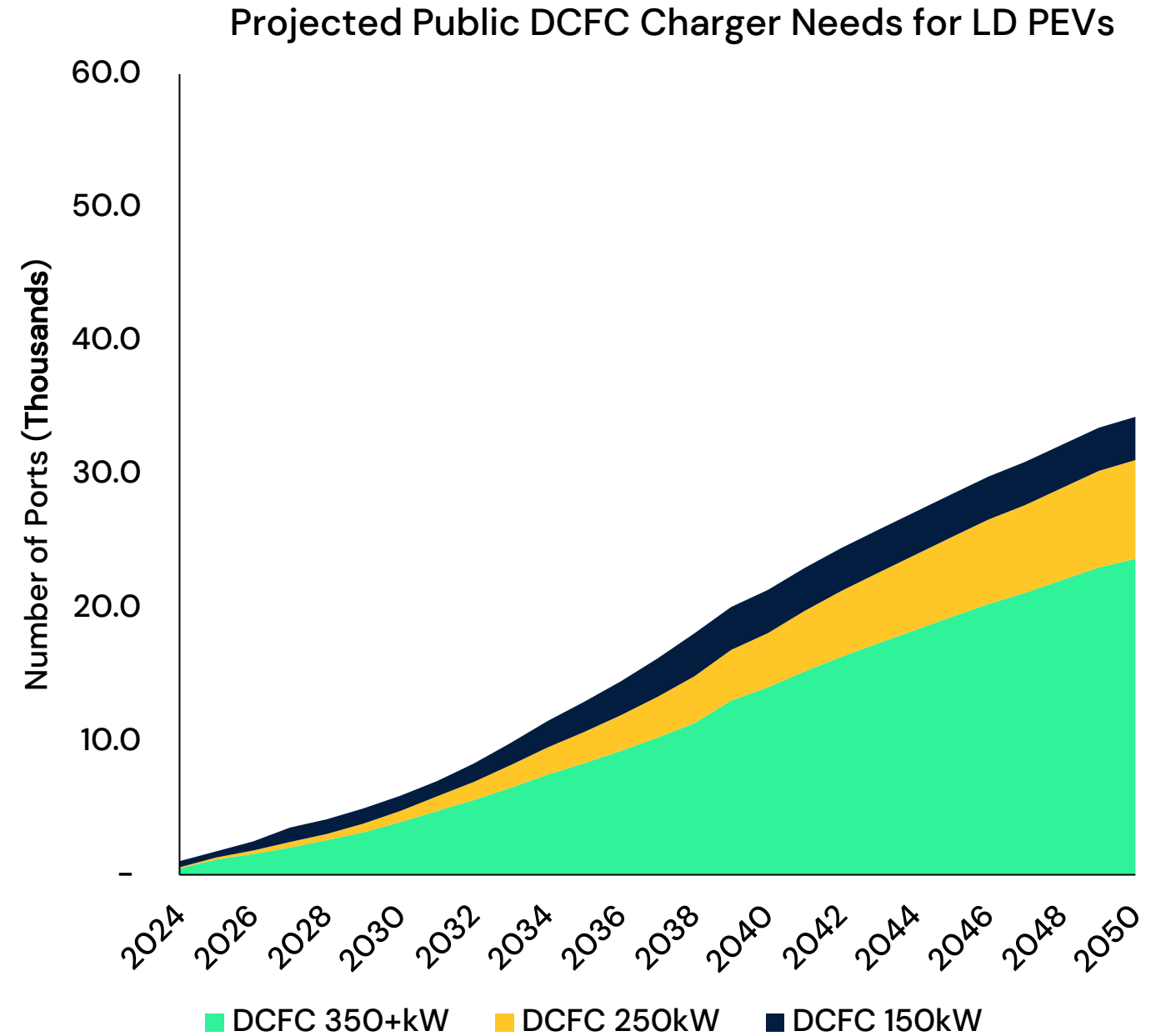
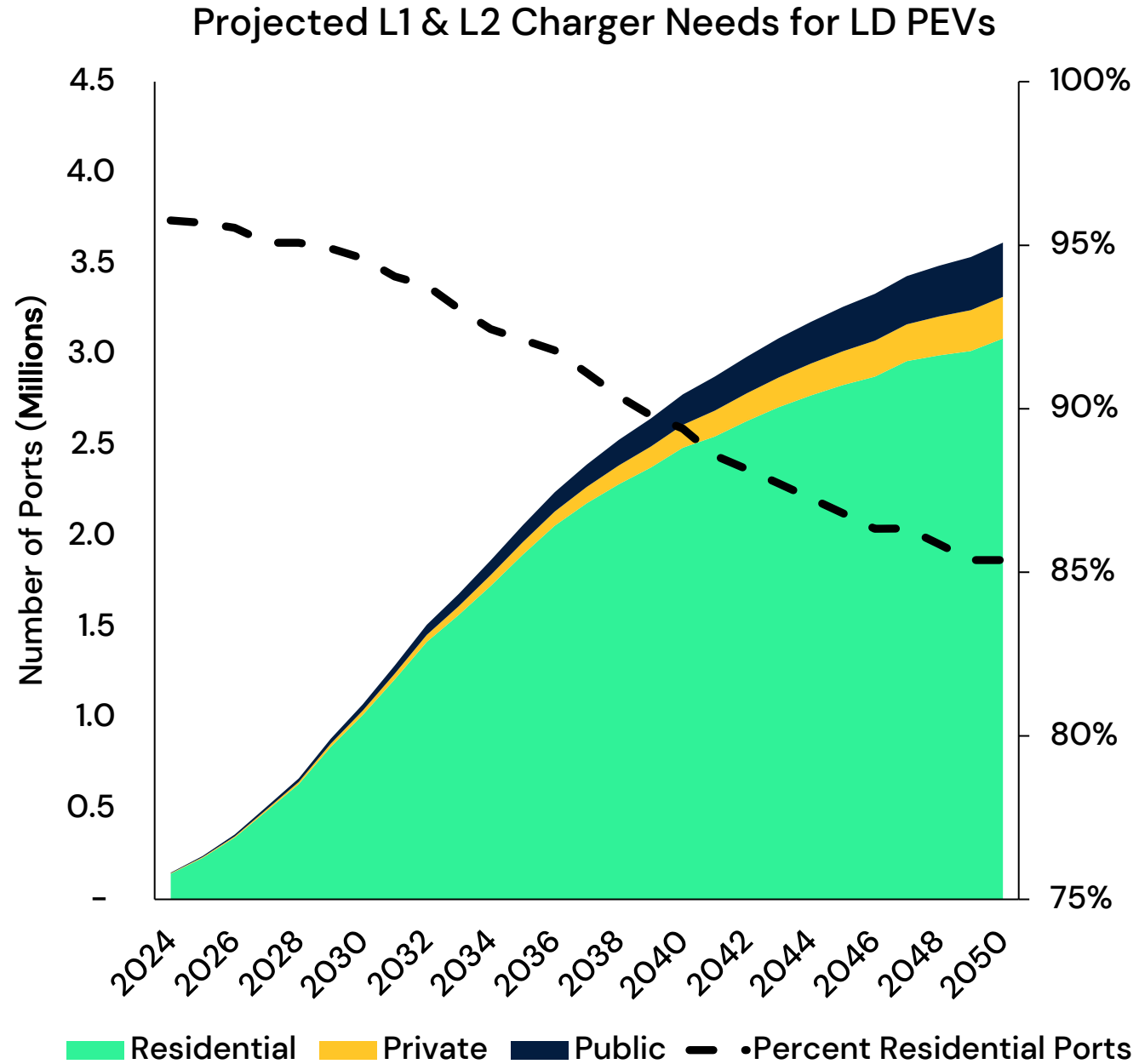
Light Duty Vehicle Charging Infrastructure – Methodology

- **NREL’s Electric Vehicle Infrastructure Projection Tool (EVI-Pro)**
 - Single Family
 - Shared Private (multi-unit dwelling, office, etc.)
 - Public Level 2
 - Public DCFC
- **NREL’s EVI-OnDemand**
 - Fast charging needs for ride-hailing electrification
 - Also used to account for charging needs from road trips and interregional trips
 - Public DCFCs
- **Approach**
 - Aggregate total passenger car and passenger truck counts by state and year
 - Determine home charging access percent
 - Offer input to EVI-Pro and EVI-OnDemand for expected charging needs and distribution
 - Distribute state-level to county-level by EV population.



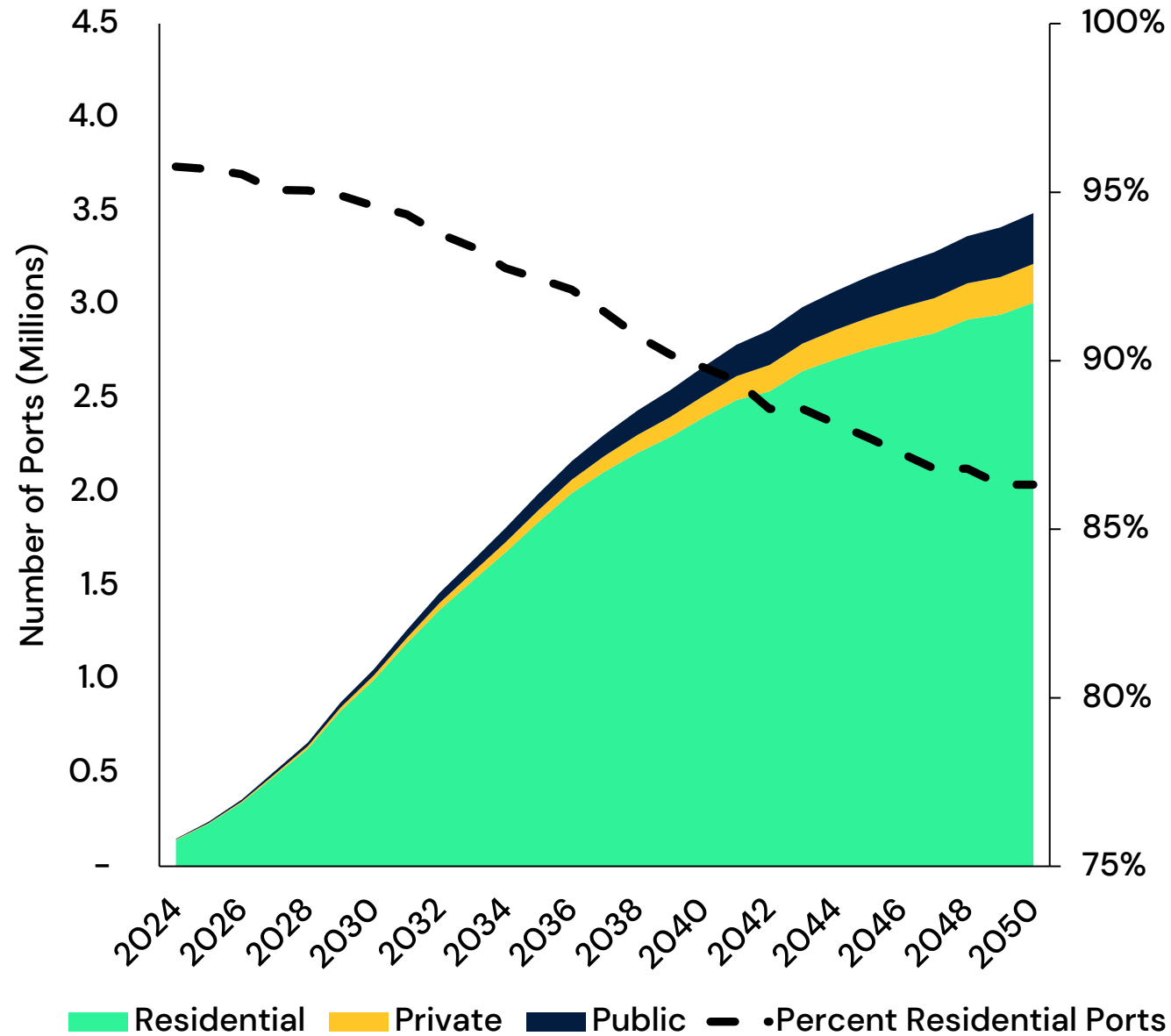
<https://www.nrel.gov/docs/fy23osti/85970.pdf>
<https://afdc.energy.gov/evi-pro-lite>

Light Duty Vehicle Charging Infrastructure Needs Assessment (Scenario 1)

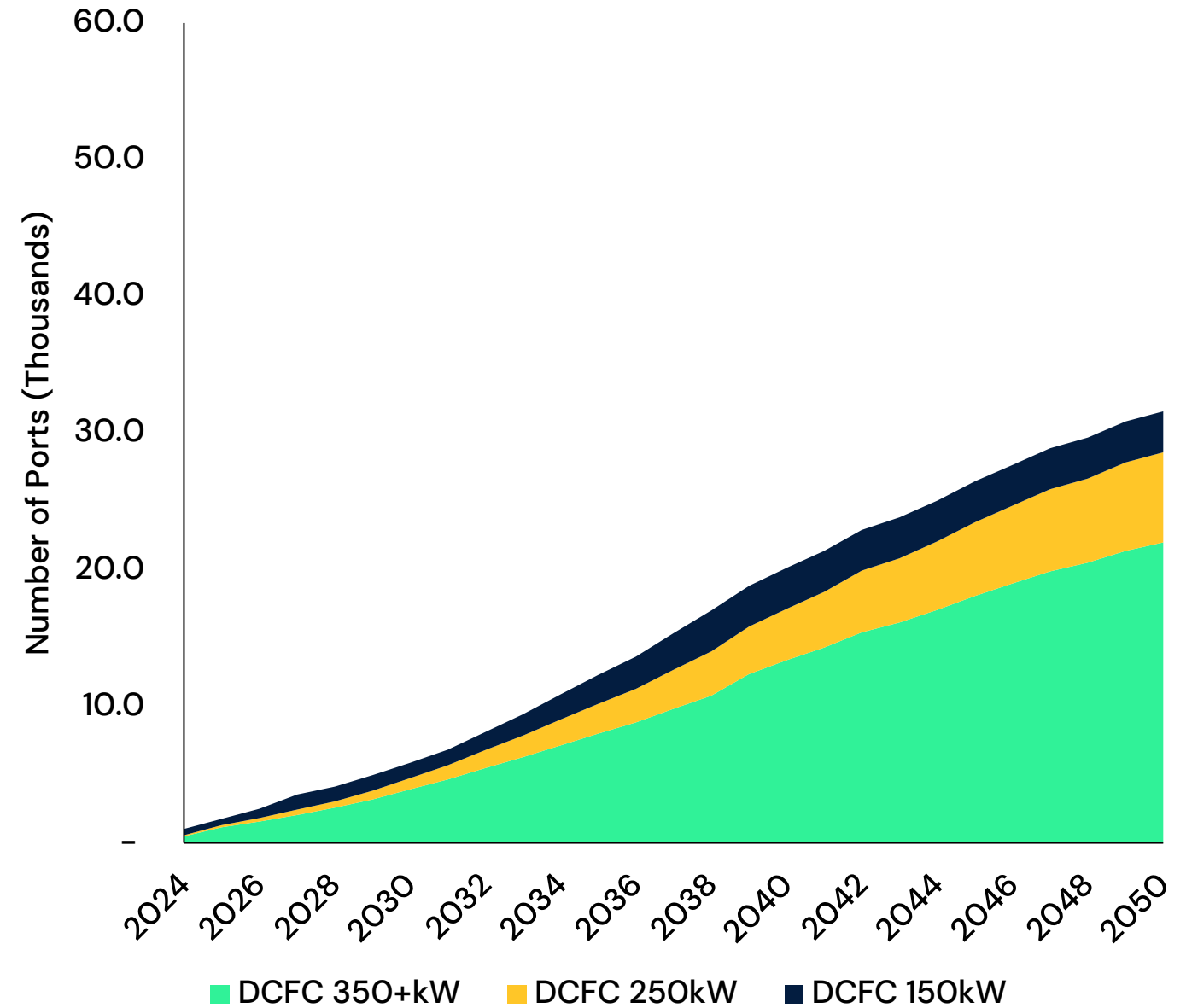


Light Duty Vehicle Charging Infrastructure Needs Assessment (Scenario 2)

Projected L1 & L2 Charger Needs for LD PEVs

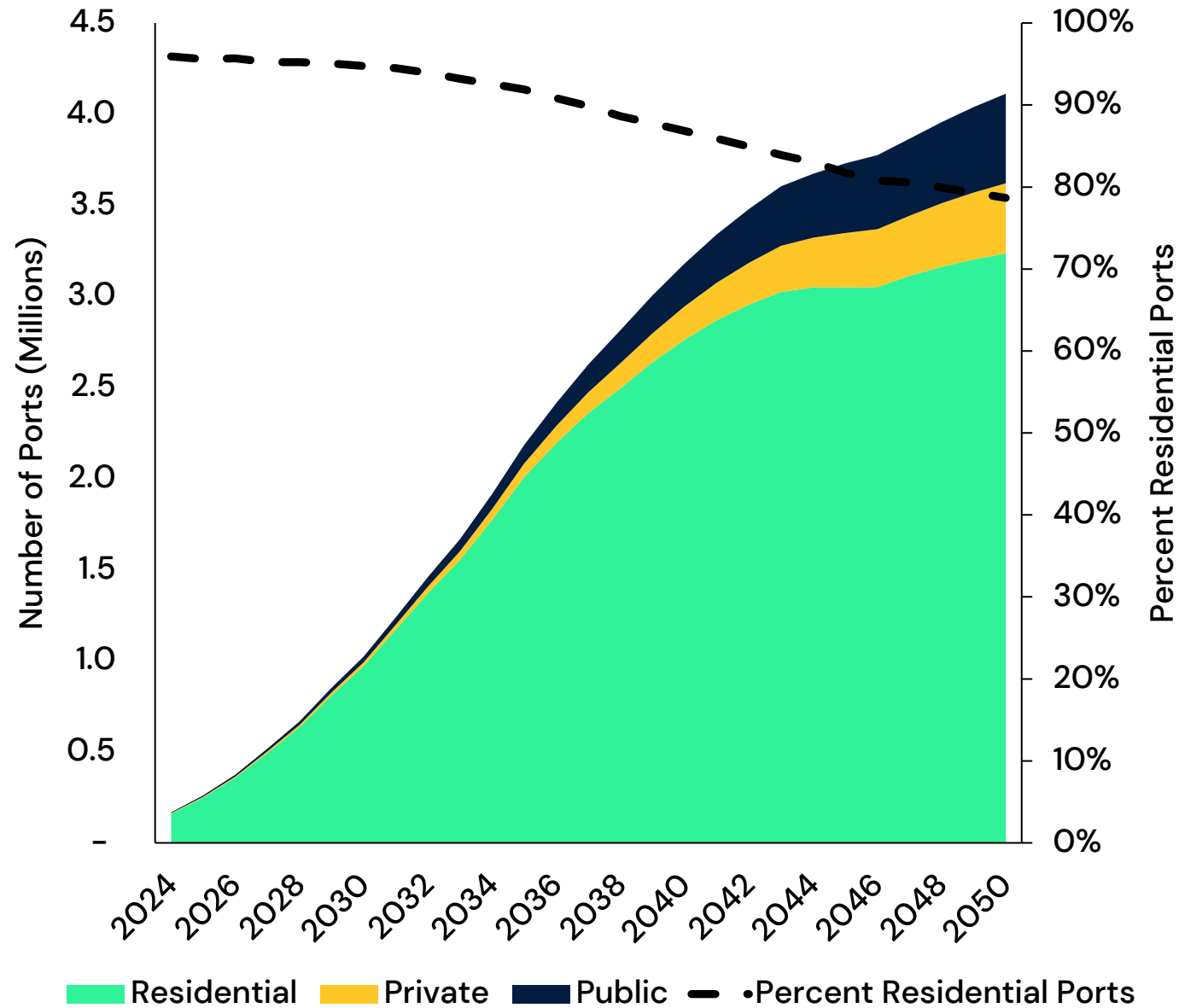


Projected Public DCFC Charger Needs for LD PEVs

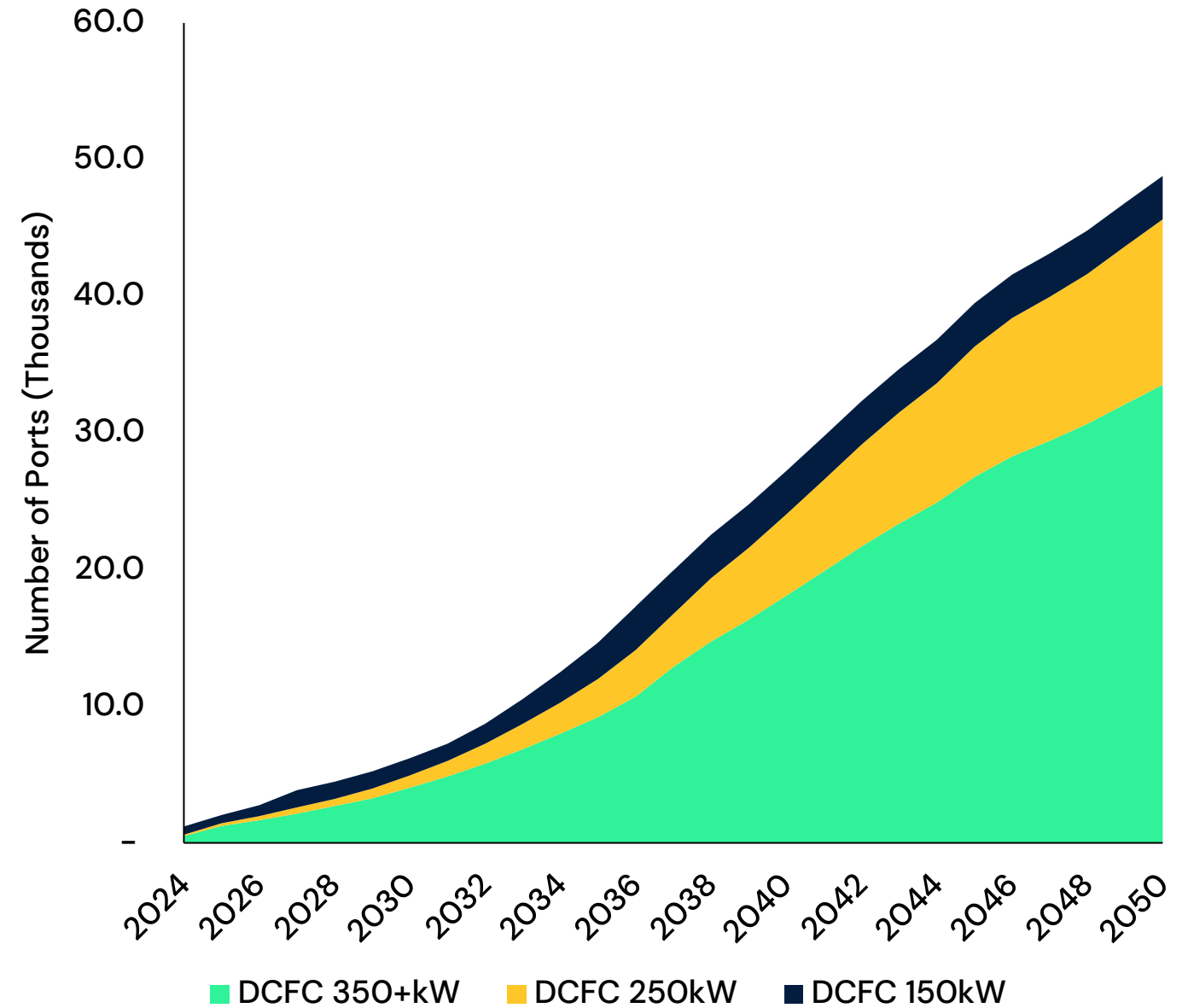


Light Duty Vehicle Charging Infrastructure Needs Assessment (Scenario 3)

Projected L1 & L2 Charger Needs for LD PEVs



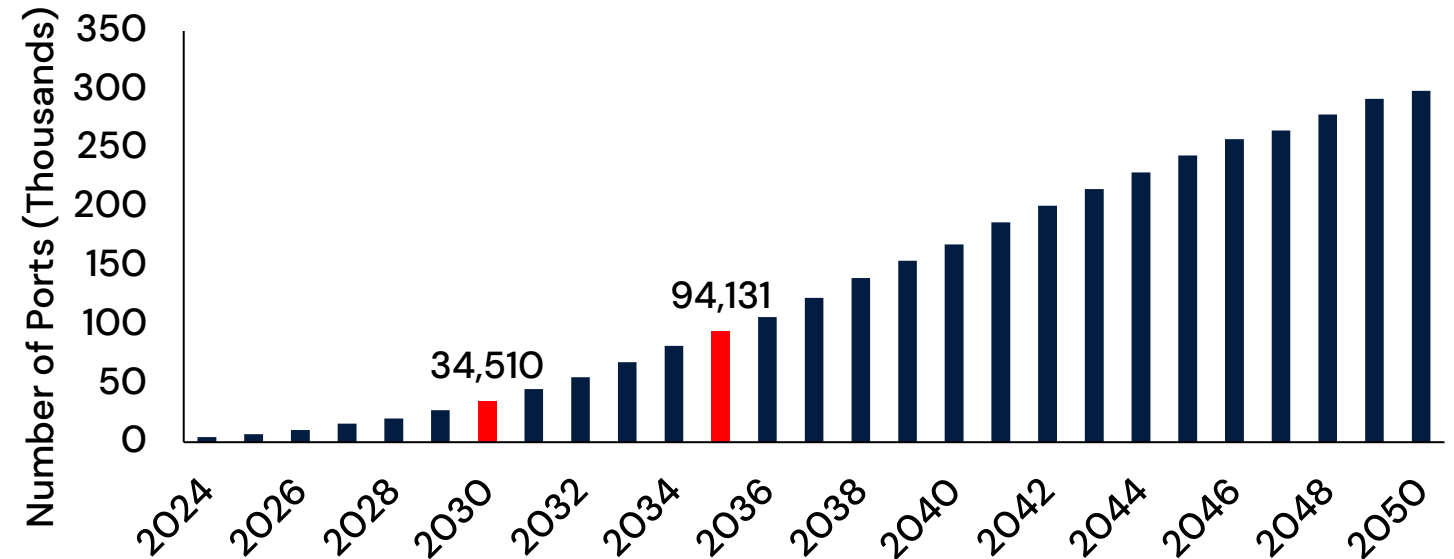
Projected Public DCFC Charger Needs for LD PEVs



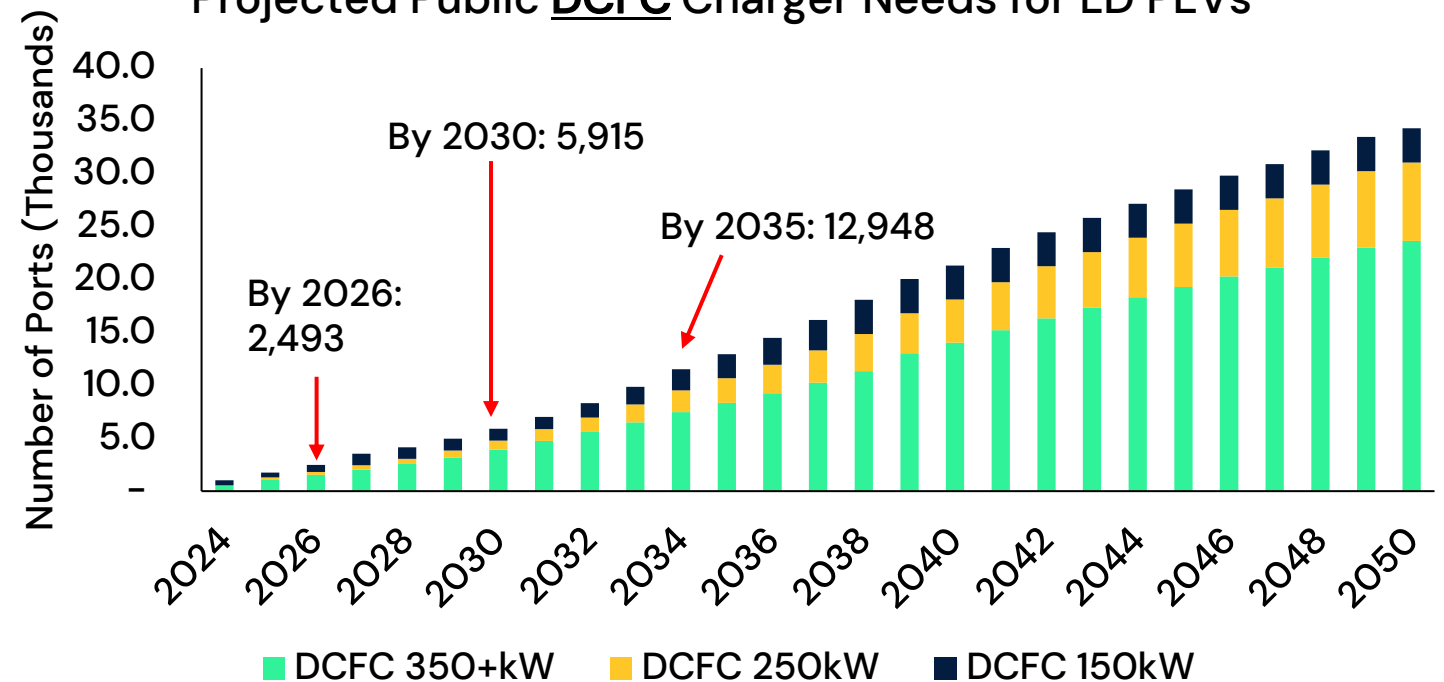
What's the gap?

- Under Scenario 1 (national proposed standards), the state will need roughly 34,510 public (L1+L2) charging ports by 2030 for light duty vehicles
- Currently the state has roughly 3,200 Level 2 public charging ports available.
- There is a need for **11x increase** in public Level 2 light duty charging infrastructure over the next 6 years to meet demands under scenario 1.
- With respect to DCFC charger, the state currently has roughly 1,000 DCFC plugs (majority being Tesla superchargers)
 - 302 DCFCs by 2026 through [NEVI Round 1](#)
- By 2030, the state will need almost 6,000 DCFC chargers to meet demand from Scenario 1. A **6x increase** in DCFC chargers over the next 6 years

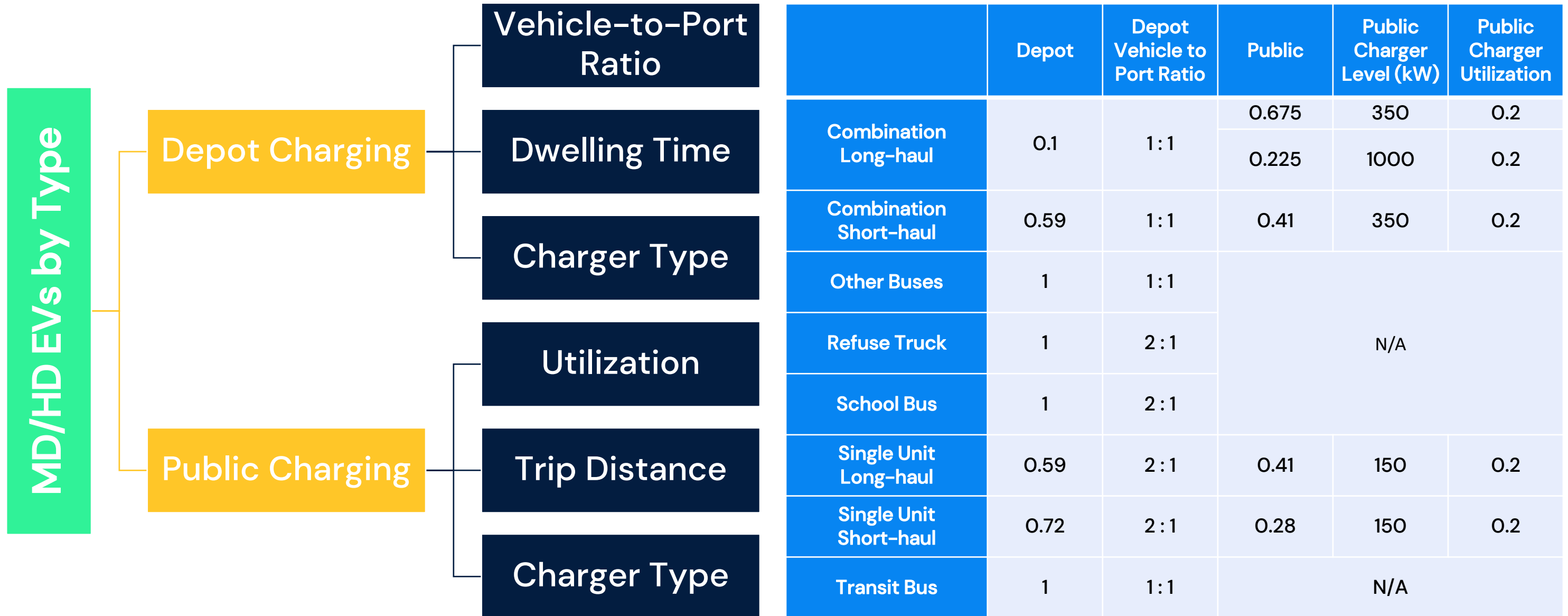
Projected Public (L1+L2) Charger Needs for LD PEVs



Projected Public DCFC Charger Needs for LD PEVs

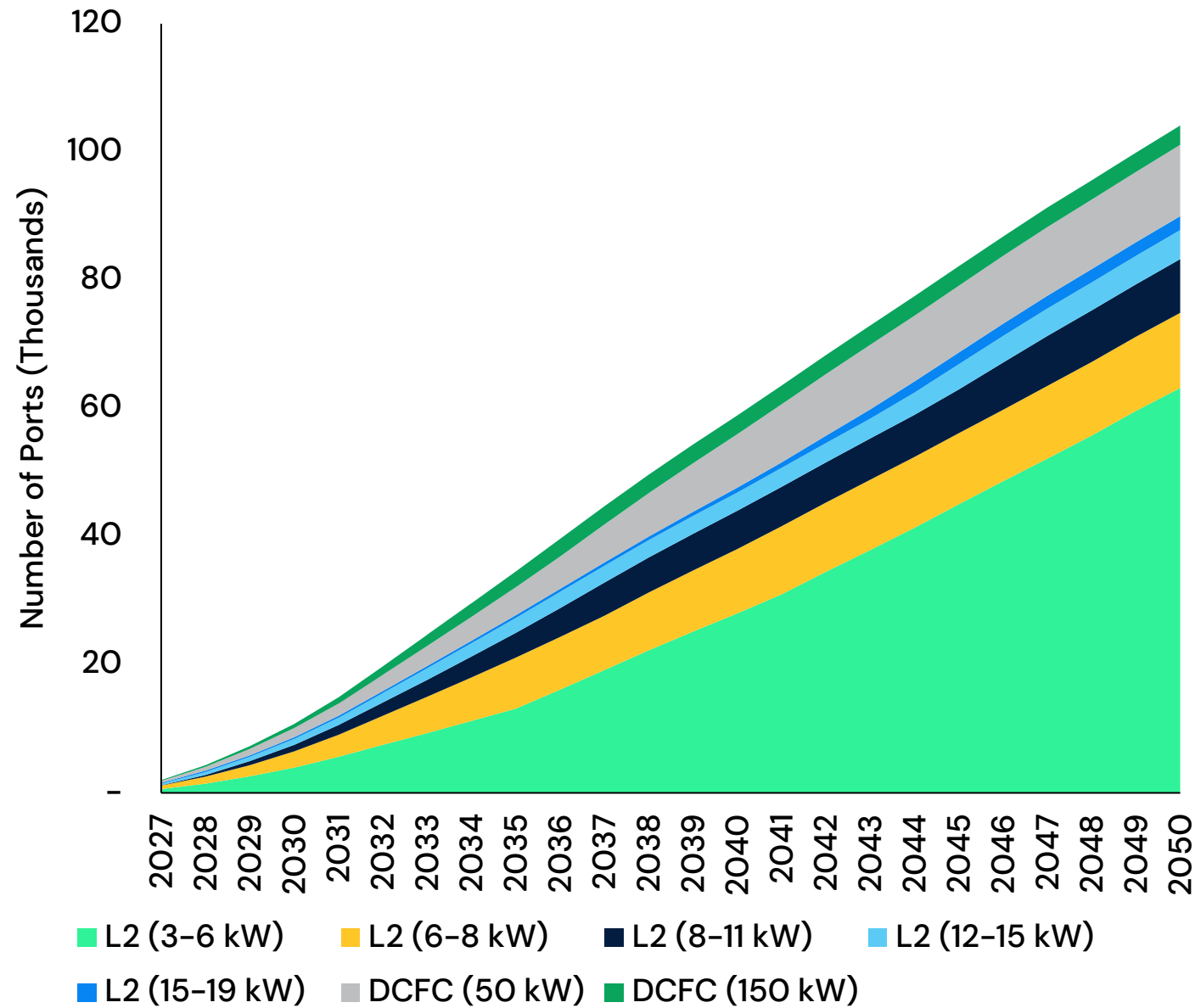


Infrastructure Needs Assessment Methodology – MDHD PEV

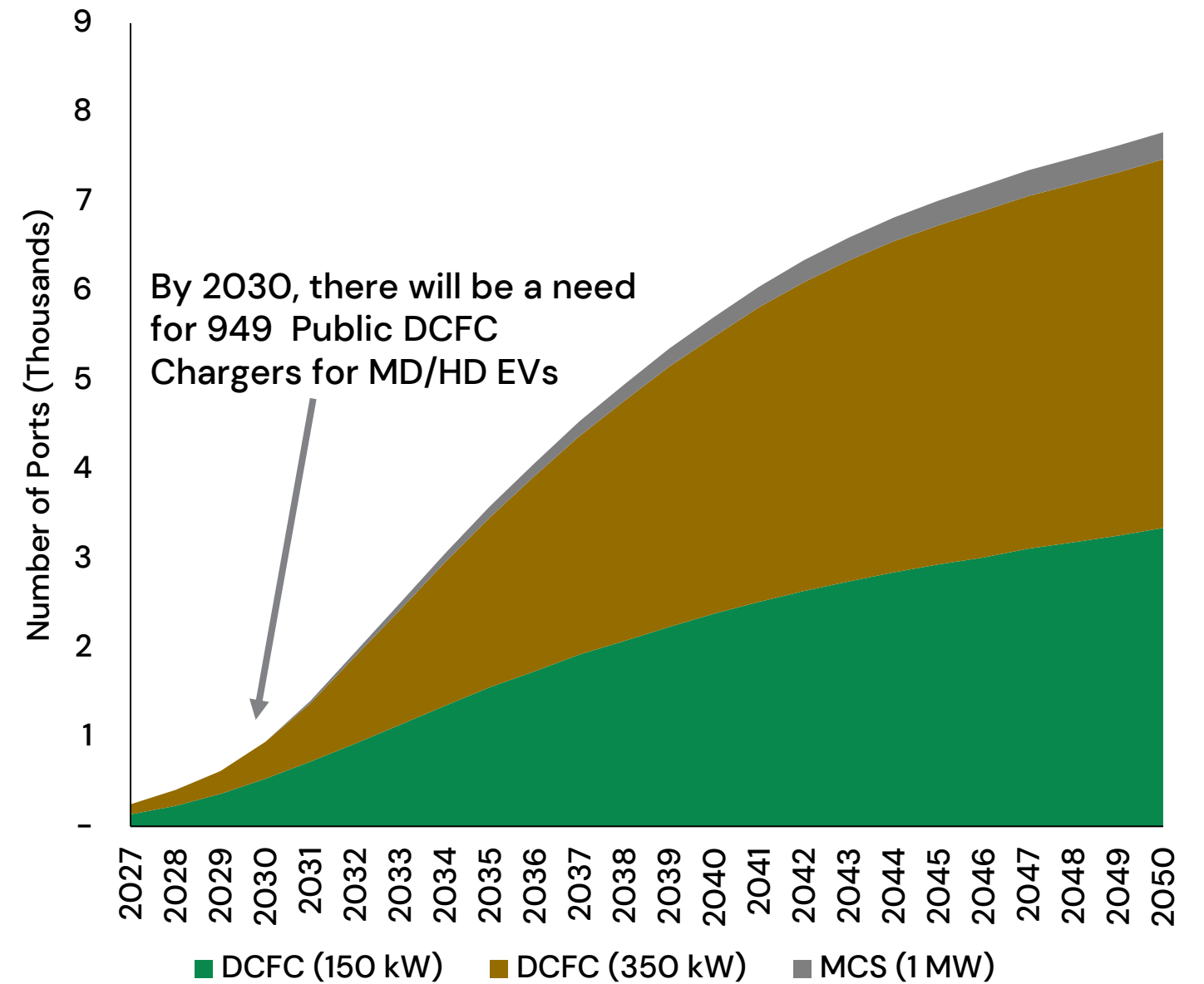


Medium & Heavy-Duty Charging Infrastructure Needs – Scenario 1

Projected Depot Chargers for MDHD Vehicles

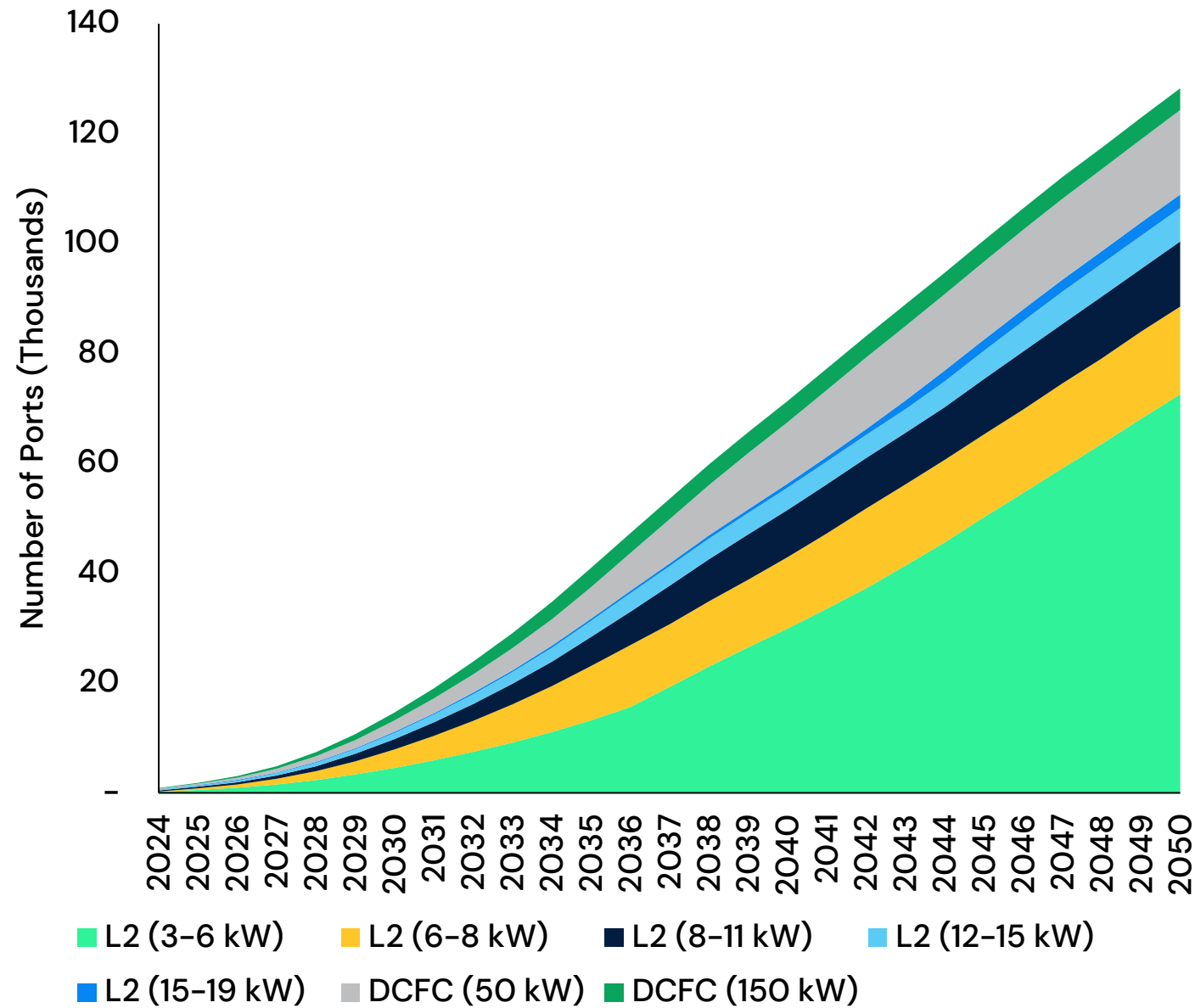


Projected Public Chargers for MDHD Vehicles

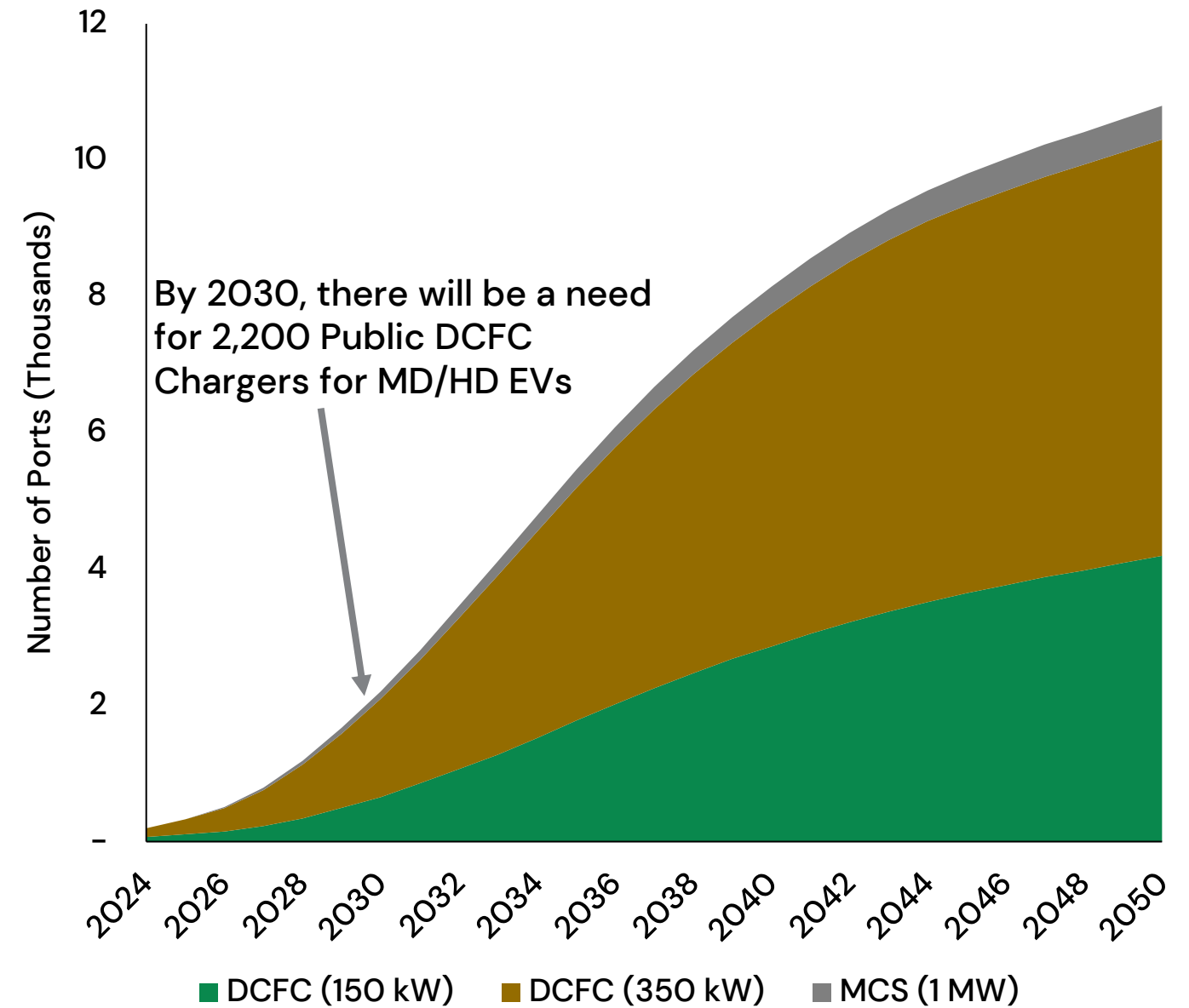


Medium & Heavy-Duty Charging Infrastructure Needs – Scenario 2

Projected Depot Chargers for MDHD Vehicles

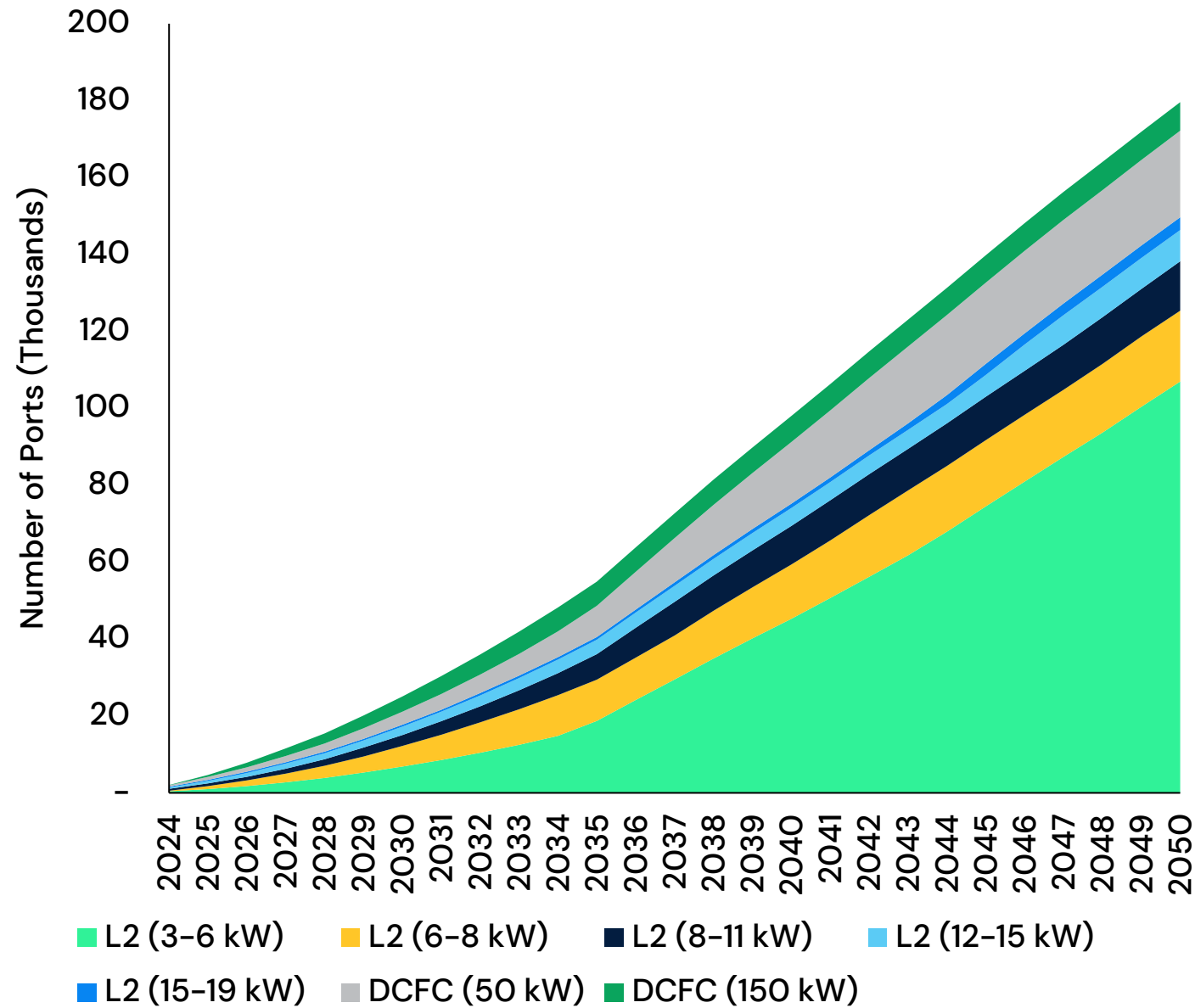


Projected Public Chargers for MDHD Vehicles

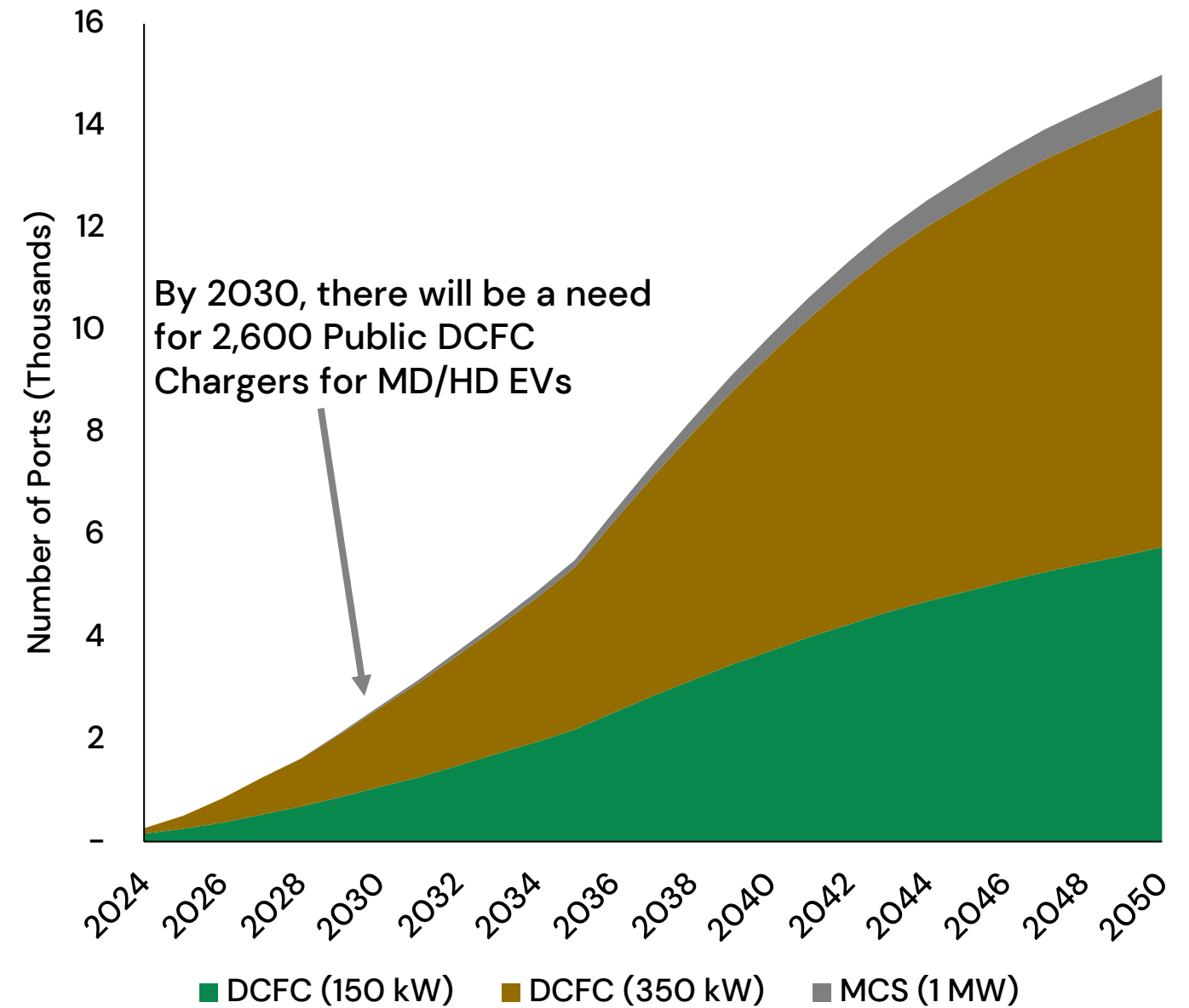


Medium & Heavy-Duty Charging Infrastructure Needs – Scenario 3

Projected Depot Chargers for MDHD Vehicles

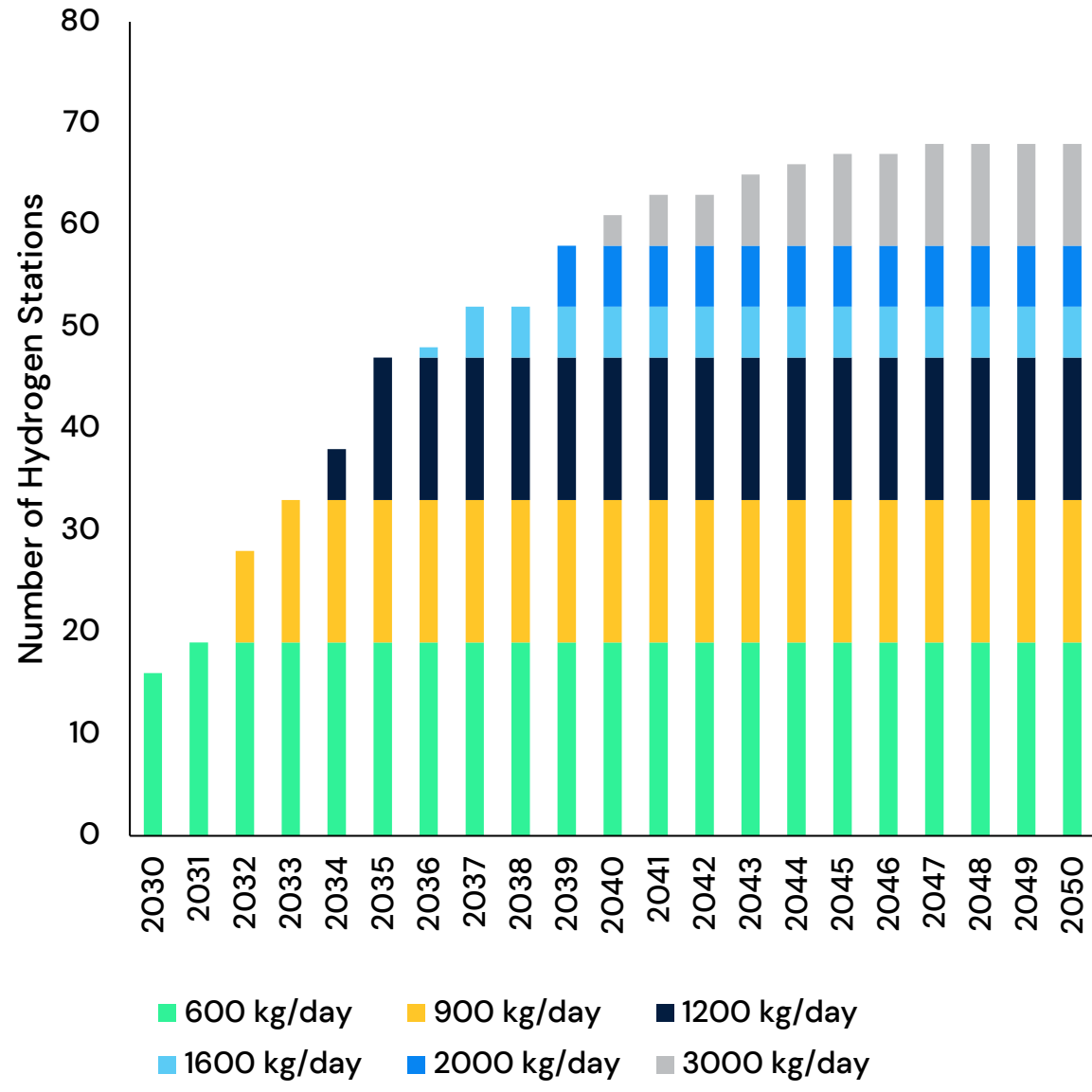


Projected Public Chargers for MDHD Vehicles

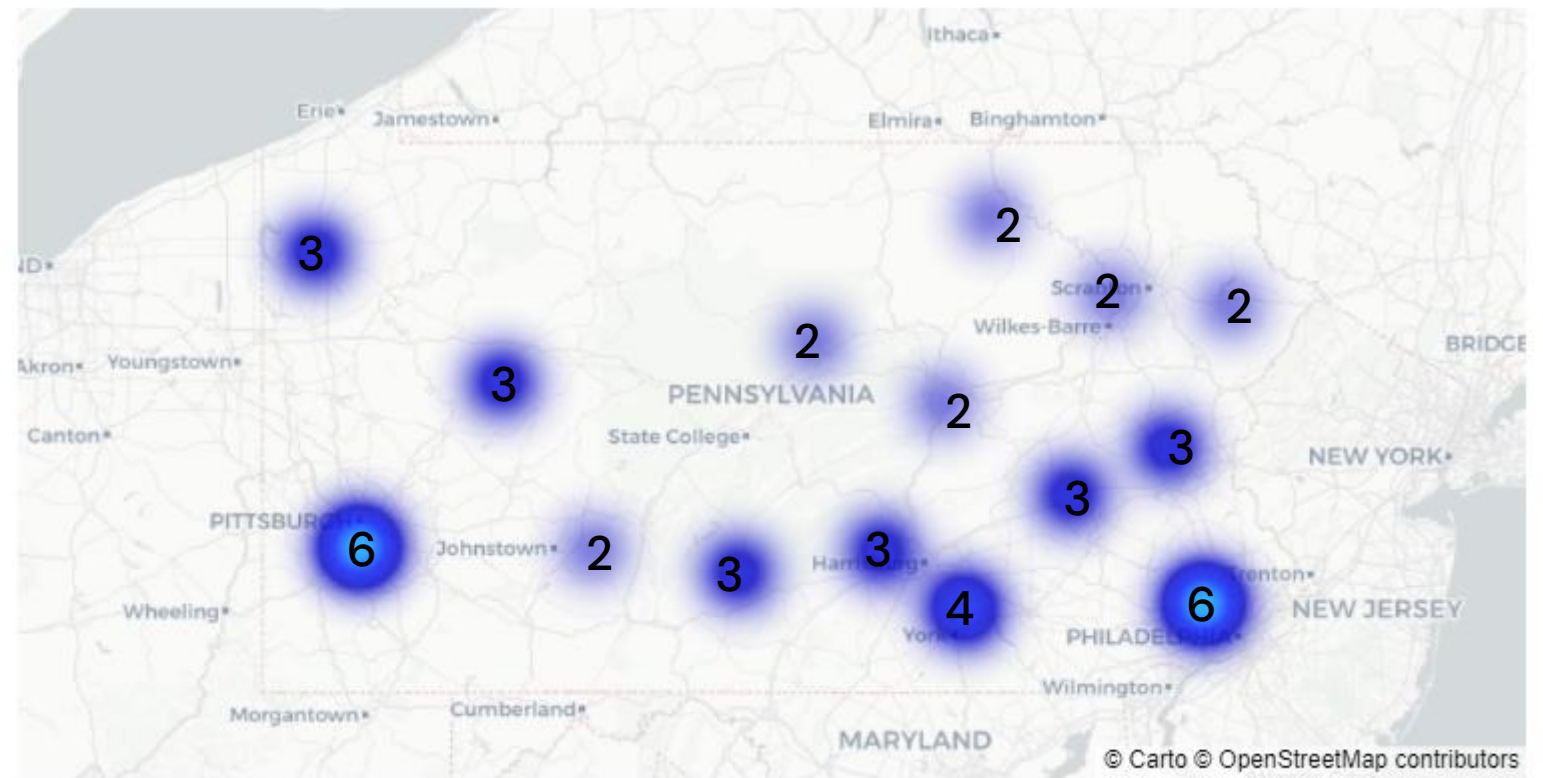


Hydrogen Infrastructure Needs – Scenario 1

Total Number of Hydrogen Stations

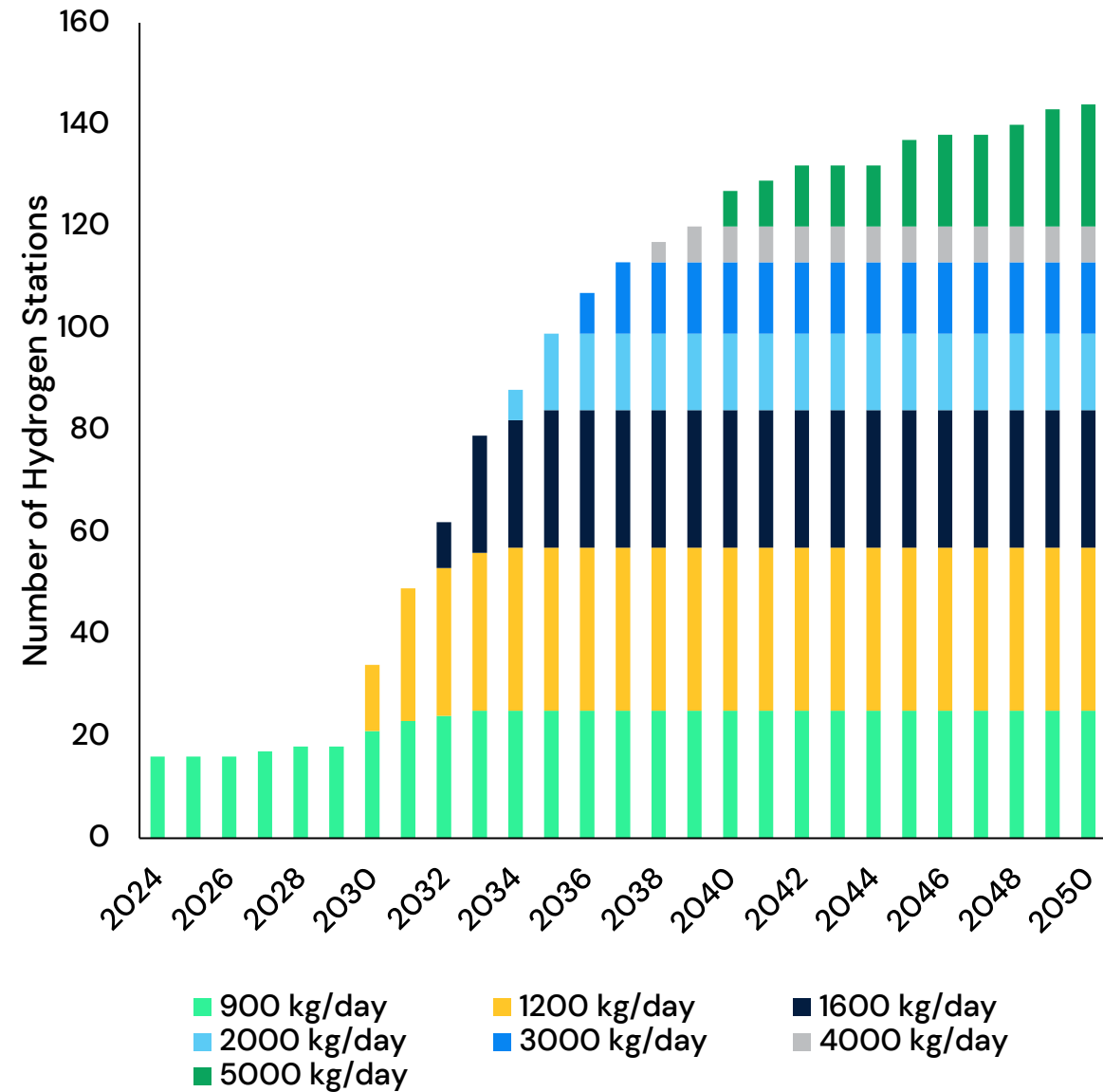


Number of Hydrogen Stations by 2035

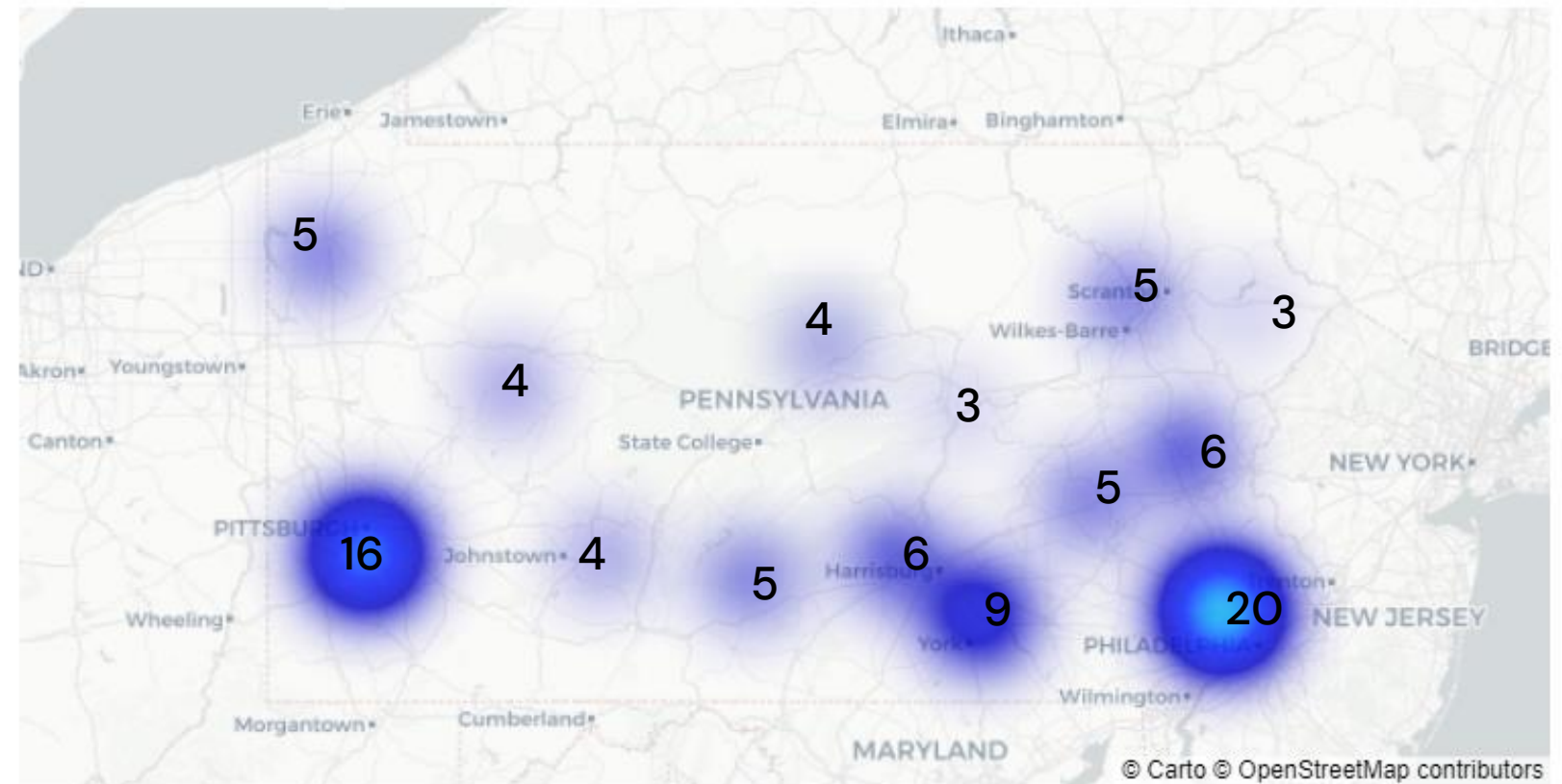


Hydrogen Infrastructure Needs – Scenario 2

Total Number of Hydrogen Stations

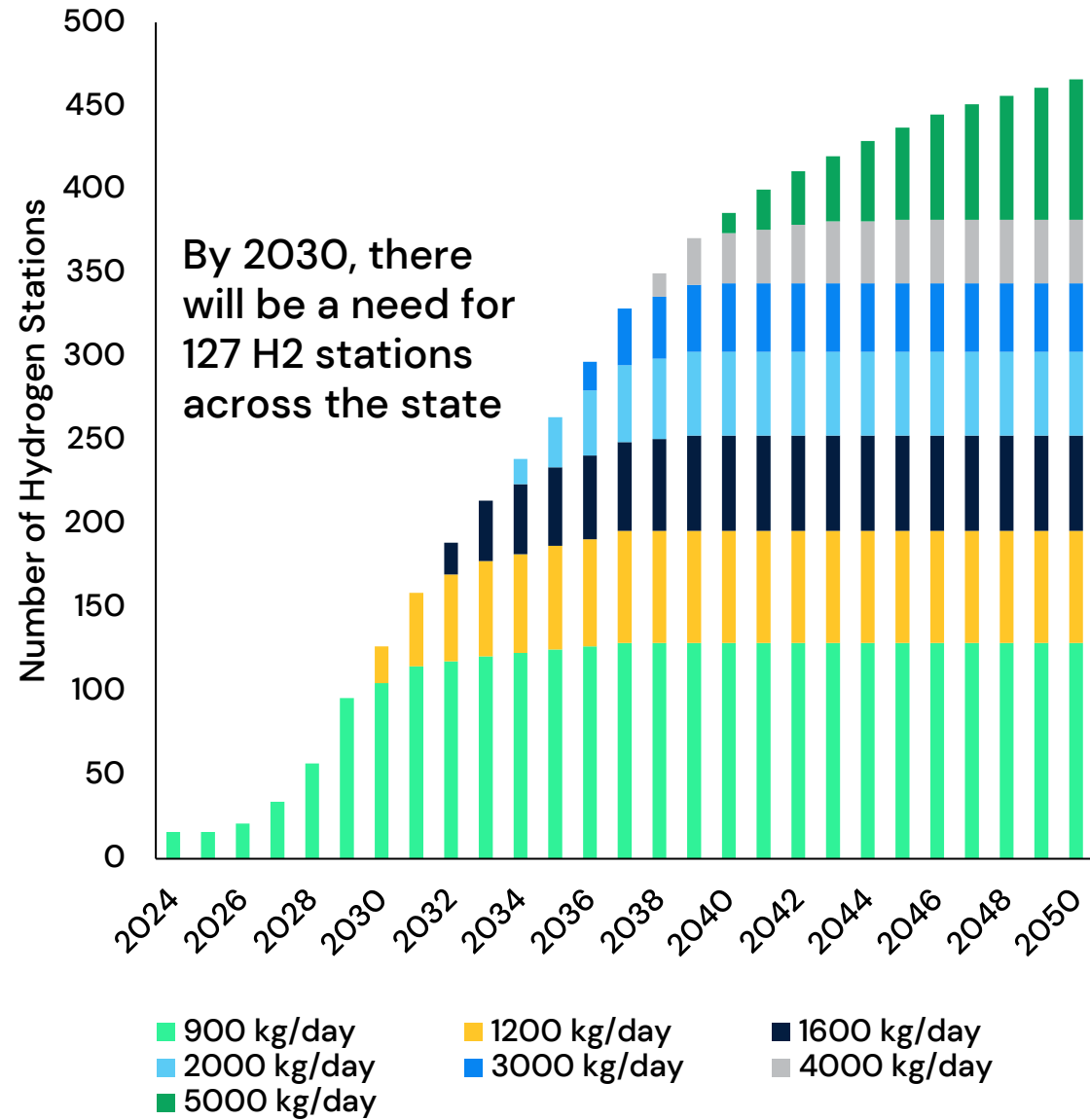


Number of Hydrogen Stations by 2035

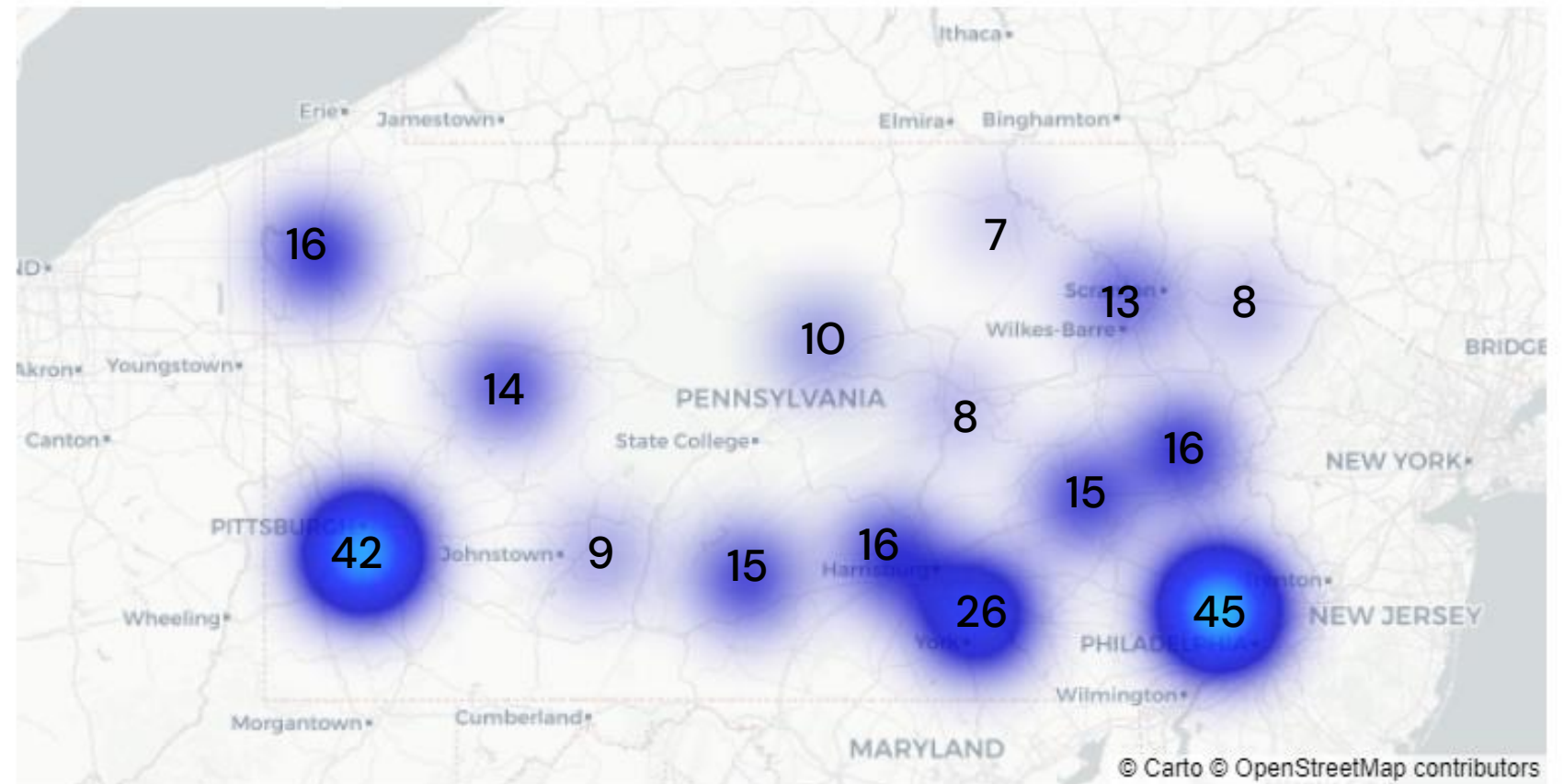


Hydrogen Infrastructure Needs – Scenario 3

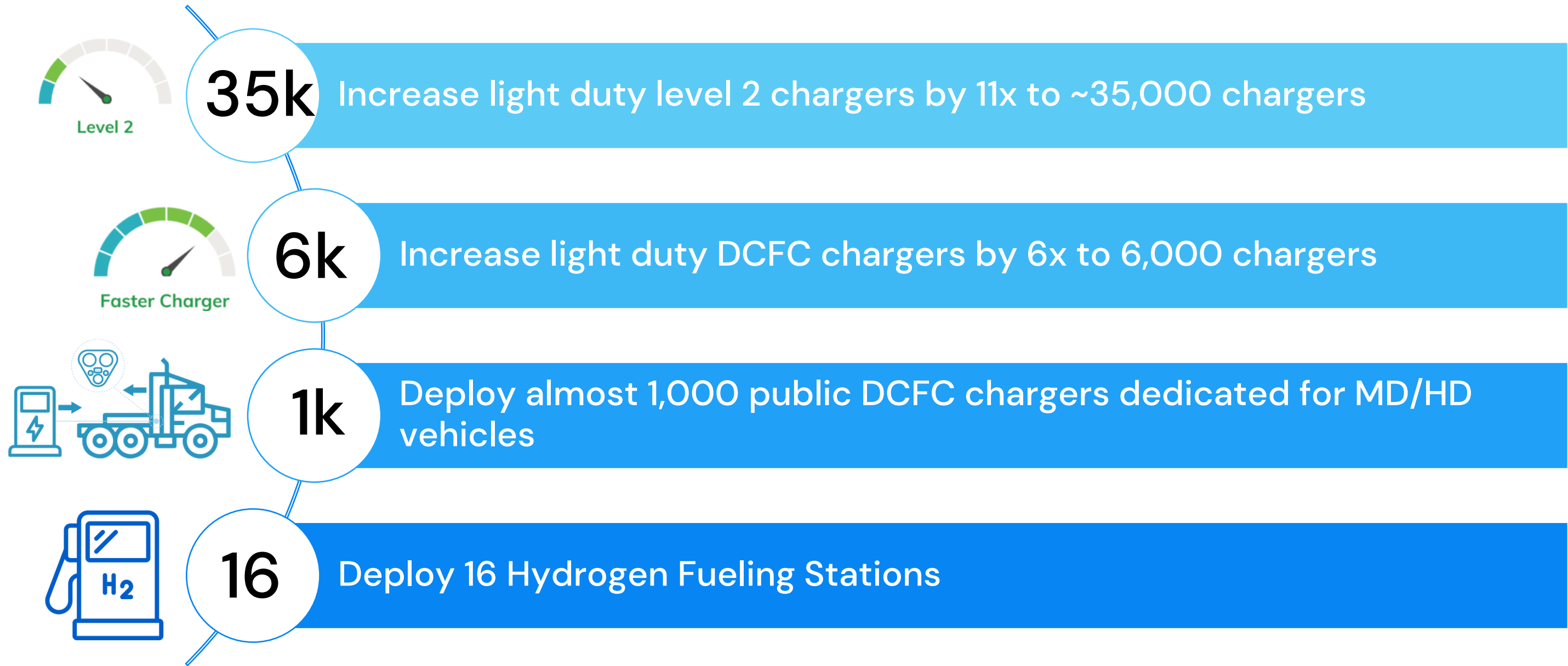
Total Number of Hydrogen Stations



Number of Hydrogen Stations by 2035



To meet the ZEV infrastructure needs under Scenario 1, the State needs to..





Preliminary Growth Strategies

(Give us your feedback)



Objective

Goal: craft a set of strategies for the accelerated adoption of Zero-Emission Vehicles (ZEVs) and their associated infrastructure in Pennsylvania



Foundational Research

- i. Analyze existing PA ZEV Roadmap, conditions and barriers
- ii. Identify successes and assess changes in the landscape.
- iii. Analyze successful practices in other regions/programs.



Collaboration with DEP

Engage DEP Energy Programs Office for insights and alignment with Pennsylvania's unique requirements.



Stakeholder Engagement

Leverage Drive Electric PA Coalition for real-world experiences and insights (group discussions, surveys).



Strategy Formulation

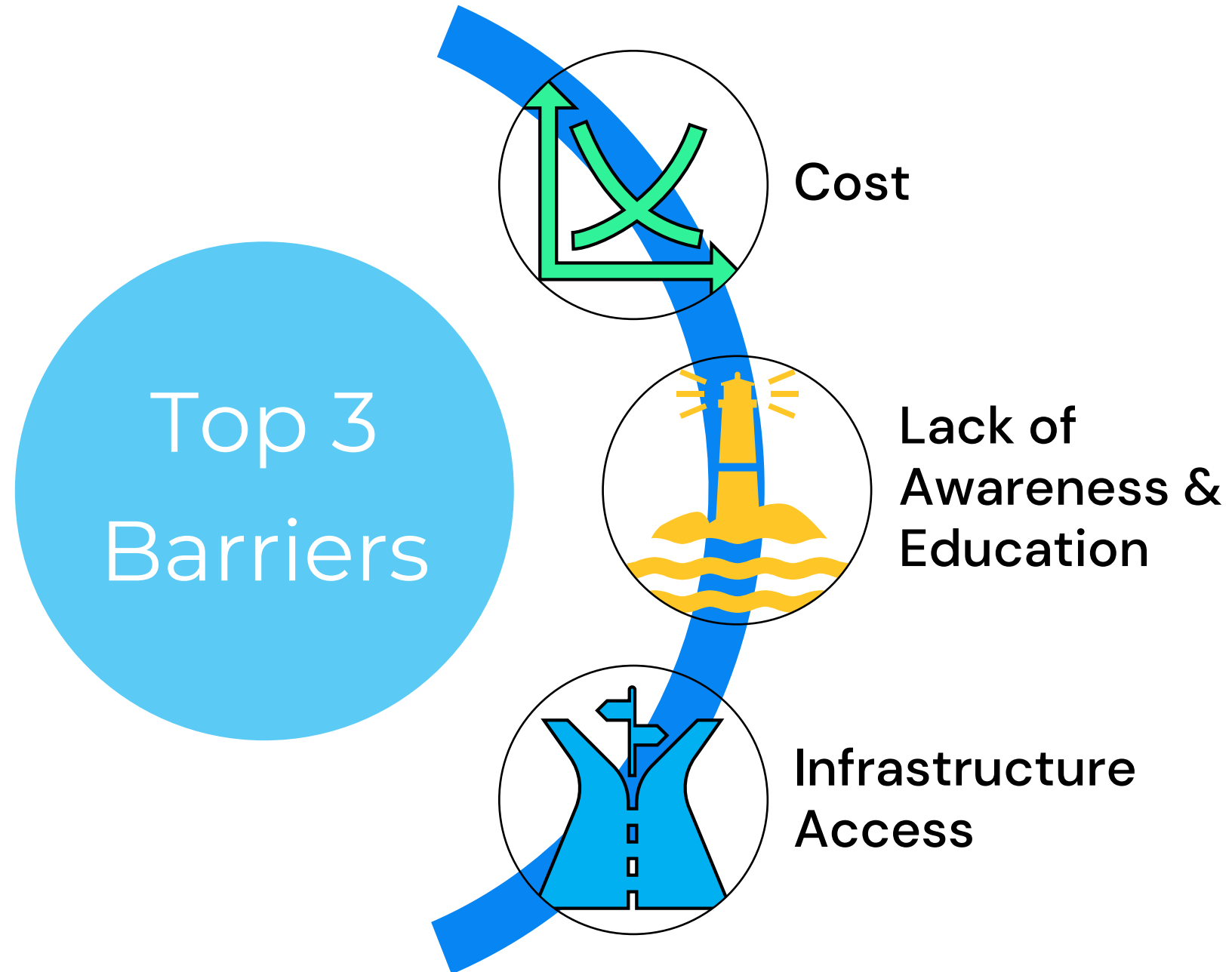
Draft strategies addressing goals, policies, regulations, planning, marketing and education.



Iterative Refinement

Incorporate feedback from DEP and stakeholders for holistic and actionable strategies.

Major Barriers to Transition



Strategy Categories



Develop and support **targeted incentive programs** for vehicles and infrastructure



Implement **targeted marketing and education program**



Enhance **data collection** on ZEV vehicle registrations, infrastructure reliability, and consumer interests



Support local jurisdictions in **amending building codes, permitting, and zoning** to promote ZEVs



Promote **public-private partnership models**



Provide **technical assistance** through resource sharing and fleet support



Support the development of a **specialized workforce** through training and apprenticeship



Lead by example: Support transitioning state and local public fleets to ZEVs

Targeted Incentive Programs



Purchase Incentives

- Purchase incentives (new or used ZEVs)
- Diversified incentive types
- Accessible to low-income applicants and small businesses



Infrastructure Incentives

- Equipment, construction, and operation
- Prioritize disadvantaged communities
- Encourage clean energy generation and distribution



Utility Incentives

- Utility EV rate programs
- Make-ready & grid enhancement programs



Access Incentives

- Promote clean technology in designated areas
- Priority parking access for ZEVs



Research and Development Incentives

- Clean transportation technology and safety
- Clean energy generation and smart charging
- Research institutes and startup companies

Targeted Incentive Programs



[Clean Cars 4 All, California](#)



[Clean Vehicle Rebate Program \(OCVRP\), Oregon](#)



[Tacoma's Electric Vehicle Discount Program, Washington](#)



[California Electric Vehicle Infrastructure Project \(CALeVIP\)](#)



[Curbside Level 2 Charging Project, New York](#)



[Energy Infrastructure Incentives for Zero-Emission Commercial Vehicles \(Energize\), California](#)



[Charge Ready NY program](#)

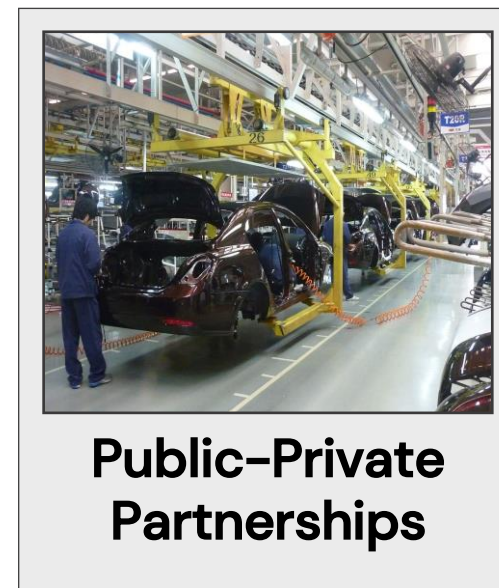
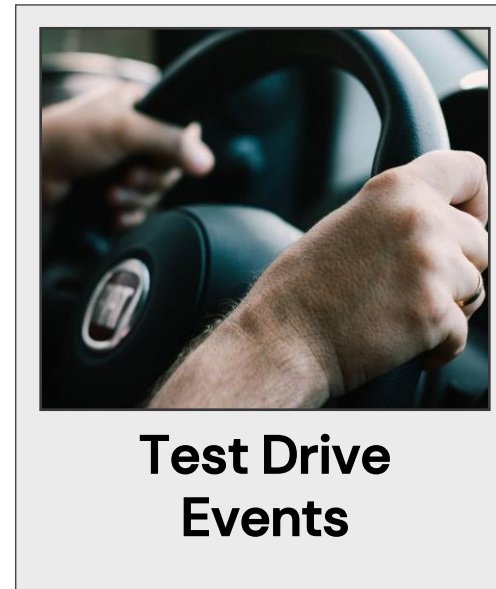


[Community Renewable Energy Grant Program, Oregon](#)



[Alternative Fuel Vehicle \(AFV\) Parking Incentive, Arizona](#)

Marketing, Education, and Outreach



Marketing, Education, and Outreach



Zero Emission Trucks Showcase + Ride & Drive

CALSTART CALIFORNIA AIR RESOURCES BOARD

ZERO-EMISSION TRUCKS

SHOWCASE + RIDE AND DRIVE

INCLUDING OFF-ROAD AND CHARGING/REFUELING EQUIPMENT

REGISTRATION OPENS MAY 15

WEDNESDAY 6/21/23

8 A.M. - 4 P.M.

SAVE MART CENTER @ FRESNO STATE
2650 E. SHAW AVENUE, FRESNO, CA 93710
FOR MORE INFORMATION, PLEASE CONTACT SJV@CALSTART.ORG

[CALSTART Ride & Drive](#)

EDF ENVIRONMENTAL DEFENSE FUND Finding the ways that work

Dallas-Fort Worth CLEAN CITIES

North Central Texas Council of Governments

Zero-Emission Vehicle Workshop

April 25, 2022

Question and Answer

We will be using Online Questions throughout the presentation. Event number is: **4252022**

- Visit OnlineQuestions.org
- OR
- Scan the QR Code to join

[Texas Zero-Emission Heavy-Duty Vehicles Workshop](#)

Webinar: Understanding and supporting the used ZEV market

Presenters: Alexander Tankou (*International Council on Clean Transportation*); Rachel Sakata (*Oregon Department of Environmental Quality*); Scott Case (*Recurrent*); and Aseer Khalid (*Electric Vehicle Association England*)

December 15, 2021

[ZEV Alliance Second-hand ZEV market webinar](#)

Data Collection

Detailed ZEV Registration Data

- Establish and maintain an improved centralized system to track ZEV data
- Public surveys

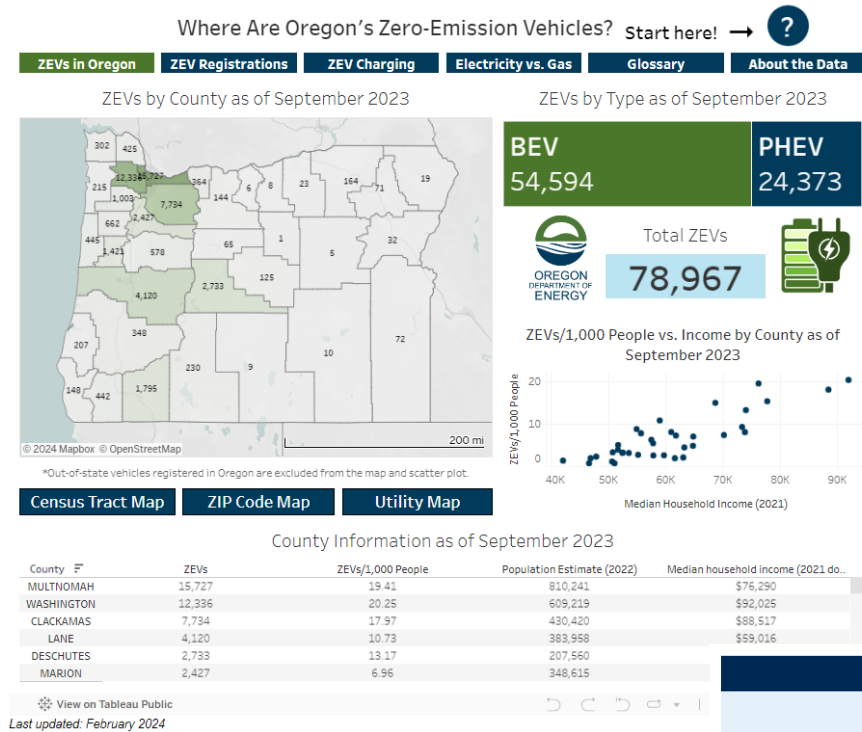
Refueling Infrastructure Reliability

- Collaborate with charging operators & hosts
- Collaborate with local jurisdictions and adopt standard data collection methods
- Public surveys

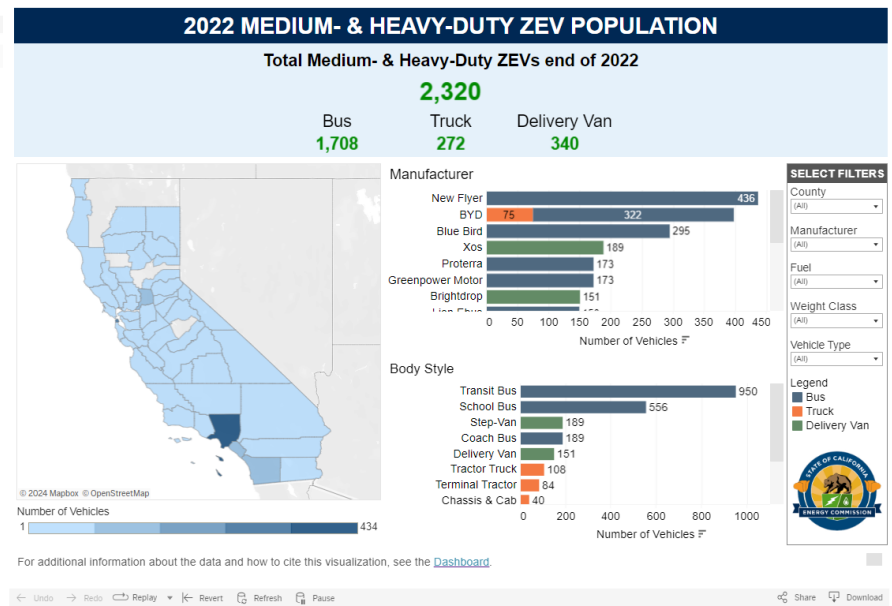
Consumer Interests

- Collaborate with research institutions or other organizations to conduct market research surveys & focus group discussions
- Collaboration with dealerships

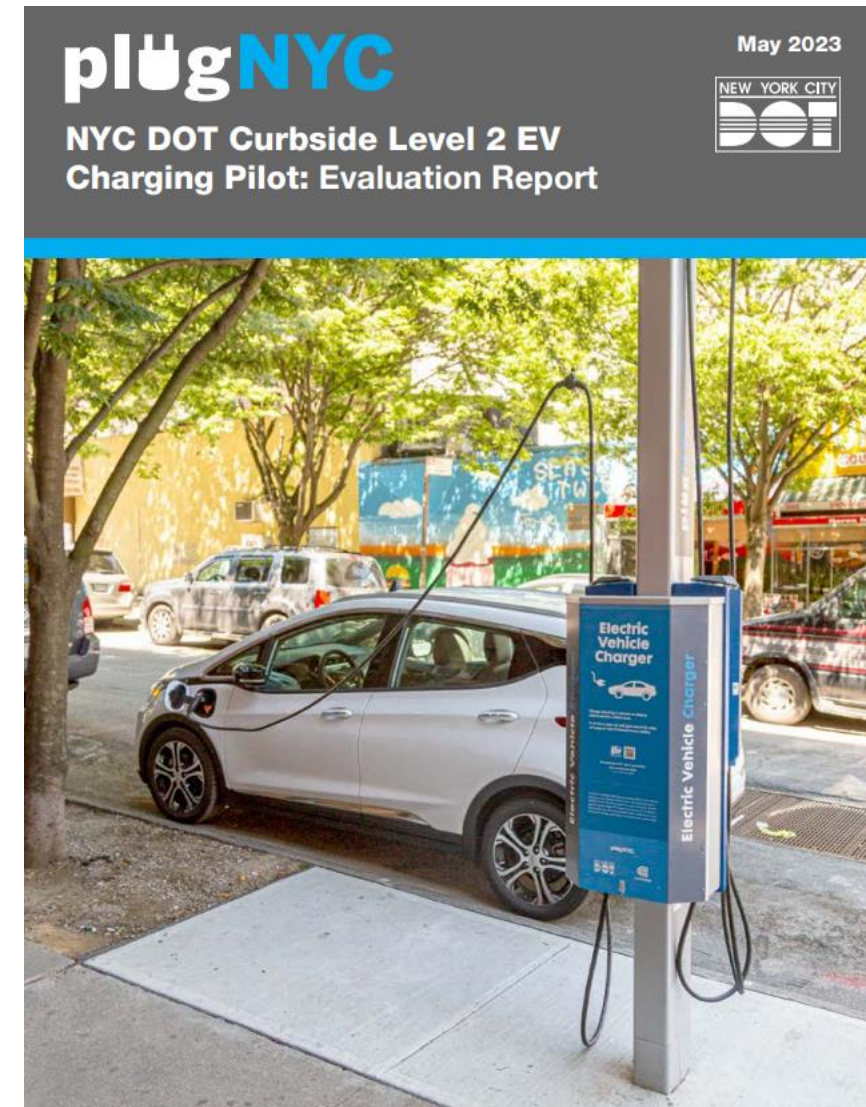
Data Collection



[Oregon ZEV Dashboard](#)



[California Energy Commission-Medium- and Heavy-Duty Zero-Emission Vehicles](#)



[NYC DOT-Nation's first evaluation report on curbside electric vehicle charging](#)

Building Codes, Permitting and Zoning

Provide guidance and support for local jurisdictions to promote ZEVs through:



Building Codes

Improve charging access for multifamily housing, urban areas etc.

Establish EV Capable Building Requirements

Ensure accessibility for people with disabilities



Leverage Public Property

Allocate public land for ZEV infrastructure

Improve and streamline land acquisition process



Land Banking

Acquire and hold land for ZEV infrastructure development

Ensure land availability for future demand



Zoning and Land Use Amendments

Facilitate infrastructure development in residential and commercial zones

Create designated zones for ZEV infrastructure



Streamline Permitting Processes

Simplify and expedite permitting for infrastructure projects

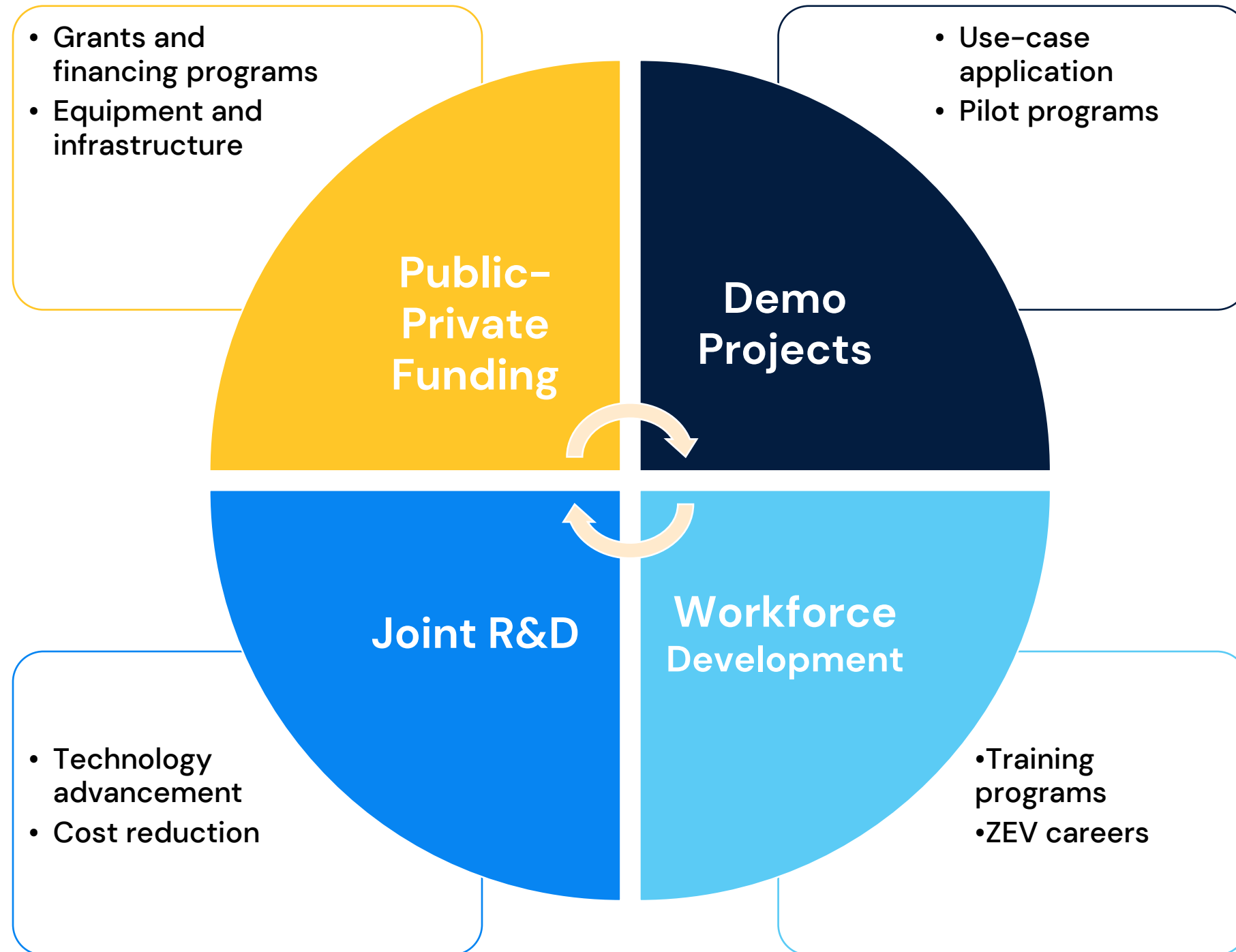
Reduce bureaucratic hurdles and approval time



Incentives for Developers

Tax credits or grants to encourage inclusion of infrastructure in projects

Promote Public-Private Partnership Models



Technical Assistance

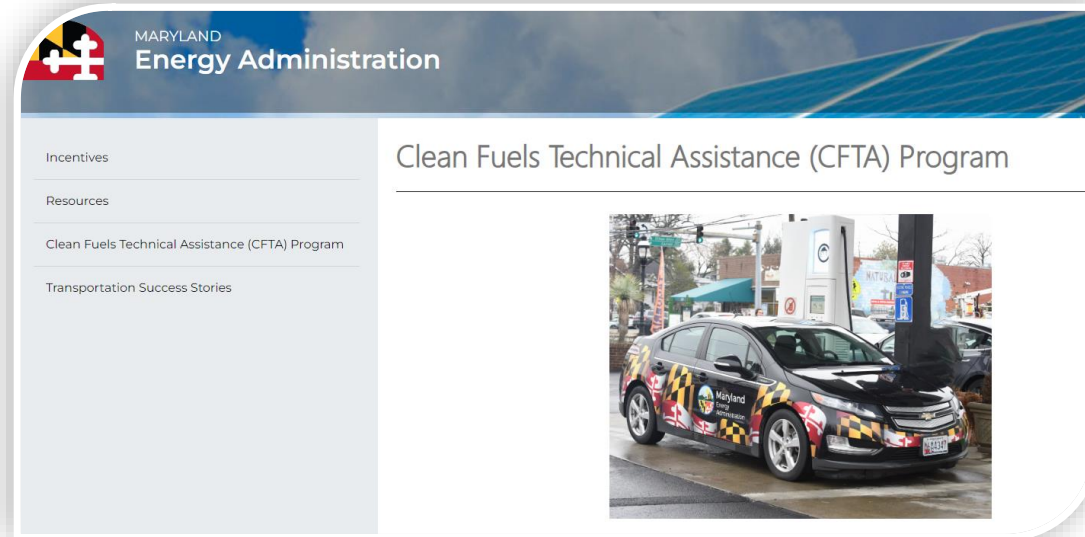


**Resources Sharing &
Improved User Experience**

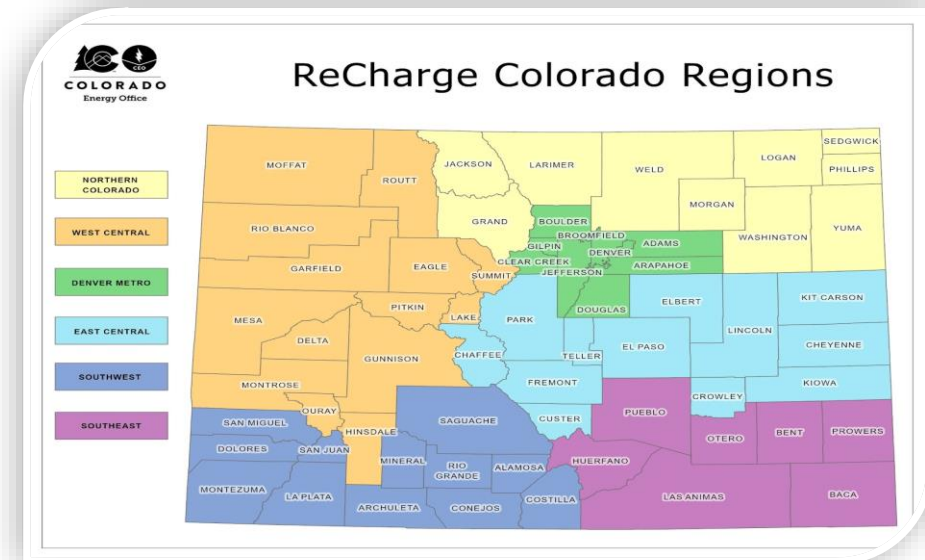


**Technical Support to
Fleets**

Technical Assistance



[Maryland Clean Fuels Technical Assistance \(CFTA\) Program](#)



[Colorado Energy Office's ReCharge Colorado program \(ReCharge\)](#)



[California Cal Fleet Advisor \(CFA\) program](#)



[Washington Department of Commerce & WSU Green Transportation Program- Alternative Fuels & Vehicles Technical Assistance Group](#)

Workforce Development

- Develop curriculum materials
 - Design and development of vehicles and equipment
 - Production of batteries
 - Upstream energy generation
 - Installation and maintenance of infrastructure
- Provide training programs for auto dealers
 - Collaborate with Pennsylvania Auto Association
 - Focus on vehicle specifications, EV incentives and alternative rate programs
- Fund student research projects
 - Support cutting-edge technology advancement
 - Nurture interests and empower the new generation

OUC ELECTRIFIED DEALER PROGRAM

Orlando Utilities Commission (OUC – The Reliable One) has introduced a new Electrified Dealer Program designed to enhance the electric vehicle (EV) purchasing experience and help increase and encourage EV purchasing/leasing in Central Florida. Through this program, local dealers can take advantage of financial incentives for each eligible electric vehicle sold or leased along with specialized EV training and educational materials.

BENEFITS

- Direct-to-dealer sales incentives
- Recognition on OUC's website
- Promotional media kit
- Lead generation from OUC Ride and Drive programming
- Marketing collateral for on-site use
- EV sales training to staff
- Co-marketing opportunities
- Opportunity for future marketing and program development with OUC and the City of Orlando

REQUIREMENTS

1. EV/PHEVs and ICE in inventory on lot
2. Actively sell and advertise EV/PHEVs
3. Share monthly EV/PHEV sales data with OUC
4. Two sales staff members must train with OUC twice a year
5. Functioning EV charging station on site at the dealership and available to customers
6. Participate with OUC in cross-promotion marketing

SALES STAFF TRAINING

Each training session will last approximately one hour, and cover key items, including:

- Overview of OUC and EV programming
- A highlight of available EV incentives
- How to engage with prospective EV buyers
- EV charging overview

SALES INCENTIVE (AVAILABLE ON AN INCREASING SCALE)	
NUMBER OF VEHICLES SOLD/MONTH	INCENTIVE PER VEHICLE
One EV	\$25 per vehicle
Two EVs	\$50 per vehicle
Three or more EVs	\$75 per vehicle

Join today and start earning incentives! To learn more, email tspencer@ouc.com.

OUC The Reliable One

[Orlando Utilities Commission](http://OrlandoUtilitiesCommission.com)

ELECTRIFIQTM

Distinguish your dealership and elevate your EV sales performance.

Key Benefits

- **Stand Out:** National ElectrifiQ certification boosts your dealership's EV reputation.
- **Comprehensive Training:** 90-minute, mobile-friendly course for you and your staff.
- **Join a Network:** Access the national ElectrifiQ network.
- **Drive Sales:** Learn techniques to address EV customer concerns.

Get Certified

- 1 PURCHASE**
Get two seats for the online course.
- 2 ENROLL**
Two staff members complete the course.
- 3 COMPLETE**
Listing in the national ElectrifiQ network.

Enroll Today!

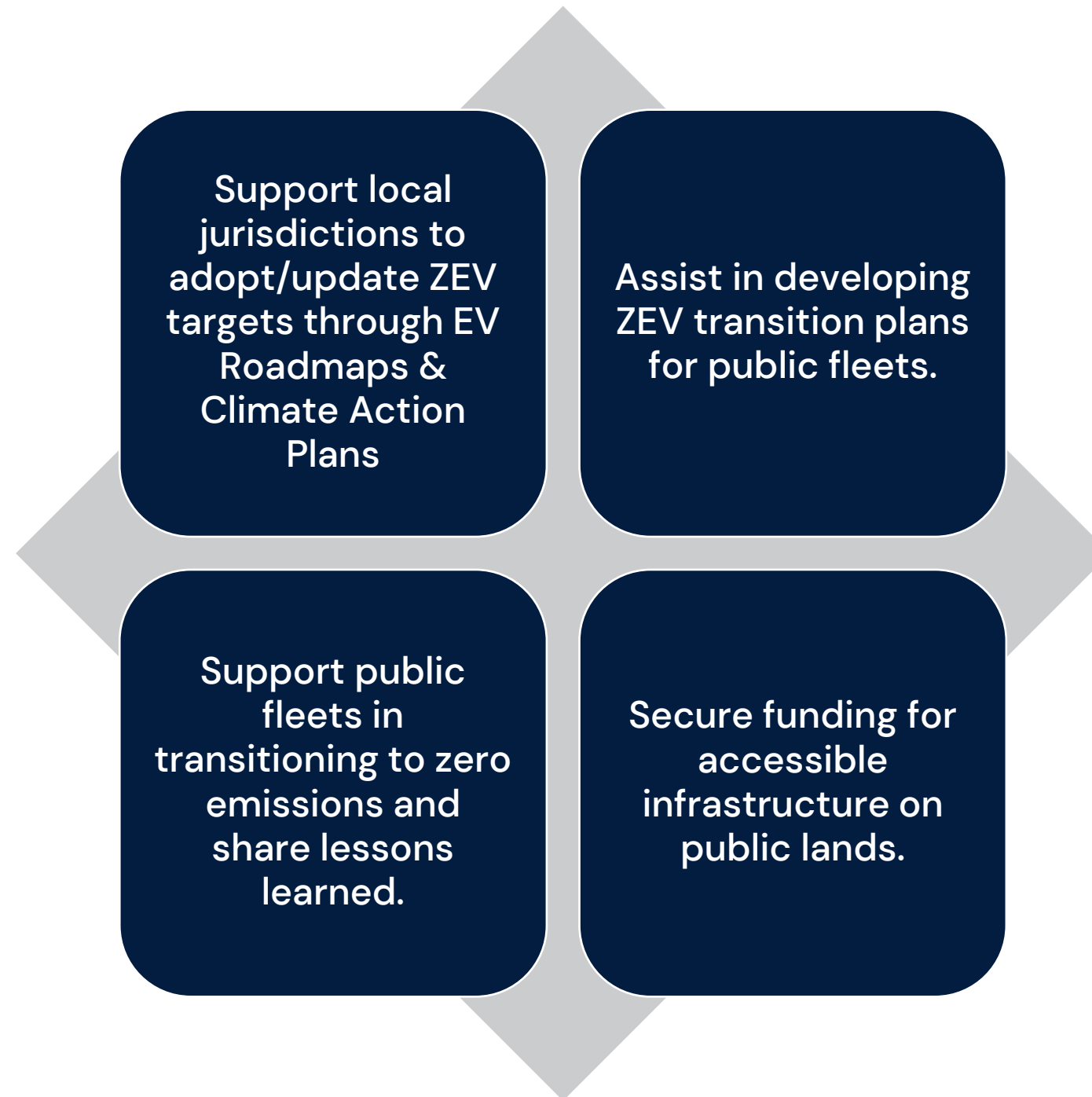
DISCOUNTED PRICING FOR SHOW
(With code NADASHOW. Good through February 16)

\$199
TWO CERTIFICATIONS

\$349
ENTIRE ROOFTOP

[National Automobile Dealers Association \(NADA\)](http://NationalAutomobileDealersAssociation.com) and the [Center for Sustainable Energy \(CSE\)](http://CenterforSustainableEnergy.com)

Lead by Example



Lead by Example

State and local examples

Connecticut: Gov. Ned Lamont's EO 21-3 aims for all newly leased state light-duty vehicles to be zero emissions by 2030.

Oregon: SB 1044 mandates 25% of new state agency light-duty fleet vehicle purchases to be ZEVs by 2025.

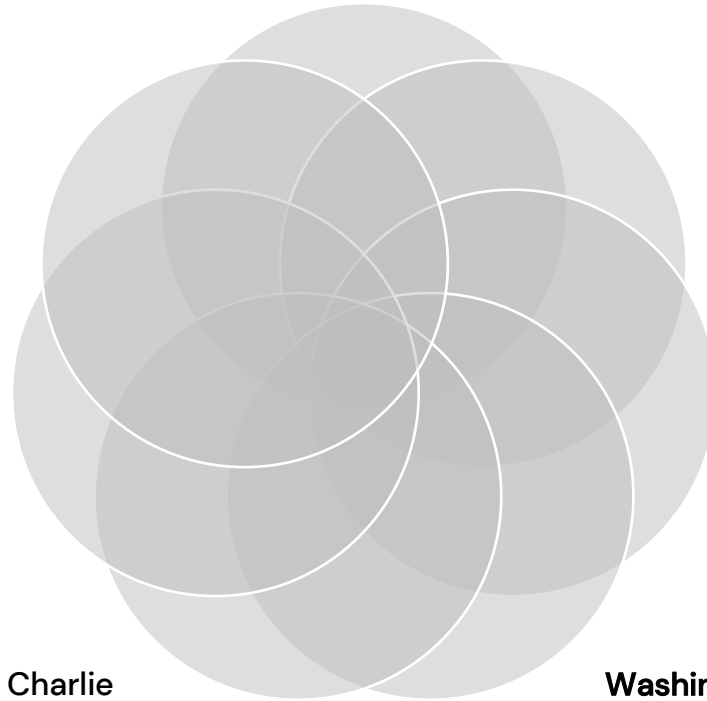
Virginia: SB 575 mandates the development of a total cost of ownership calculator for purchasing light- and medium-duty vehicles.

Massachusetts: Gov. Charlie Baker's EO 594 requires state agencies to buy ZEVs, double electric charging stations by 2030, and achieve a 100% zero-emission vehicle fleet by 2050.

Washington: Gov. Jay Inslee's EO 21-04 sets targets for 100% light-duty battery electric vehicle fleets by 2035 and fully electric medium- and heavy-duty fleets by 2040.

Maine: Gov. Janet Mills's EO 13 prioritizes lowering employee vehicle mileage, adopting EVs, and installing charging stations on state property.

Illinois: Gov. J.B. Pritzker's EO 2021-08 establishes a vehicle procurement program for electric and zero-emission vehicles, creating a state fleet working group.



The city of Philadelphia released a plan for the city to electrify 6,000 vehicles in the city fleet by 2030.



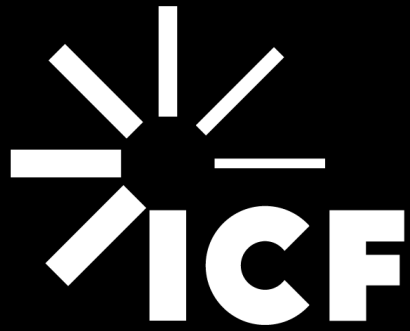
Discussion & Feedback

Attendee Input



Please Complete Feedback Form by March 6!

<https://forms.gle/WoHjUiUnGUoKcpLHA>



Get in touch with us:
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About ICF

ICF (NASDAQ:ICFI) is a global consulting and digital services company with over 7,000 full- and part-time employees, but we are not your typical consultants. At ICF, business analysts and policy specialists work together with digital strategists, data scientists and creatives. We combine unmatched industry expertise with cutting-edge engagement capabilities to help organizations solve their most complex challenges. Since 1969, public and private sector clients have worked with ICF to navigate change and shape the future.



Back up slides



Targeted Incentive Programs—Examples of Actions

Consider improving/expanding existing rebate programs to 1) adjust eligibility requirements to make the incentives accessible to a broader range of residents, including pre-owned EV owners, high-mileage fleets and residents in DACs or suburban/rural areas and 2) consider voucher incentive structure (point-of-sale rebates).

Create and administer new incentive program to financially support the development, construction, and operation of charging or refueling stations. These programs can include grants, tax credits, or low-interest loans for residents, businesses or organizations investing in such infrastructure. Collaborate with utilities to expand at-home and near-home charging for multifamily residents, especially in DACs. State's role is focused on providing siting guidelines, community outreach, site evaluation.

Collaborate with and actively engage utility companies to negotiate, and develop a strategy for testing and implementing alternative EV rate programs.

Lead initiatives to develop "make-ready" and grid enhancement programs. These programs should focus on accelerating the installation of charging equipment, especially in areas with limited access to ZEV infrastructure. Engage utility companies to secure investments for grid enhancements in targeted areas.

Enact legislation and regulations that support the alignment of interests among developers, utilities, and customers. This may include creating frameworks for cost recovery mechanisms, allowing utilities to recover costs associated with "make-ready" programs through rate adjustments or other recovery mechanisms.

In addition to existing HOV access, develop and implement ZEV parking incentive programs in public parking facilities and park-and-ride lots. These incentives can include preferential spaces, reduced fees, and fueling infrastructure.

Introduce grants, tax credits, incubator programs and partnerships to support R&D in EVs, fuel-cell technology, and sustainable transportation solutions. Host innovation challenges and competitions to attract talent, and provide financial rewards for successful projects. Specific focus should be given to projects for medium- and heavy-duty vehicles.

Marketing, Education, and Outreach—Examples of Actions

Develop an information hub to educate the public, potential buyers, and new ZEV owners, covering various aspects of ZEV ownership, including vehicle availability, charging/ fueling infrastructure considerations, generic total cost of ownership calculators, a “how to get started guide” including typical steps and timelines for considering ZEVs in fleets, available incentives, public facing reports or case studies.

Create feedback portal where residents across Pennsylvania can actively suggest preferred locations for charging stations and voice any concerns about potential installations.

Maintain an EV Dashboard that provides detailed data on EV registrations, charging infrastructure, and incentive utilization.

Organize workshops for consumers to address common concerns and misconceptions about ZEVs or provide feedback on proposed policies/incentive programs.

Collaborate with EV manufacturers and dealerships to organize more test drive events for medium-and heavy-duty vehicles or loaner programs that allow fleets to borrow a truck for a period of time and use it in real-world service, helping fleets gain operational experience.

Host webinars tailored to different industries (e.g., logistics, construction) to showcase successful case studies of medium- and heavy-duty electric and hydrogen vehicle implementations.

Implement pilot demonstration projects in collaboration with local municipalities or businesses to showcase the viability and benefits of medium and heavy-duty electric and hydrogen vehicles.

Use public-private partnerships for implementation to speed deployment, leverage private investment, and reduce the financial exposure of the cities.

Existing Barriers–Overview

Barrier	Affected vehicle type	Affected fuel type
High upfront vehicle costs (especially for low-income households)	LDV	E, H
Limited fueling infrastructure	LDV, MHDV	E, H
Range anxiety	LDV, MHDV	E
Charging station reliability	LDV, MHDV	E
Grid capacity, grid connectivity and power availability	LDV, MHDV	E, H
Lack of awareness and education	LDV, MHDV	E, H
Technology availability	LDV, MHDV	E, H
Legislative support and state leadership	LDV, MHDV	E, H
Data gaps	LDV, MHDV	E, H
Dealership experience	LDV, MHDV	E, H
Lack of secondary vehicle market	LDV	E
Lack of maintenance/trained workforce	LDV, MHDV	E, H
Equity considerations in installing/funding for charging infrastructure	LDV, MHDV	E, H
Permitting and code enforcement	LDV, MHDV	E, H

Notes:
 LDV: light-duty vehicle; MHDV: medium-/heavy-duty vehicle
 E: electric; H: hydrogen

Project Schedule

