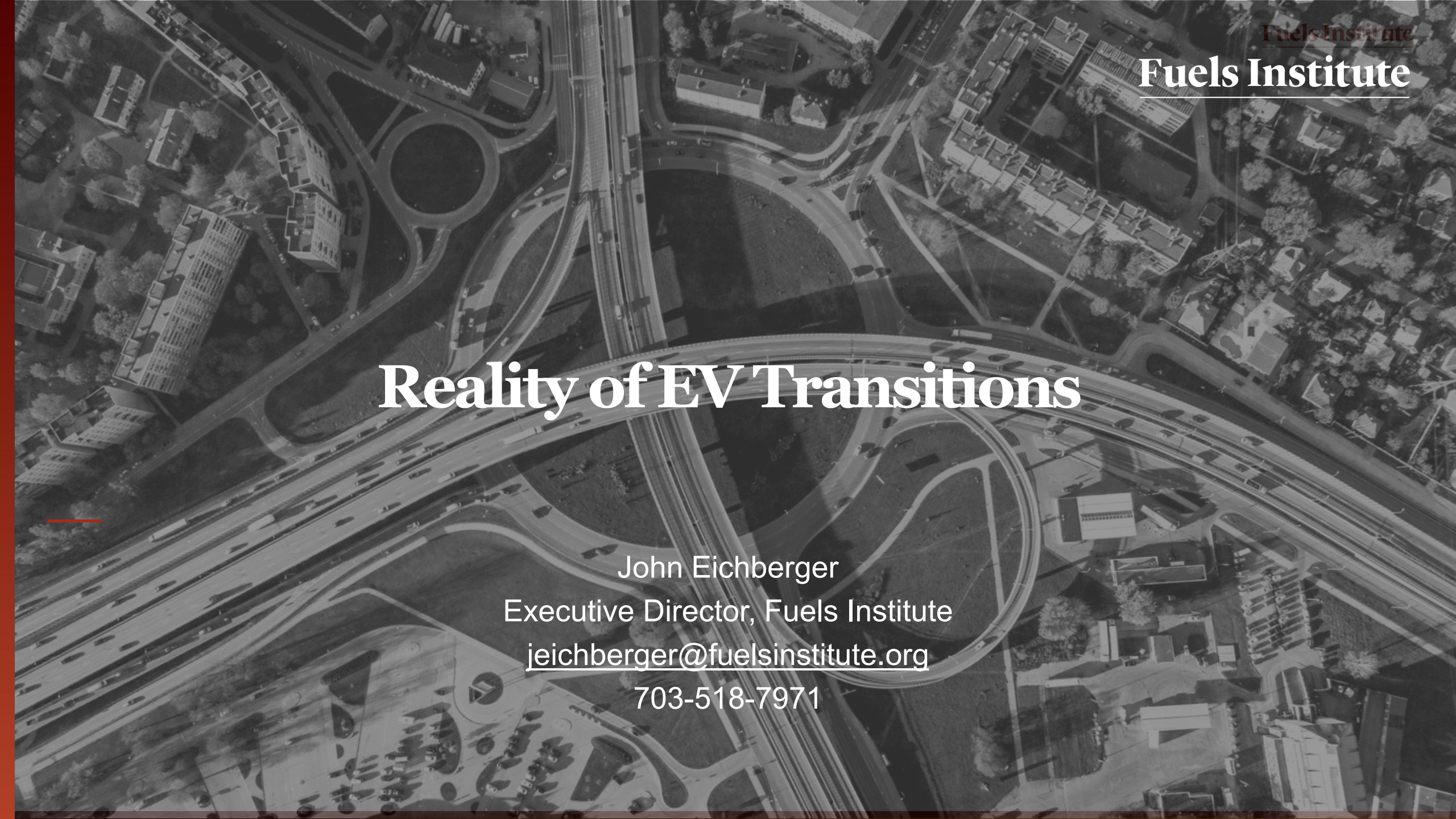

Fuels Institute

Reality of EV Transitions

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Fuels Institute Board of Advisors

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Electric Vehicle Council

Powered by Fuels Institute

Formed in March 2020, comprised of 65 different organizations focused on EV infrastructure.

7-Eleven	GC Consulting	PEI
ACI Worldwide	GetGo Café+Market	Petroleum Marketing Group
Alliance for Transportation Electrification	Gilbarco Inc.	Phillips 66
Capital One	Gilbarco-Veeder Root	Plug-In America
ChargerHelp!	Global Partners	Potter EV
Costco Wholesale	Guardian Fueling Technologies	Potterev
CSE	Hightowers EV Solutions, LLC	Seneca Companies
Delek US	Intel Corporation	Sheetz
Diebold-Nixdorf	JF Petroleum	Shell
Dover Fueling Solutions	Kalibrate	SIGMA
Duke Energy	Kum & Go, L.C.	Smart Energy Consumer Collaborative
EcoEngineers	Kum&Go	Southern Company
Electric Era Technologies	NACS	Techniche Americas LLC
Electric Power Research Institute (EPRI)	NAFA Fleet Management Association	Tesla
Electrify America	National Car Charging	Texas Food & Fuel Association
EVgo	National Transportation Research Center	Toyota Motors North America
EY Parthenon	NextEnergy	Transport Energy Strategies
FLO	North Central Texas Council of Governments	U.S. Department of Energy
Franklin Electric	NREL	Verifone
FreeWire	Oneida Engineering Solutions, LLC	W. Capra Consulting Group
FreeWire Technologies	P97 Networks, LLC	Walmart
Fuel Market News	Parkland Fuel Corporation	

Electric vehicles will play a very important role, but…

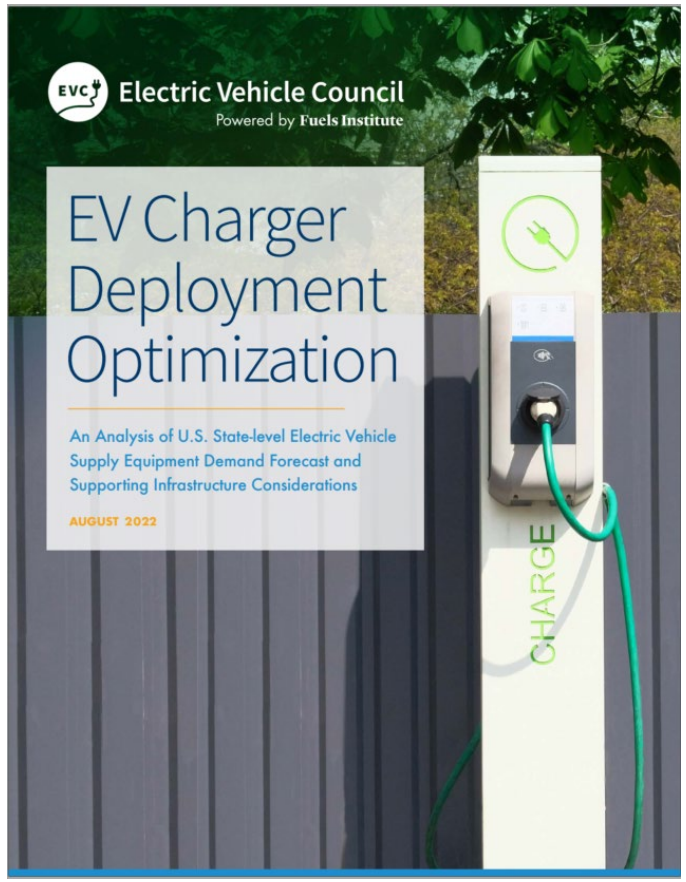
Perception and Reality Differ

Americans believe that 20% of vehicles in operation are electric and that 24% of vehicles sold in 2021 were electric.

There is a distinct difference between perception & reality, projections & practical expectations.

S&P Global Mobility Forecast

Contrast this with recent forecasts of 50% of sales by 2030



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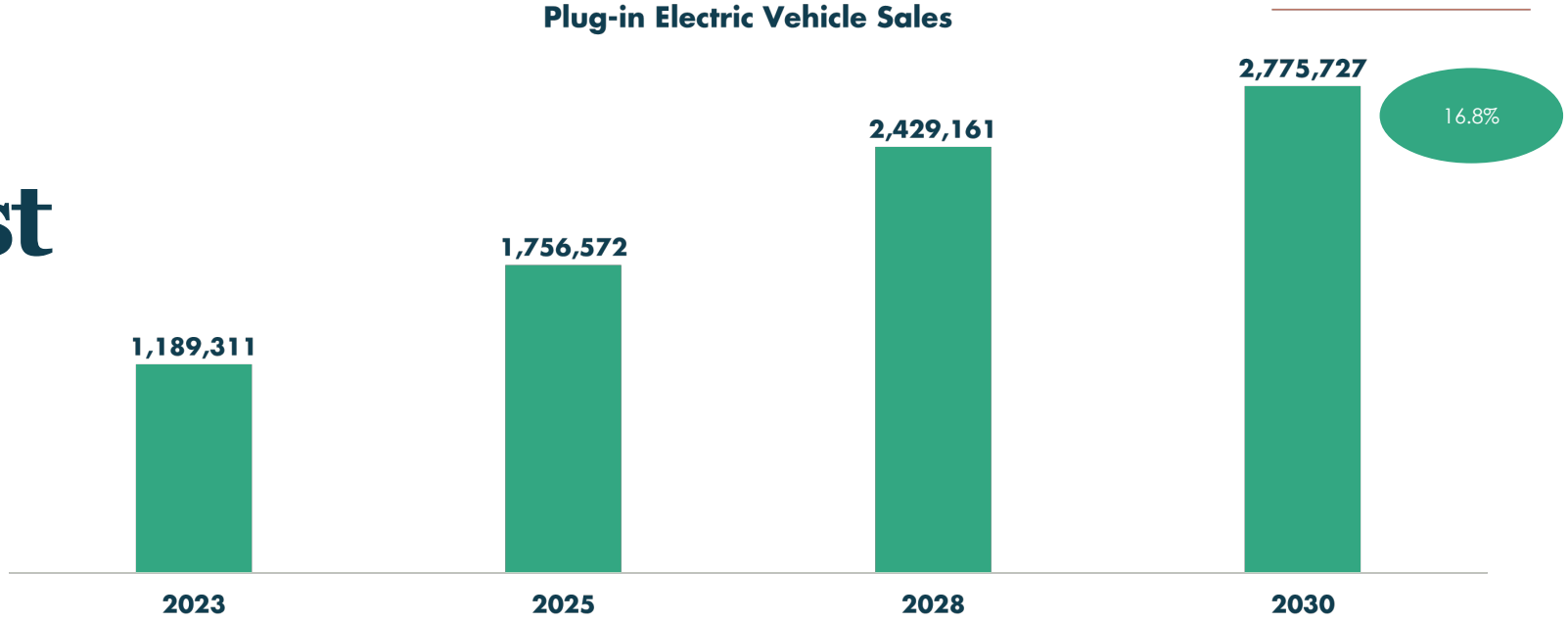
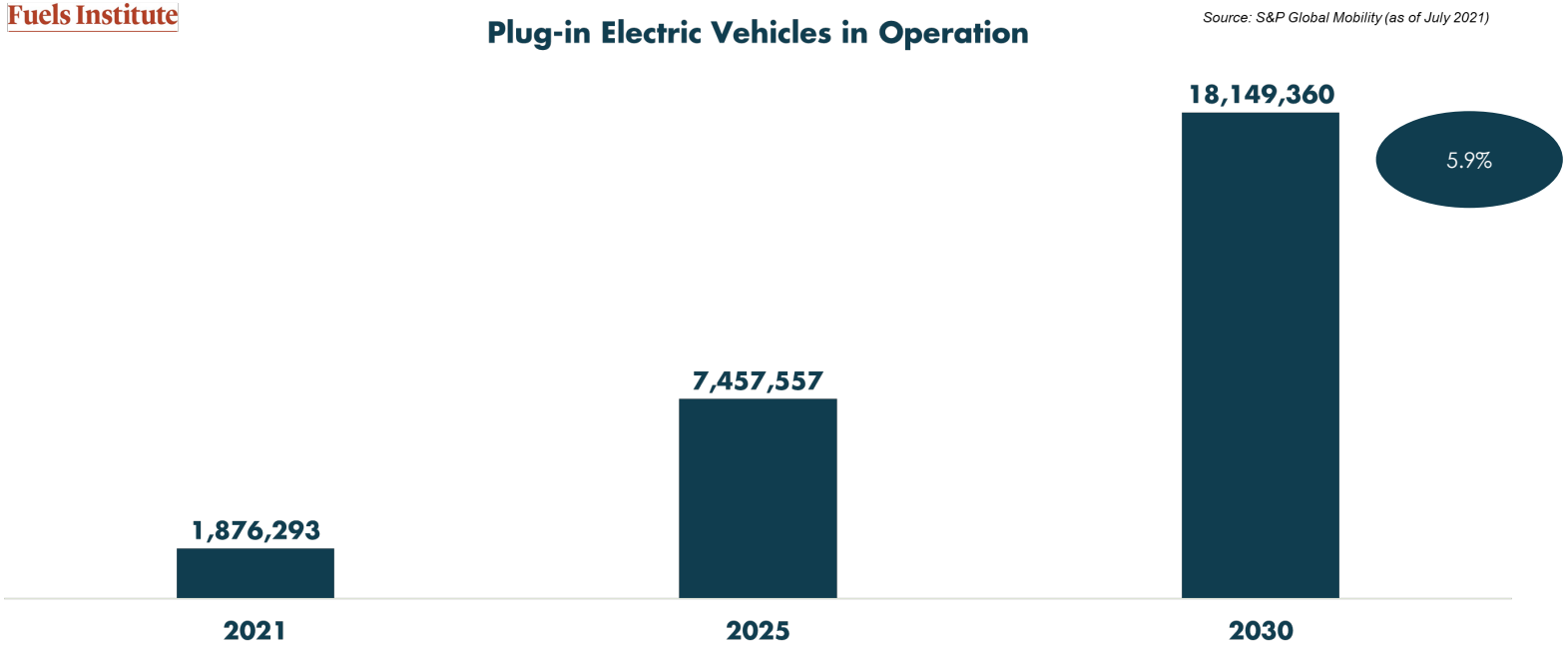


Fuels Institute

Source: S&P Global Mobility (as of July 2021)

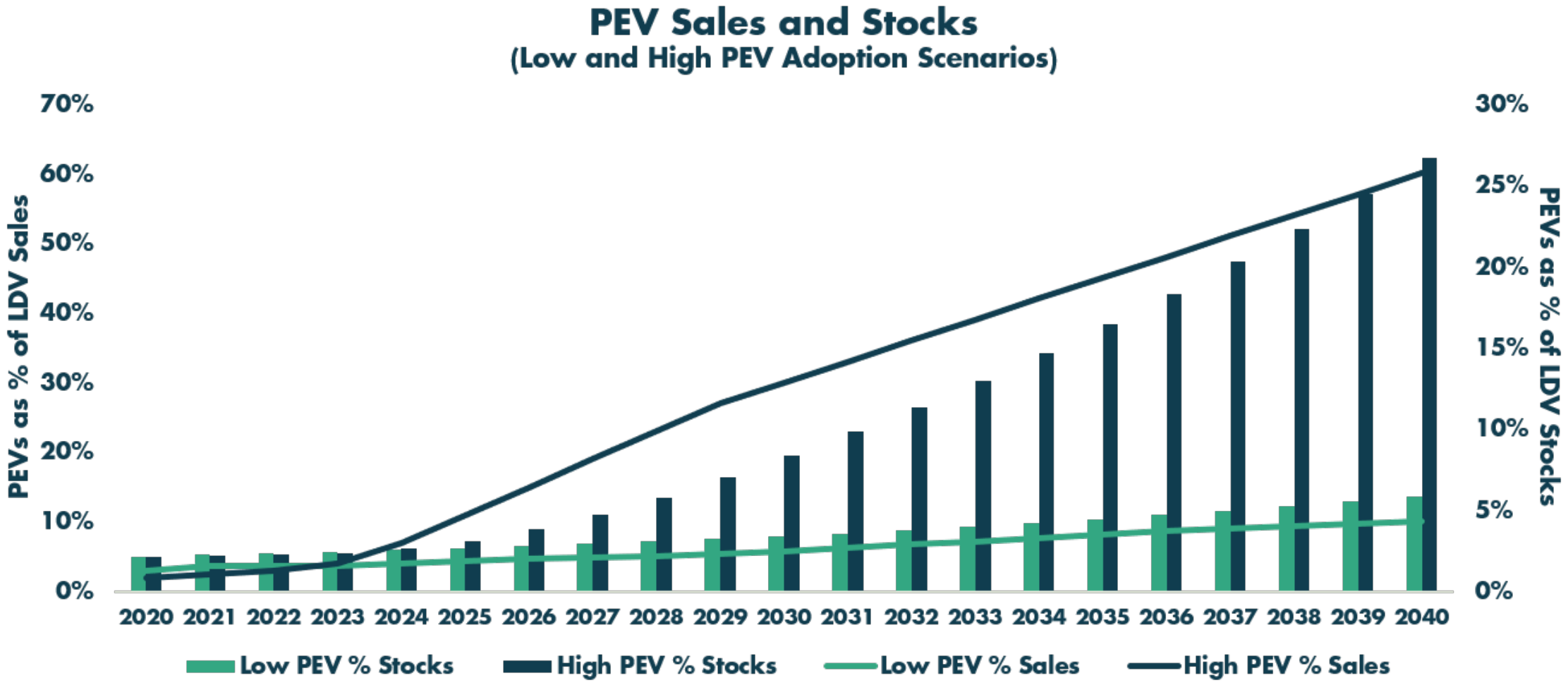


Fuels Institute

Source: S&P Global Mobility (as of July 2021)

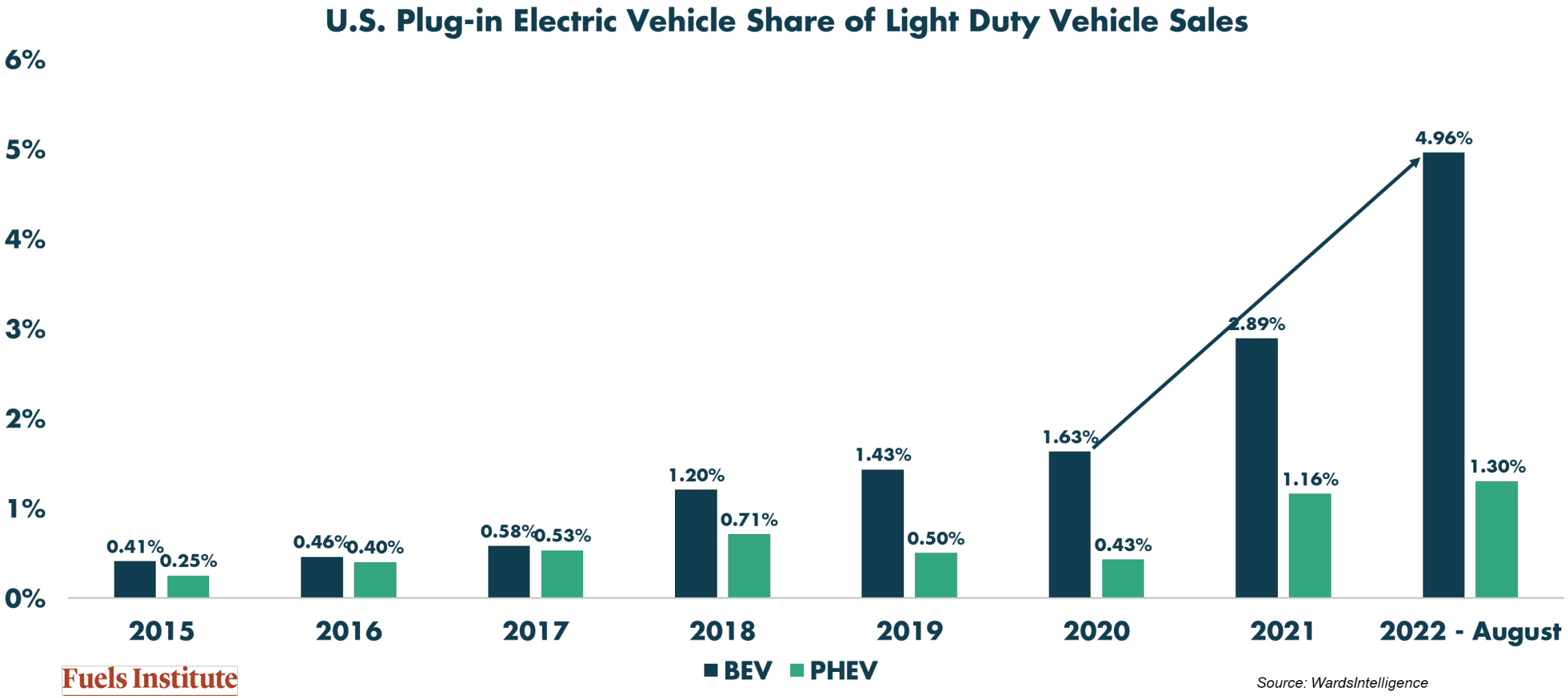
Turnover is slow, even w/rapid sales growth

If PEVs reach 60% sales in 2040, they may only represent 27% of LDVs on the road



BEVs hit 5% of sales through September 2022

A big question remains: Can and for how long might this momentum continue considering price increases and supply shortages?



Fuels Institute

Source: WardsIntelligence

Fuels Institute

EV prices are going in the wrong direction

Up — they're going up

By Andrew J. Hawkins | @andyjayhawk | Aug 24, 2022, 11:07am EDT | 19 comments

IRS clarifies new EV tax credit rules, lists 2022-23 vehicles that may be eligible

Upon signing of the Inflation Reduction Act, the IRS is clarifying what happens between now and the end of the year.

August 17, 2022 01:23 PM

MARCH 14

Tesla increases prices throughout whole lineup, its cheapest electric car now starts at $47,000

Fred Lambert - Mar. 14th 2022 9:27 pm PT @FredericLambert

AUTOS

Ford CEO doesn't expect electric vehicle battery costs to drop anytime soon

PUBLISHED WED, AUG 10 2022•1:44 PM EDT | UPDATED WED, AUG 10 2022•10:09 PM EDT

John Rosevear @JOHN__ROSEVEAR | Michael Wayland @MIKEWAYLAND

SHARE

Rivian discontinues its cheapest electric truck option

By Ramishah Maruf, CNN

Updated 4:55 PM EDT, Sat August 20, 2022

Battery Pack Costs Rise for Battery Electric Vehicles

15 August 2022 | Monika Punshi

AUTOS

Ford hikes price of electric Mustang Mach-E by as much as $8,475 due to 'significant' battery cost increases

PUBLISHED FRI, AUG 26 2022•10:59 AM EDT | UPDATED FRI, AUG 26 2022•2:07 PM EDT

Michael Wayland @MIKEWAYLAND

SHARE

TRANSPORTATION

Used EV prices rising five times faster than gas-powered cars

BY SUSAN CARPENTER | NATIONWIDE
PUBLISHED 12:15 PM PT AUG. 30, 2022

Ford Raises Prices of F-150 Lightning Electric Truck, Citing Rising Material Costs

Demand for electric vehicles has been far stronger than the supply of battery materials like lithium, nickel and cobalt.

REPORT

Used electric car prices jump 54%, far outpacing gas-powered models

Gas prices and new-vehicle shortages have driven buyers to preowned EVs

CHRIS TEAGUE
Aug 25th 2022 at 10:27AM

38 comments

AUGUST 12

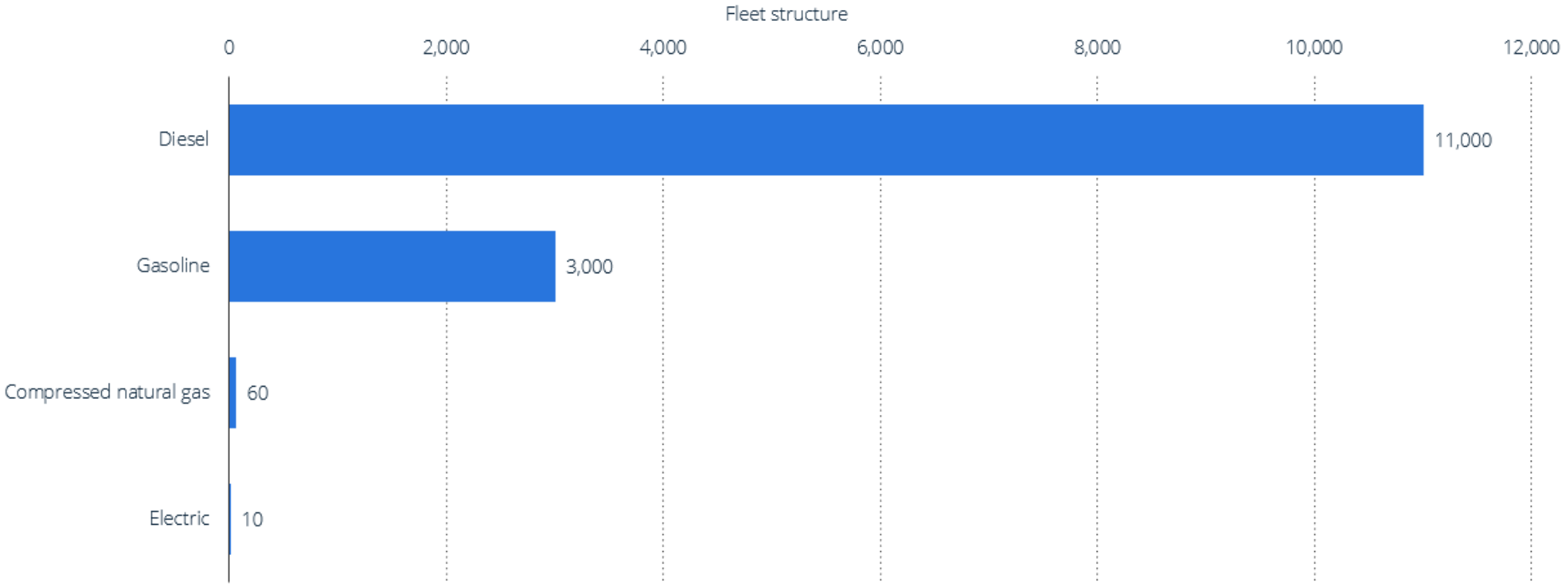
Tesla stops taking Model 3 Long Range orders as backlog extends to 2023

Fred Lambert - Aug. 12th 2022 2:38 pm PT @FredericLambert

MHDV Alternatives have small footprint

Commercial vehicle fleet in the United States in 2020, by fuel type (in 1,000s)

Commercial vehicle fleet by fuel type in the U.S. 2020



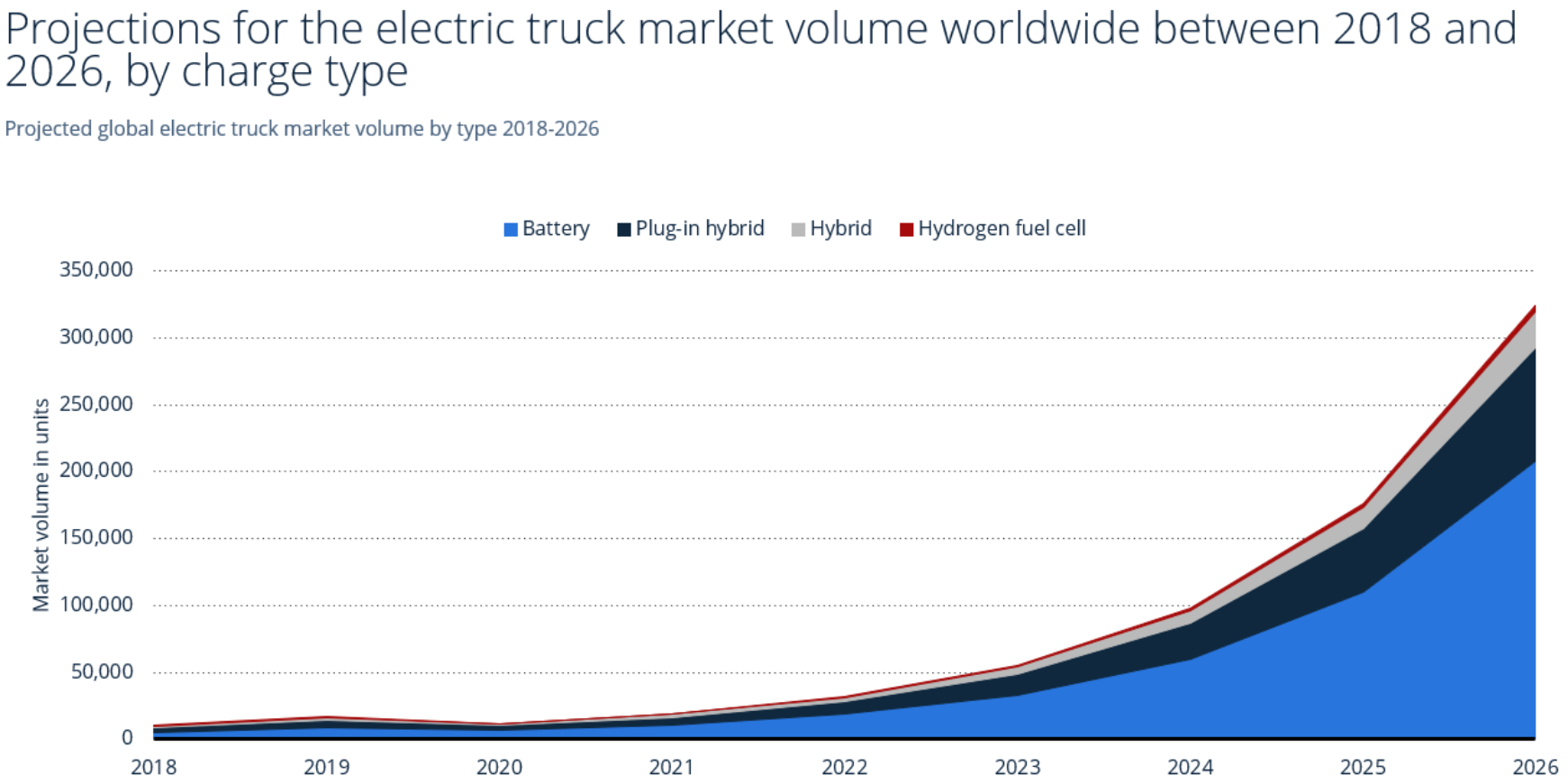
Note(s): United States; as of December 2020

Further information regarding this statistic can be found on page 8.

Source(s): IHS Markit; Diesel Technology Forum; ID 1269132

Global forecasts for MHDVs remain modest

Global annual sales of commercial vehicles was reported to be around 22 million units.
The forecast below projects total fleet inventory of ZEVs of about 325,000 units in 2026.



29

Description: Projections estimate battery-electric trucks will make up approximately 64 percent of the total electric trucks fleet in 2026, at just under 208,000 units. This segment is the most rapidly growing, with a compound annual growth rate forecast at 78.58 percent between 2020 and 2026. By contrast, hydrogen fuel cell trucks are projected to represent some 4,390 vehicles in the fleet, up from 468 in 2019. Read more
Note(s): Worldwide; 2018 to 2019
Source(s): MRFR

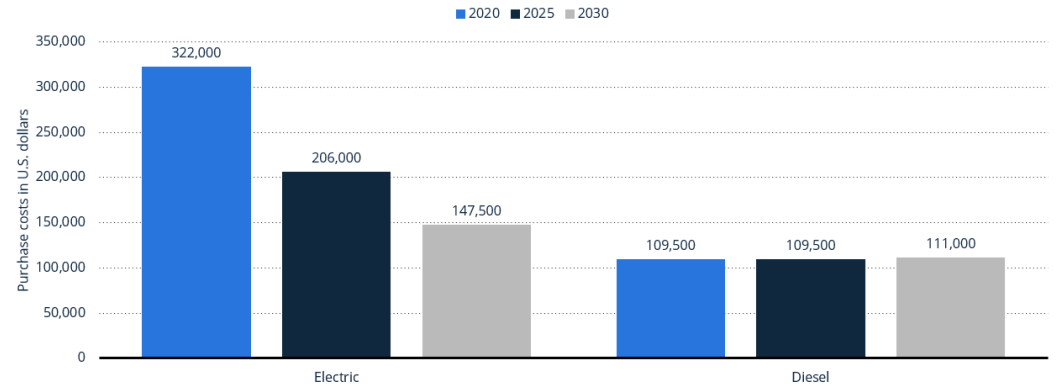
statista

Why is market share growth slow?

Price, infrastructure, ROI

Projected medium-duty truck purchase costs between 2020 and 2030, by fuel type (in U.S. dollars)

Projected diesel and electric medium-duty truck purchase costs 2020-2030

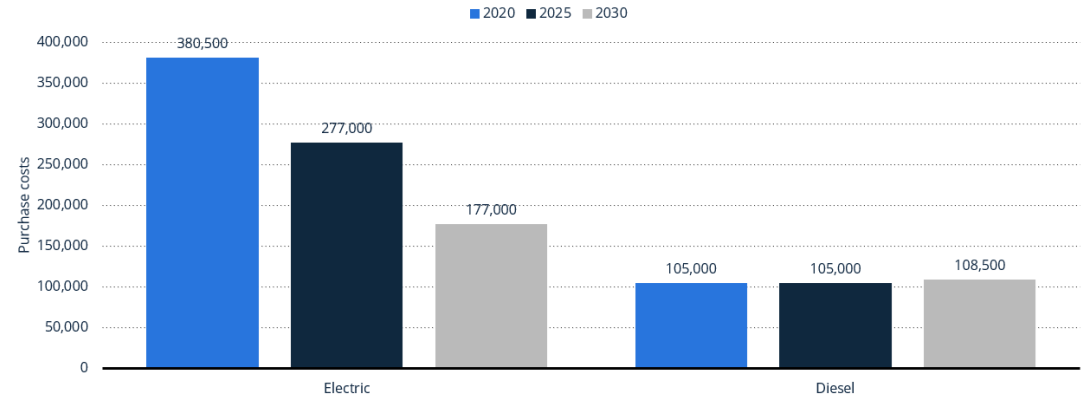


32 **Description:** Between 2020 and 2030, the purchase cost for electric medium-duty trucks is projected to drop by over half compared with 2020 to some 147,500 U.S. dollars. The trend for diesel vehicles is the opposite. While purchase costs are projected to remain stable throughout 2025, they are tipped to increase by some 1,500 U.S. dollars by 2030. Read more
Note(s): Worldwide; 2020
Source(s): Calstart; FIER Automotive; Global Commercial Vehicle Drive to Zero

statista

Projected heavy-duty truck purchase costs between 2020 and 2030, by fuel type (in U.S. dollars)

Projected diesel and electric heavy-duty truck purchase costs 2020-2030

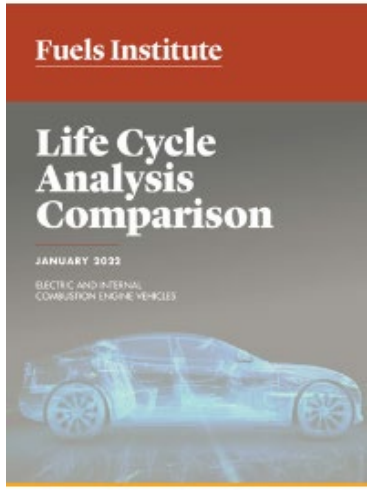


33 **Description:** Between 2020 and 2030, the purchase cost for electric heavy-duty trucks is projected to drop by over half, compared with 2020 to some 177,000 U.S. dollars. The trend for diesel vehicles is the opposite. While purchase costs are forecasted to remain stable until 2025, they will increase by some 3,500 U.S. dollars by 2030. Read more
Note(s): Worldwide; 2020
Source(s): Calstart; FIER Automotive; Global Commercial Vehicle Drive to Zero

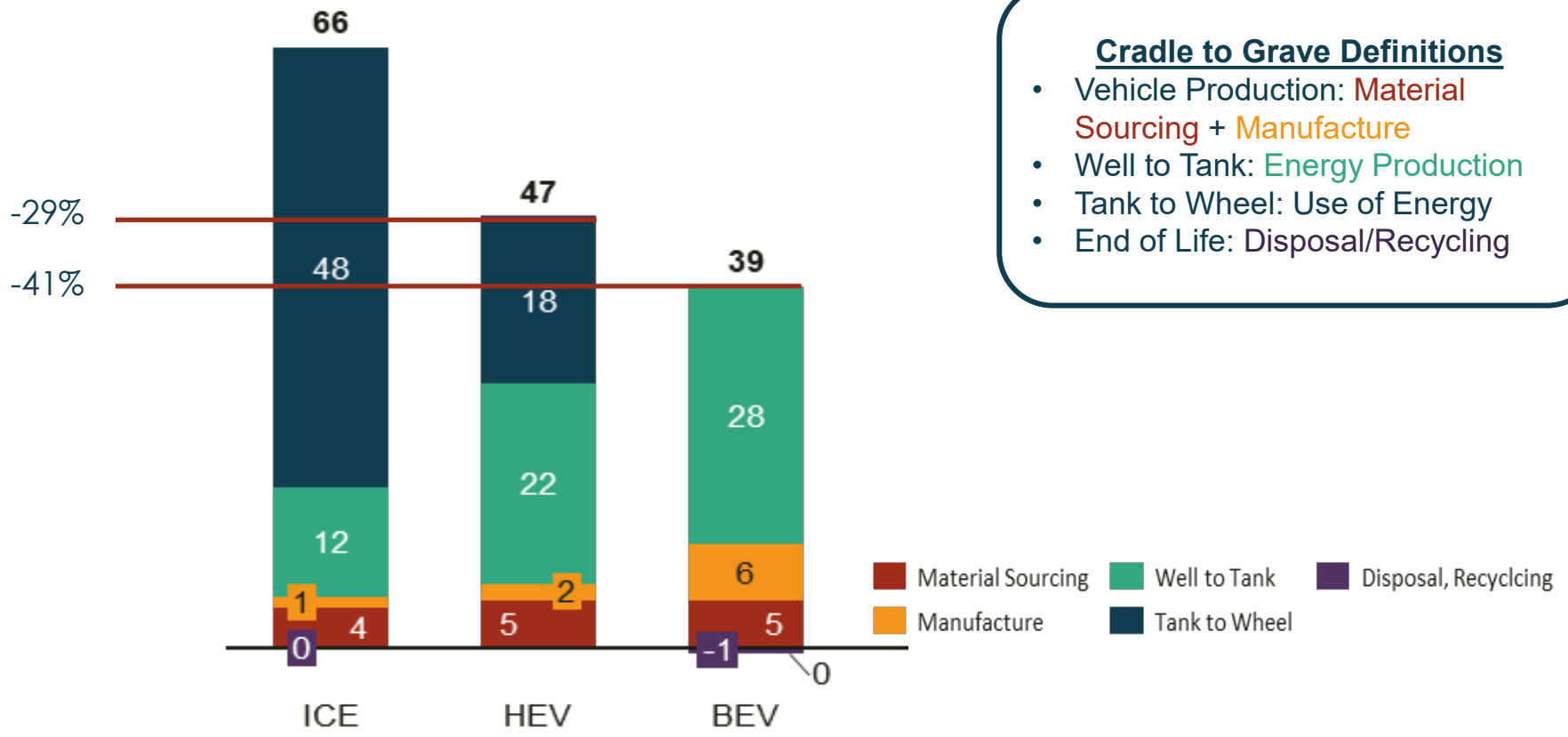
statista

High Level Summary – LCA Comparison

Over a 200,000 mile lifetime and based upon a national average electricity mix, BEVs emit less carbon than ICEVs and HEVs.



Tons of greenhouse gas emissions



200,000 miles
(average USA electricity mix)

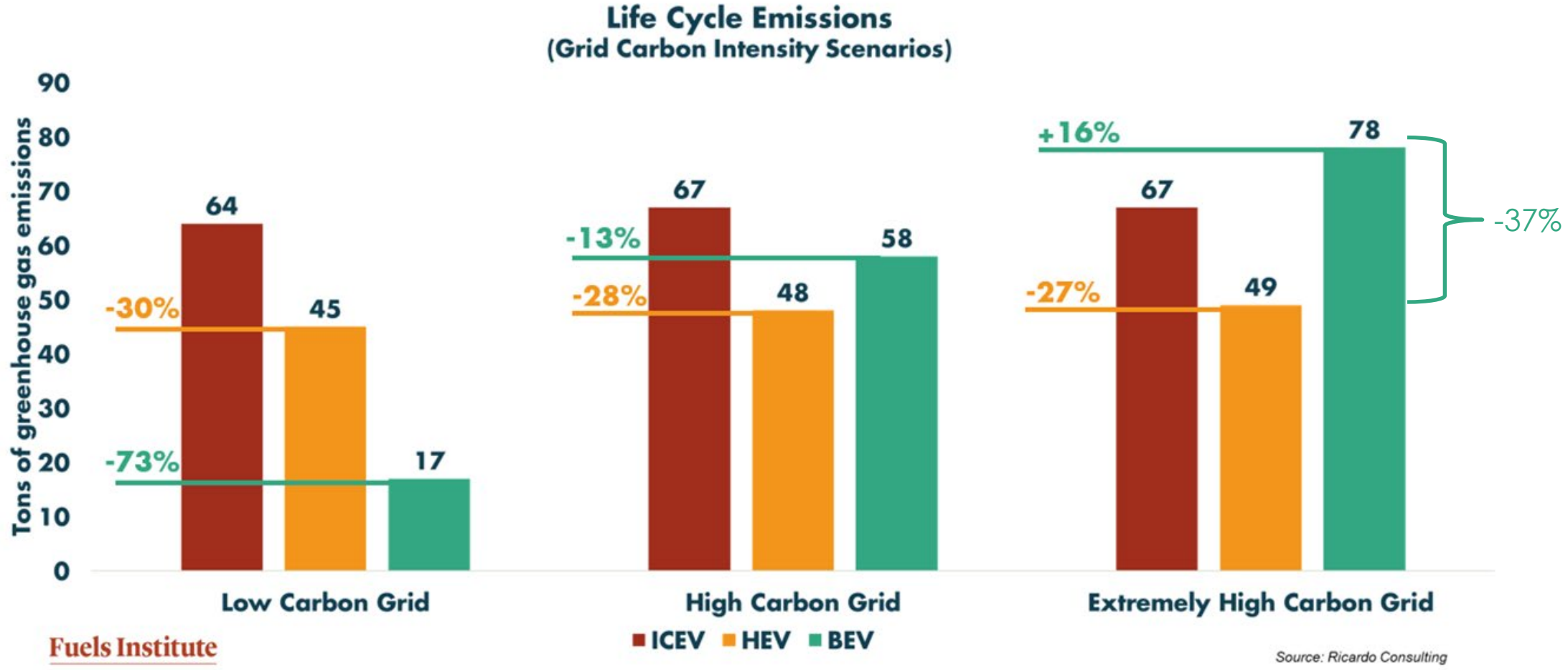
Cradle to Grave Definitions

- Vehicle Production: Material Sourcing + Manufacture
- Well to Tank: Energy Production
- Tank to Wheel: Use of Energy
- End of Life: Disposal/Recycling

Where we deploy EVs matters

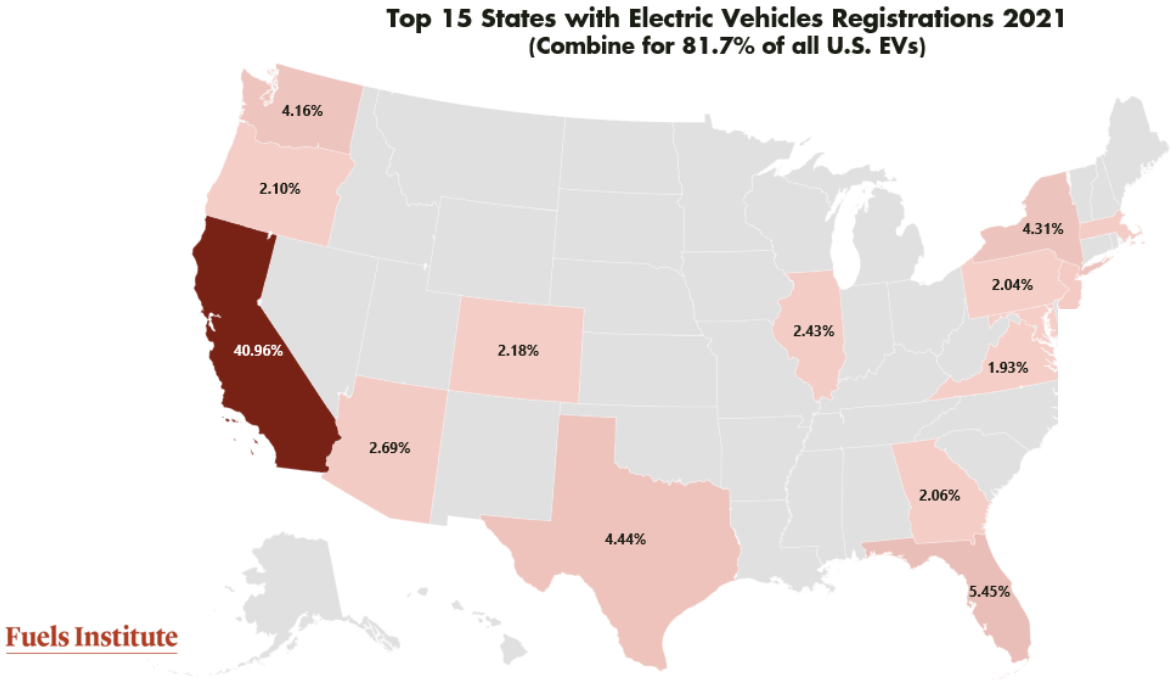
Not all markets are created equal – deployment of decarbonization strategies should take into consideration regional, market and duty-cycle variations to maximize carbon reduction as quickly and affordably as possible.

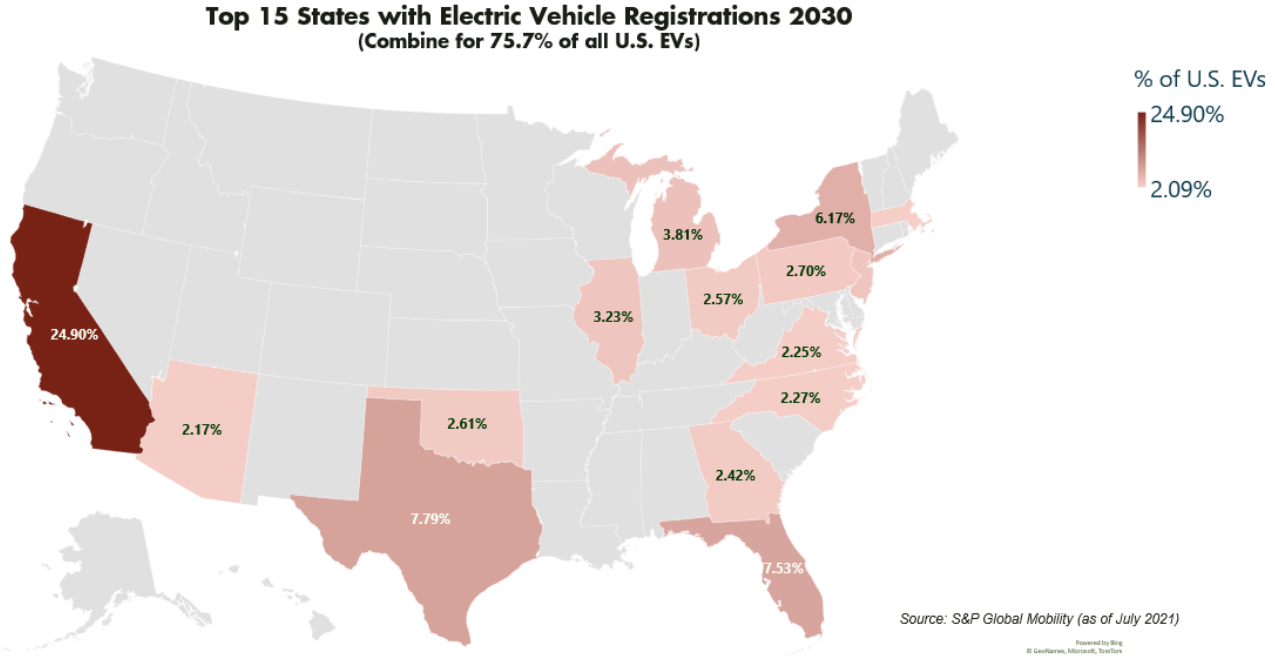
72% of a BEV's lifetime carbon emissions (on average) come from the generation of electricity.



EV Geographic Distribution is Uneven

California's dominance expected to ease through 2030, although not all ZEV partner states support ICE Ban

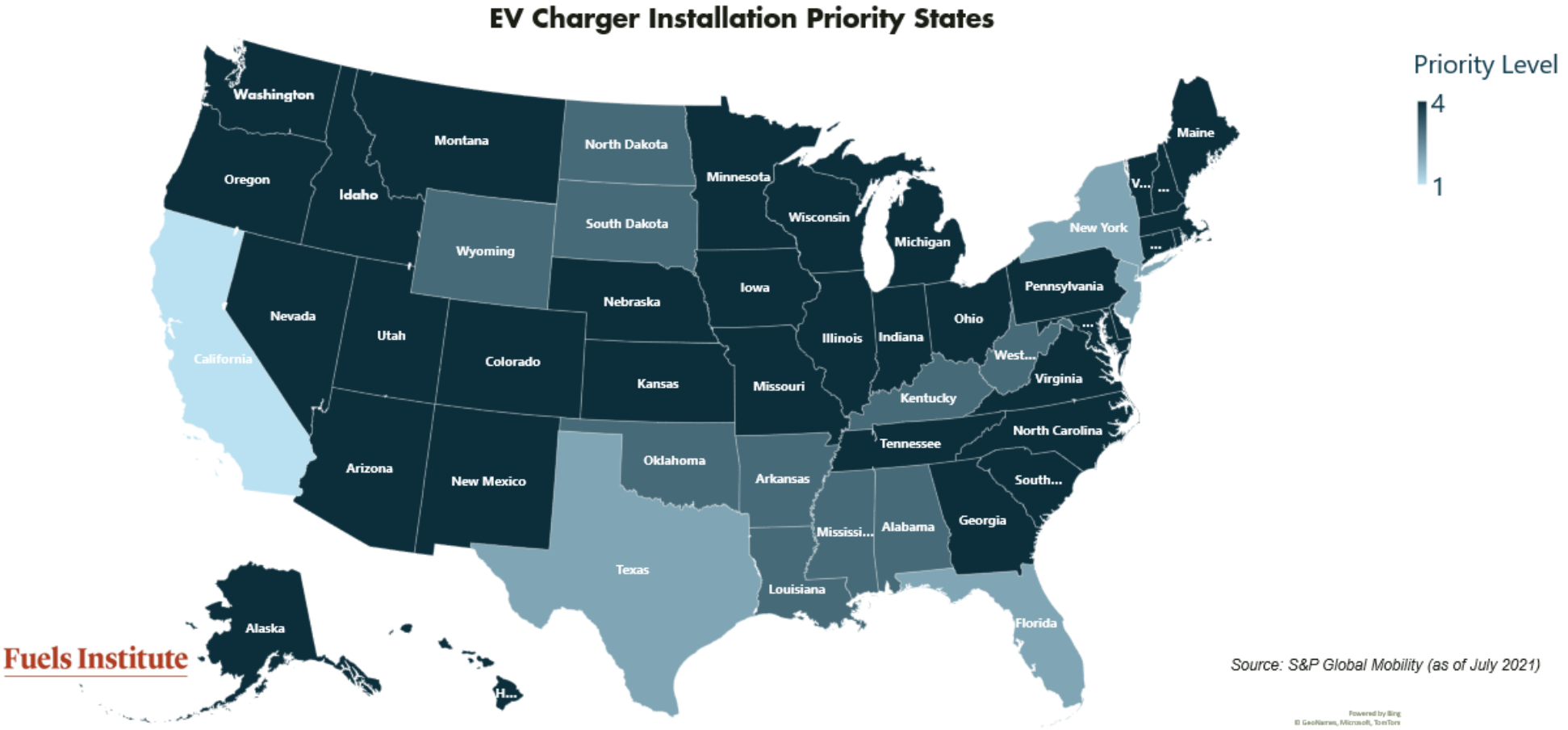




Source: S&P Global Mobility (as of July 2021)

Prioritizing EVSE Deployments

A census track evaluation considered expected plug-in EVs in operation over next 10 years, housing mix, miles traveled and parking habits, among other factors. This highly granular forecast was then aggregated to create a state-level prioritization to help guide industry stakeholders to strategically deploy stations to support the expanding demand of the EV driver.



U.S. may need more than 1.7 million charging stations in 2030 – more than 90% Level 2

- Applied international benchmark for ideal EV-to-charger ratio of 10.4:1
- Applied S&P Global Mobility's July 2021 forecast of EVs in operation in 2030 of 18 million
- This forecast is significantly lower than many other published forecasts.
- If the market for EVs develops faster than provided for in this study, the number of required charging stations to minimize market congestion will be much higher than 1.7 million.

FIGURE 26: 2030 U.S. ELECTRIC VEHICLES IN OPERATION AND ELECTRIC VEHICLE SUPPLY EQUIPMENT RATIO FORECAST, TOP 15 STATES

STATE	ELECTRIC VEHICLES IN OPERATION	AC REQUIRED	DC REQUIRED	AC RATIO	DC RATIO	OVERALL RATIO
California	4,518,839	455,915	24,216	9.9	186.6	9.4
Florida	1,413,638	120,153	6,382	11.8	221.5	11.2
Texas	1,367,370	129,196	6,862	10.6	199.3	10.0
New York	1,118,911	83,065	4,412	13.5	253.6	12.8
New Jersey	690,699	74,426	3,953	9.3	174.7	8.8
Illinois	585,425	49,072	2,606	11.9	224.6	11.3
Pennsylvania	577,492	44,072	2,341	13.1	246.7	12.4
Michigan	490,824	46,548	2,472	10.5	198.5	10.0
Ohio	474,604	42,619	2,264	11.1	209.7	10.6
Washington	465,586	33,079	1,757	14.1	265.0	13.4
Georgia	439,410	44,814	2,380	9.8	184.6	9.3
North Carolina	411,960	36,184	1,922	11.4	214.4	10.8
Massachusetts	408,620	54,115	2,874	7.6	142.2	7.2
Arizona	393,973	27,380	1,454	14.4	270.9	13.7
Virginia	378,517	34,414	1,828	11.0	207.1	10.4
Top 15	**13,735,870**	**1,275,050**	**67,724**	**10.77**	**202.8**	**10.2**
National	**18,149,360**	**1,649,942**	**87,636**	**11.00**	**207.1**	**10.4**

Metro-level EVSE Forecasting – Case Studies

Applying a micro-level of geography to analyses is critical because EVSE deployment is going to physically occur in the locales and municipalities where people live and work – and not on a federal or even state level.

To this point, the report includes three case studies (Detroit, Dallas & Portland, OR) to demonstrate how these cities should be addressing future charging demand and equity.

FIGURE 31: DETROIT, MICHIGAN: MAP OF ELECTRIC VEHICLE SUPPLY EQUIPMENT INSTALLATION REQUIREMENTS BY 2030

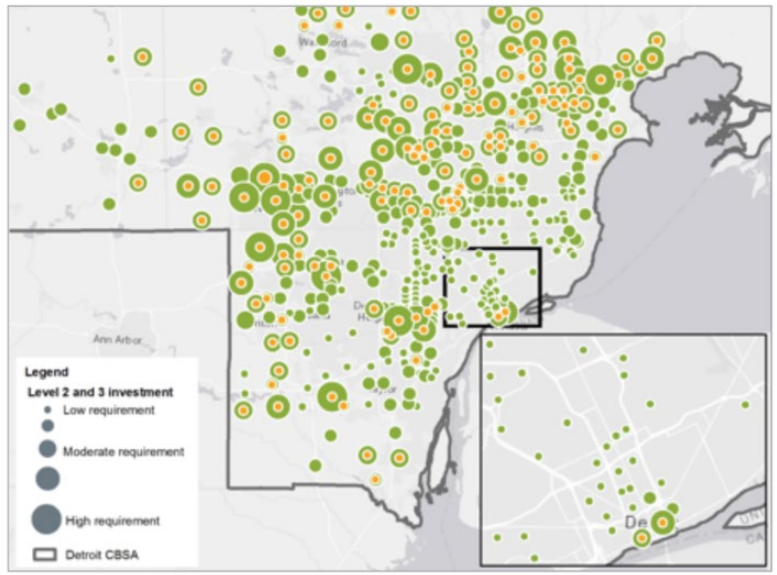


FIGURE 27: DETROIT, MICHIGAN: CHARGING DESERT IN THE CITY

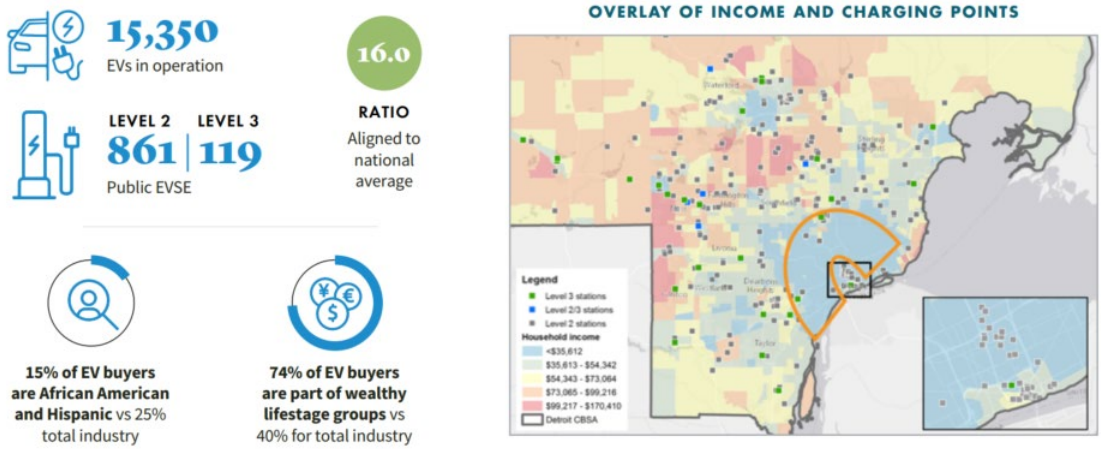
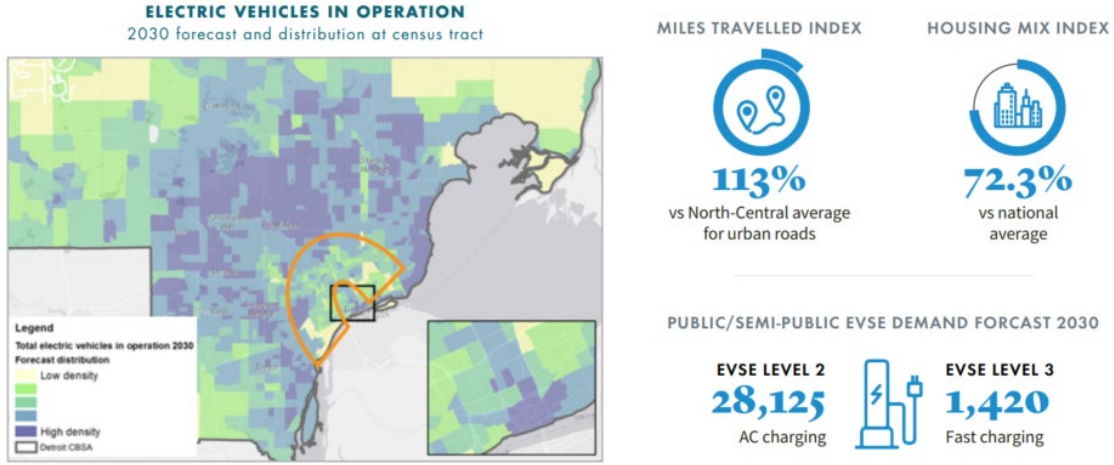


FIGURE 28: DETROIT, MICHIGAN: 2030 ELECTRIC VEHICLES IN OPERATION DISTRIBUTION BY CENSUS TRACT

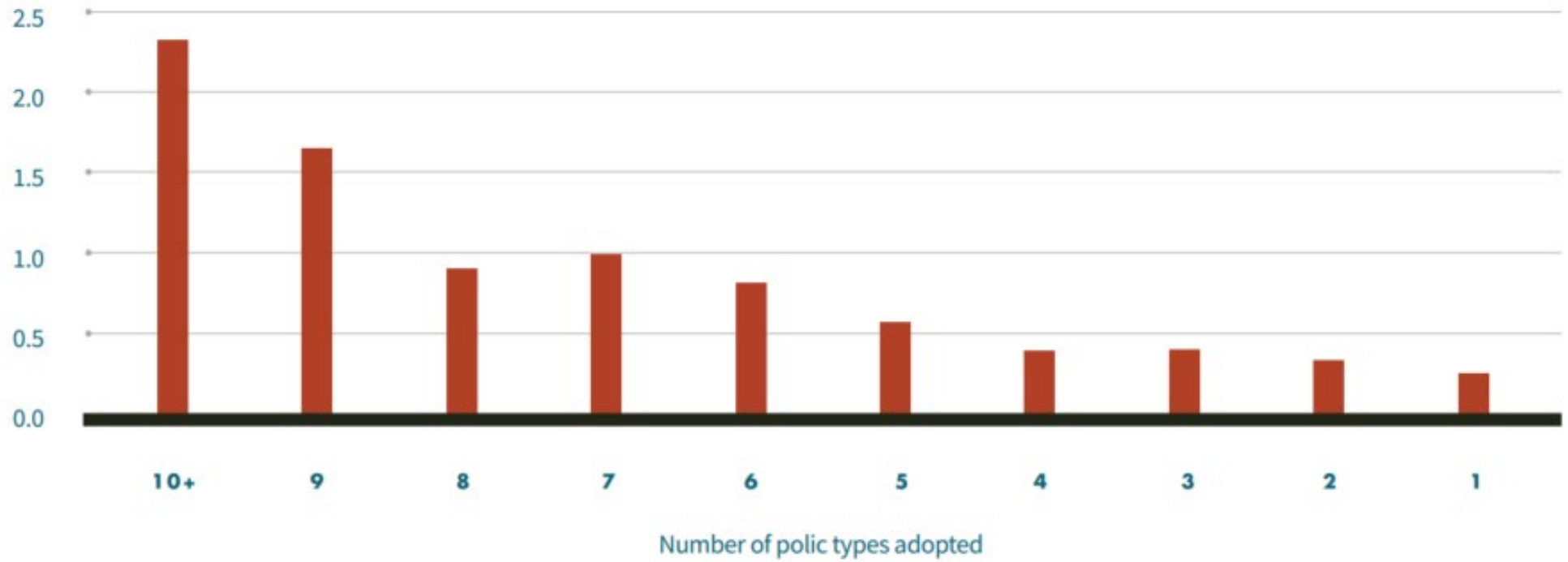


States with more programs have higher EVSE market development scores

Fuels Institute

Market Development Score: A weighted average of EVSE stations per capita (75%) and EV sales per capita (25%) between 2016 – 2020.

FIGURE 5: AVERAGE EVSE MARKET DEVELOPMENT SCORE BY BREADTH OF POLICY ADOPTION

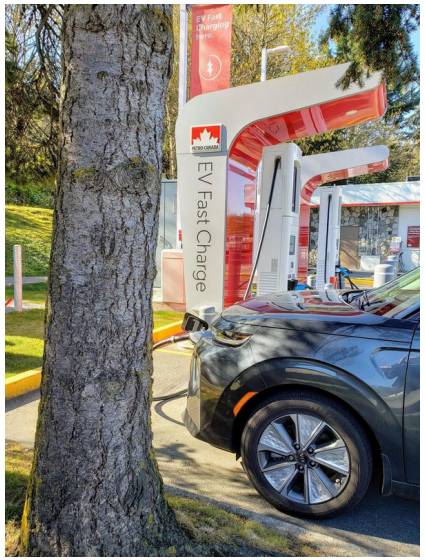


Financial incentives are important

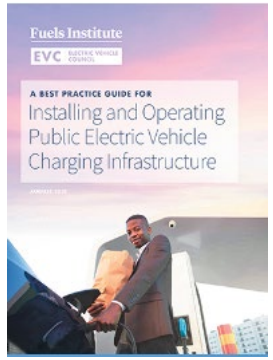
Public funding may account for roughly 26% of the variation in charging station deployments across the states, on average

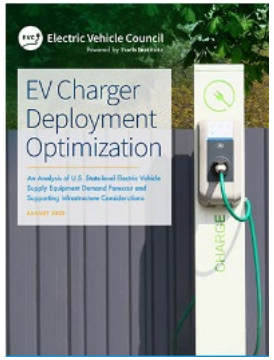
FIGURE 12: CHARGING STATION DEPLOYMENTS PER 100,000 PEOPLE VS. PER CAPITA PUBLIC FUNDING, 2016-2020 (ONLY FUNDING AWARDED AND FUNDING ENDED)

Retailers have decisions to make



- How do I enter the market – third party network or my own system?
- How much will it cost? Should I try to get NEVI funding?
- How much power should I install, what do my customers need?
- Where should I locate the chargers? How far from my fuel pumps?
- Can I make money on this?
- What is my effective utility rate?
- What are demand charges?

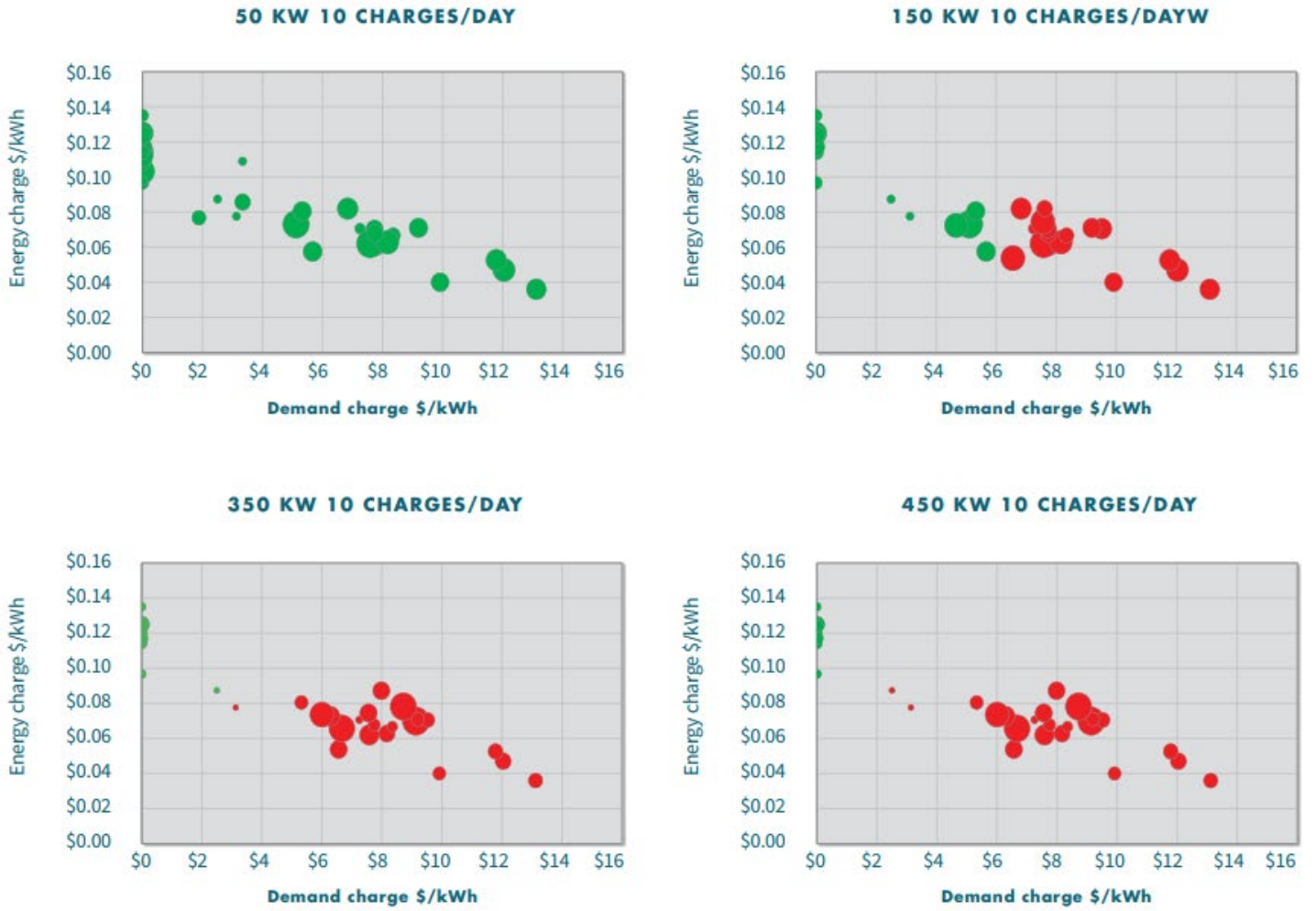




Demand Charges

- One interviewee defined demand charges as “the **biggest existential threat** for the economic viability for EVSE implementation, especially DCFC”
- Operating expenses are among the greatest challenge to profitability at a charging station.
- Several utilities are experimenting with alternate fee structures to mitigate the negative impact of demand charges on EVSE deployment, but these may not be sustainable long-term.
- The regulatory structure governing the utility sector was not designed for retail transactions like those that occur at the EV charging station.

FIGURE 18: BREAKEVEN PERFORMANCE OF DCFCS UNDER VARYING UTILITY DEMAND AND ENERGY CHARGES (VARYING POWER LEVELS AND RELATIVELY HIGH CONSTANT UTILIZATION RATE)[45]



How can localities support EVSE deployment?

"This guide has been prepared to help these officials and other readers understand in brief form the policy landscape in the U.S. at both the state and local levels, noting the types of policies that have been set and providing several examples of how different authorities having jurisdiction (AHJ) have implemented them."

"The guide concludes with best practice recommendations from regulated entities themselves, that is, stakeholders that have accumulated years of experience installing and operating EV-charging infrastructure around the U.S. Stakeholders from the EV-charging industry, fuel retailing, utility, and metropolitan planning organizations (MPOs) shared their expertise and actionable and practical recommendations as AHJs begin to develop and implement EV-charging policies."

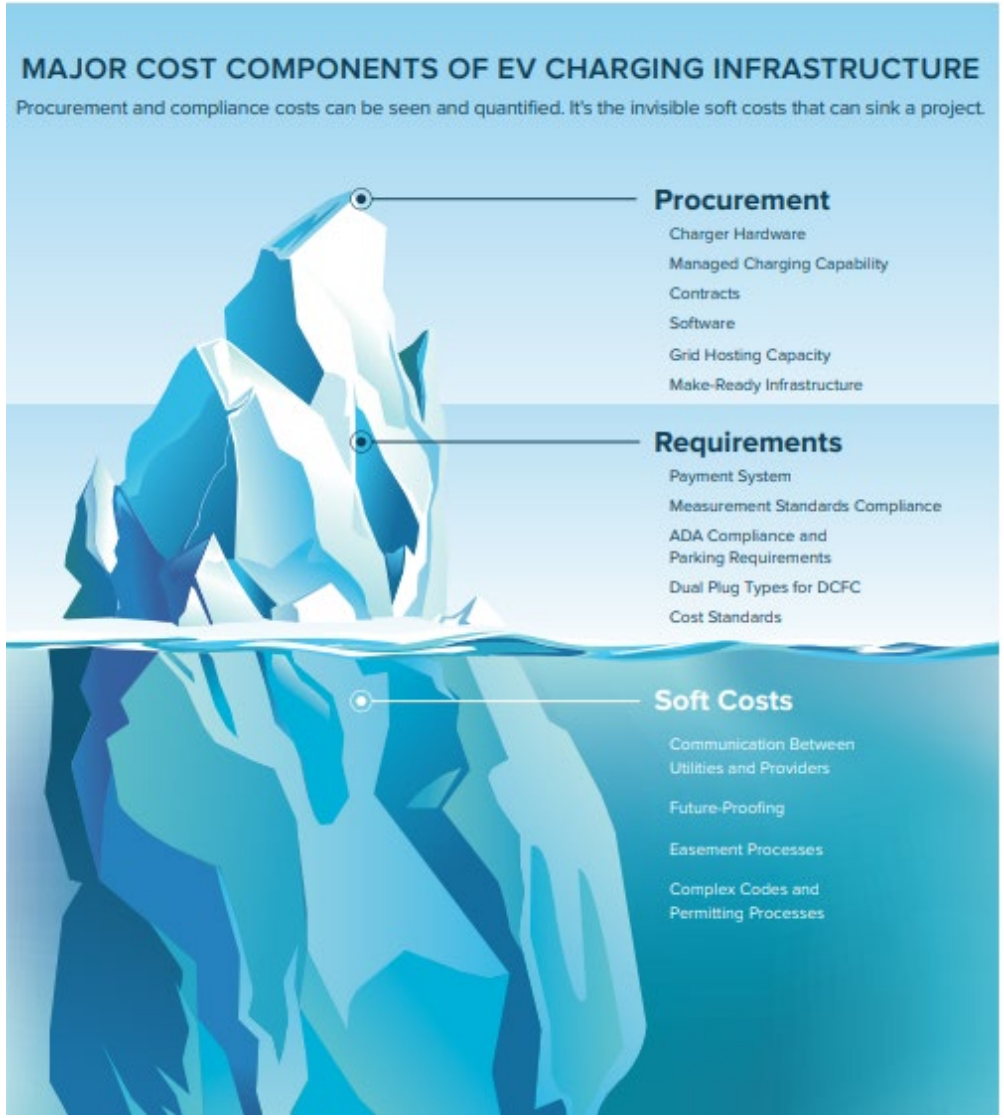
Permitting Complications

Clear, coherent guidance from higher levels of government to foster coordination and lead AHJs

Policies coordinated among jurisdictions to create consistency, predictability, economies of scale

Streamlined permitting application process and review procedures

- Single universal application for all required permits
- Clarify at the beginning what documents must be submitted to satisfy all permits
- Enable online application
- Appoint an EVSE permitting point person to assist applicants
- Enable review of application for multiple permits simultaneously rather than sequentially



Source: Rocky Mountain Institute, January 2019

Specific recommendations

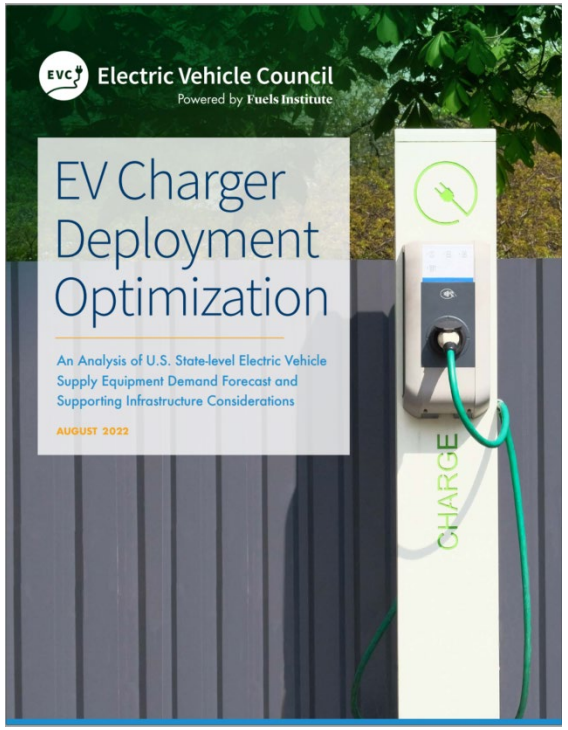
- Establish and enforce **permitting turnaround times**.
- Establish an **expedited EV permit review process** that encourages permit reviewers to administratively approve permits
- Amend zoning codes to clarify that public EVCS does not require further zoning board approval and to clearly identify any exceptions.
- Appoint an EV-infrastructure **permitting point person** to help applicants through the entire permitting process.
- Align planning codes so that EVCS application reviews are limited to health and safety.
- Clarify that EV-charging spaces count as one or more parking spaces for zoning purposes. Count EVCS spaces as regular parking stalls in the parking count study to include supporting equipment (transformer, switchboards, power cabinets).
- Classify **EVCS is as an accessory use to a site**, not as a traditional fueling station.
- Allow EVCS as an approved use as a primary use of a site with streamlined permit and zoning review.
- **Require only an electrical permit**, as opposed to an additional EVCS permit.
- Adopt an **online permitting process**. Clear permitting and inspection processes, requirements, and forms should made available on a public-facing website for single-family home, multi-family home, and workplace, public, and commercial medium- and heavy-duty charging. Establish an online submittal and payment process, ideally through a portal.
- Route permit **applications through one department**, not multiple. In cases where multiple departments need to review, the reviews should be concurrent rather than sequential. Limit the number of review comments and consolidate when possible.
- Incorporate and prioritize planning for zero emission vehicles and supporting infrastructure within documents, such as the general plan, capital improvement plan, climate action plan, and design guidelines.
- **Offer pre-application meetings** with knowledgeable staff.

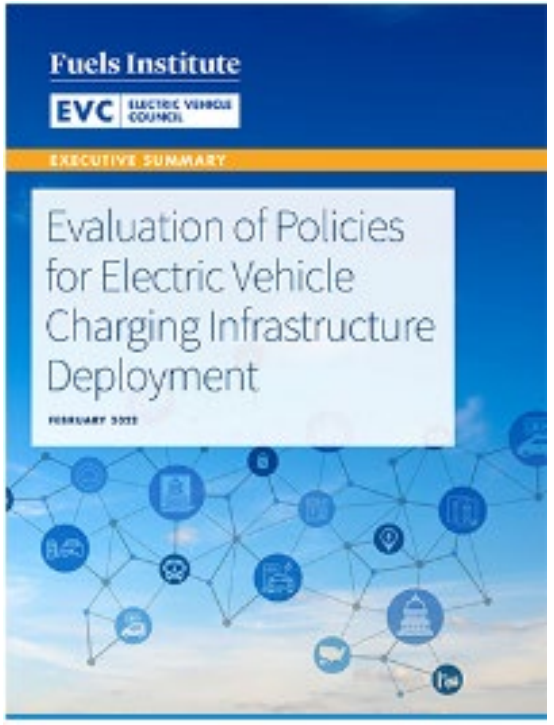
Additional recommendations wrt utilities

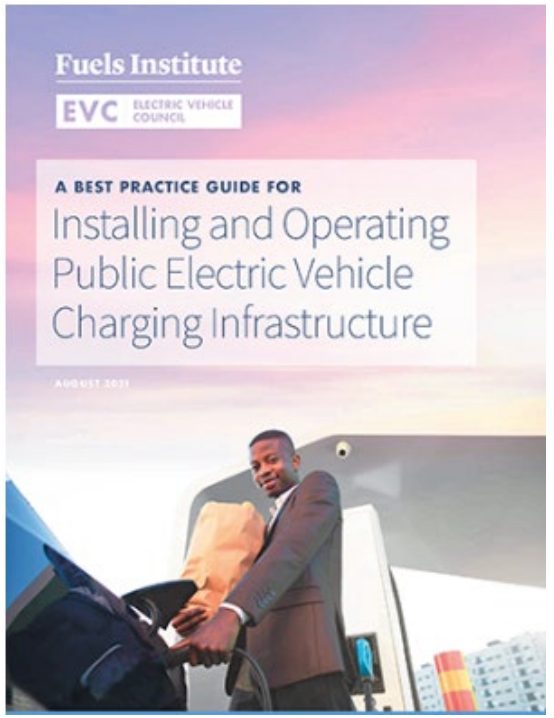
- Require utilities to disclose average timelines for service connection for EV-charging accounts.
- Provide **special easement considerations** for EV charging, including the ability to include utility easement language in site leases and contracts between an EV-charging developer and landowner or a long-term ground lessee.
- Allow for **utility make-ready** for EV charging.
- Allow **visibility into where power is available on the grid**, such as with hosting capacity maps or a way to check with the utility if power is available at a specific site.
- Improve the feasibility study phase for new projects without having to go through the full design process.
- Maintain an inventory of utility equipment commonly used in EV-infrastructure installations, specifically transformers that otherwise can be “made to order” and require long lead times.
- Provide **dedicated design and construction staff** for EV-infrastructure projects.
- **Streamline utility design approvals**.

Resources:

Fuelsinstitute.org/research - Other papers relative are also available and more are being developed







Final Thoughts & Questions

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