S&P Global
Energy

CERA Consulting

Electric Vehicle Charging Power Demand Forecast Assumptions

2026 Forecast Assumptions

Prepared for PJM Interconnection

July 10, 2026

CERA Consulting is the consulting arm of S&P Global Energy

Contents

The assumptions provided are S&P Global's initial assumptions to be used in 2026 analysis; we recognize the possibility of changes based on our analysis, project work, market developments and stakeholder feedback

Source

Assumptions in this deck are from S&P Global's "off-the-shelf" scenarios, recent developments in regulatory and legislative arena, and last year’s analysis delivered to PJM

Adjustments

These assumptions may change over the development of the forecast due to internal forecast updates, ongoing project work, and feedback from stakeholders

Importance

We focus only on most meaningful assumptions that could have significant impact to the outcome of our analysis

S&P Global would like to share the following key assumptions and inputs for stakeholder review

	Type of EV vehicles	Assumptions and inputs
Electric vehicles	All	Policy and regulations
	Light-duty	EV sales forecast based on revised OEM product plans and revised NHTSA CAFE proposed standards MY2022-2031
		EPA / CARB regulations revocation
	Medium and heavy-duty	EV national “natural demand” and performance by class
		Description of vehicle types by commercial function within classes 2–8
Charging demand	Light-duty	Miles per kWh (normal operating conditions)
		Miles driven (weekday/weekend)
		Loss in battery efficiency due to temperature
		Charging infrastructure
		Charging behavior
	Medium and heavy-duty	Miles per kWh by class (normal operating conditions)
		Miles driven (weekday/weekend) by class
		Loss in battery efficiency due to temperature by class

Source: S&P Global

We welcome stakeholder feedback on key assumptions to enhance accuracy and are specifically interested in comments, data, or insights regarding the following themes

Themes	Topics
Insights or outlooks on charging infrastructure	▪ Charging infrastructure adoption: Trends and projections for Level 1 (L1), Level 2 (L2), and Direct Current Fast Charging (DCFC) stations, including for residential application ▪ Access to homeplace/workplace chargers: Availability and utilization rates of charging stations at residential and commercial locations ▪ Visibility onto fleet charging for last mile delivery vehicles: who owns the fleet, size of fleet, numbers of chargers and type of chargers by fleet operators
Insights on current EV charging behavior and policy evolution that will impact it	▪ Charging patterns: Current EV charging patterns ▪ TOU rates: Implementation trends and their influence on EV charging behaviors ▪ MHDV: Tariff and incentive structures that impact the operation of MHDV

Please direct any feedback or questions to PJM. PJM will ensure the information is appropriately conveyed to S&P Global. Note that any information or data shared with PJM and S&P Global will be treated as confidential and handled in accordance with S&P Global's data protection policies.

Source: S&P Global

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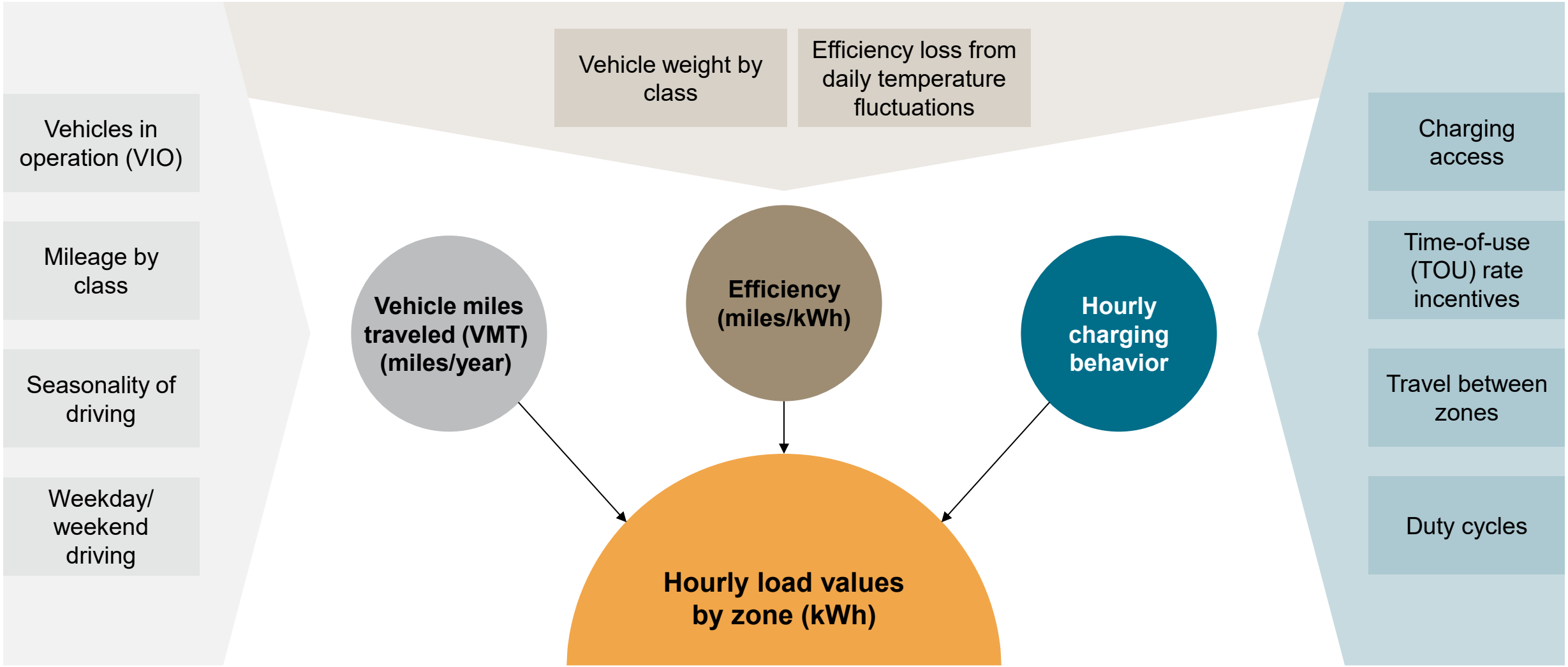
Hourly load shapes are driven by three key variables: vehicle miles traveled, vehicle efficiency, and charging behavior



Source: S&P Global

VIO, mileage, and efficiency for each vehicle type throughout the study time horizon are calculated based on a mix of field data and assumptions

Variable	Description	Methodology	Sources
Vehicles in Operation (VIO)	The total amount of vehicles that are on the road throughout the year	VIO forecast is created by forecasting yearly BEV sales, applying a scrappage rate by age class, and adding the forecast years together to calculate VIO	Mobility Global
Vehicle Miles Traveled (VMT)	The number of miles driven each year by vehicle type	VMT is calculated by the number of vehicles on the road and their mileage. Average annual mileage per vehicle and vehicle usage patterns are also factored. SPGE data was also supplemented by California Air Resource Board data	Mobility Global, California Air Resource Board
Efficiency	The numbers of miles driven per each kWh of charging	Field/manufacturer data is used where available (e.g., Tesla Model 3) to estimate the overall fleet efficiency of the vehicle category. Incremental efficiency improvements are considered through the end of the outlook	Manufacturer published data, Mobility Global

Source: S&P Global

S&P Global's regularly updated base-case scenario, built on integration of regional and sectoral energy analysis, formed the foundation for this project

Scenario description

- S&P Global Energy base-case scenario represents the integration **of regional and sector analysis** from across S&P Global Energy, illustrating the pace of change in long-term global energy supply, demand and trade, based on current views and assumptions about markets, policy, consumer behavior and technology.
- This scenario illustrates the **challenges and opportunities** in the global energy transition. It underscores the complexities of achieving ambitious climate and energy goals in an unpredictable geopolitical landscape. The scenario highlights the **critical role of national and multilateral policies**, corporate strategies, and public sentiment in shaping the future of energy markets, and despite the hurdles in delivery of targets and goals, paints a picture of gradual but sustained progress.
- For the United States, the scenario incorporates the most recent policies and programs shaping the energy and economic landscape, including the **impact of the One Big Beautiful Bill Act** on tax policy, inflation, supply chains, and energy markets.
- **Key themes of this scenario include:**
  - A period of geopolitical instability and economic uncertainty through the earlier years
  - Energy security, geopolitics and climate are inextricably linked
  - Through the medium term there is a multidimensional world focused on national interests. In later years, there is a rejuvenation of multilateral cooperation
  - While ambitious climate and energy transition goals set in the 2010s and early 2020s become increasingly difficult to achieve, there is incremental but sustained progress in global decarbonization and energy transition, even if climate targets are missed

Key indicators (global)

		History	S&P Global Base Case Outlook					
		2024	2025	2026	2031	2036	2041	2046
Real GDP	(billion 2024 $)	$110,364	$112,768	$115,448	$131,572	$149,026	$167,647	$187,744
	Average annual growth	2.8%	2.8%	2.8%	2.6%	2.6%	2.5%	2.5%
		(1990–2024)	(1990–2025)	(1990–2026)	(2026-2031)	(2026-2036)	(2026-2041)	(2026-2046)
Primary energy consumption	(mmtoe)	15,402	15,573	15,788	16,344	16,681	16,956	17,224
	Average annual growth	1.7%	1.7%	1.7%	0.7%	0.6%	0.5%	0.4%
		(1990–2024)	(1990–2025)	(1990–2026)	(2026-2031)	(2026-2036)	(2026-2041)	(2026-2046)
Primary energy intensity of GDP	(toe per million 2024 $)	140	138	137	124	112	101	92
US light-duty EV penetration[1]	Sales	10.2%	9.7%	7.4%	19.3%	32.5%	41.5%	50.3%
	Fleet	1.9%	2.5%	3.0%	6.5%	13.4%	21.3%	32.1%

1. Includes battery-electric vehicles (BEVs), plug-in hybrid electric vehicles (PHEVs), range extender electric vehicles (REX or REEV), and fuel-cell electric vehicles (FCEVs)
EV assumptions and estimates were further updated based on regulatory changes through Jul, 9, 2026 (OBBBA, CAFÉ, EPA, CARB and TARIFF)
toe: metric ton of oil equivalent; mmtoe: million metric tons of oil equivalent
Source: S&P Global Base Case Energy and Climate Scenarios (July 2025)

Industry rebalances its BEV ambitions as profitability and government support remain constrained

Regulations

- **NHTSA (Keep):** CAFE standards lowered stronger than expected with room for ICE/HEV to grow
- **EPA (Remove):** Standards for 2027–2032 regulation revoked by rescinding the 2009 “Endangerment Finding”
- **CARB: has lost rights to set their own emission/ZEV ambitions** Legal challenges to federal government very likely to delay ICE ban goal of 2035

Incentives

- **IRA retail consumer lease credit eliminated** (Section 45W)
- **IRA advanced vehicle manufacturing credits (45X) kept,** relevant for battery production, until 2031 in full, phasing out 1 year earlier
- **Expanded Foreign Entity of Concern (FEOC)** with regard to ownership and control limit pace of technology evolution (esp. China)
- **Government funding EV battery factories** frozen or cancelled
- **Bipartisan Infrastructure Law** to be weakened. Funds not spent to be possibly reallocated

OEM

- **All major OEMs** have **canceled, reduced and/or postponed EV investments**
- **Openness to REX (Range extenders)** likely to come with product development by the likes of VW, Hyundai, Ford and Stellantis
- **Toyota, Honda** double on their HEV aspirations with Toyota offering only an HEV version for some of its best-selling models

Customer readiness

- **ICE up** due to relaxed CAFE targets. Production planning to adjust potentially based on country of origin and wages
- **BEV supply expected to be constrained** as most domestic players do not reach necessary economies of scale and foreign competition is restricted through trade and national security policy
- **HEVs to benefit as cheapest electrified alternative**
- **REX** models to pose as an alternative solution for electrification as consumer concerns on public infrastructure buildout remain

Forecast consequence: More powertrain flexibility and further downgrade of BEV trajectory

1. The CAFE update by NHTSA signals a clear intention to ease demands for Zero Emission Vehicles, new MPG goals likely to follow
Source: S&P Global Mobility Sales-based Powertrain Forecast (August 2025)

Demand forecasts are created in 3 layers: top-down (national) and bottom-up (metro) to arrive at state/zone level

An established **multi-factor demand forecast model** integrates sales trends, household growth estimates, customer brand and dealer loyalty, leasing return-to-market, and hundreds of demographic purchase predictor variables, to create an EV adoption prediction at the granular **census tract level** geography. Bottom-up demand analysis at census tracts is then **reconciled** with our industry-leading national and State level forecasts to observe macro-economic boundaries.

National level

Industry-leading Sales-based Powertrain Forecast based on:

- Economic Market Framework
- Federal Legislation, Taxation, Emission Targets, etc.
- OEM Production Forecast and Model Policy Outlook
- Registration Segment Trends

State/zone level

National → State level forecasting based on:

- State Economics
- Demographic Growth Prediction
- State Legislation & Incentive Support for EVs/Charging

Metro level

Metro level demand identification based on:

- Demographic Profiles
  (psychographic household data to identify likely buyers at census tract level)
- Household Growth/Decline
  (projections at census tract level)
- S&P Loyalty Database
  (return-to-market potential and loyalty)
- Historic MHDV Area of Use (used sales) vs Area of Sale (Understanding fleet hub and spoke models and distribution patterns)

Source: Mobility Global

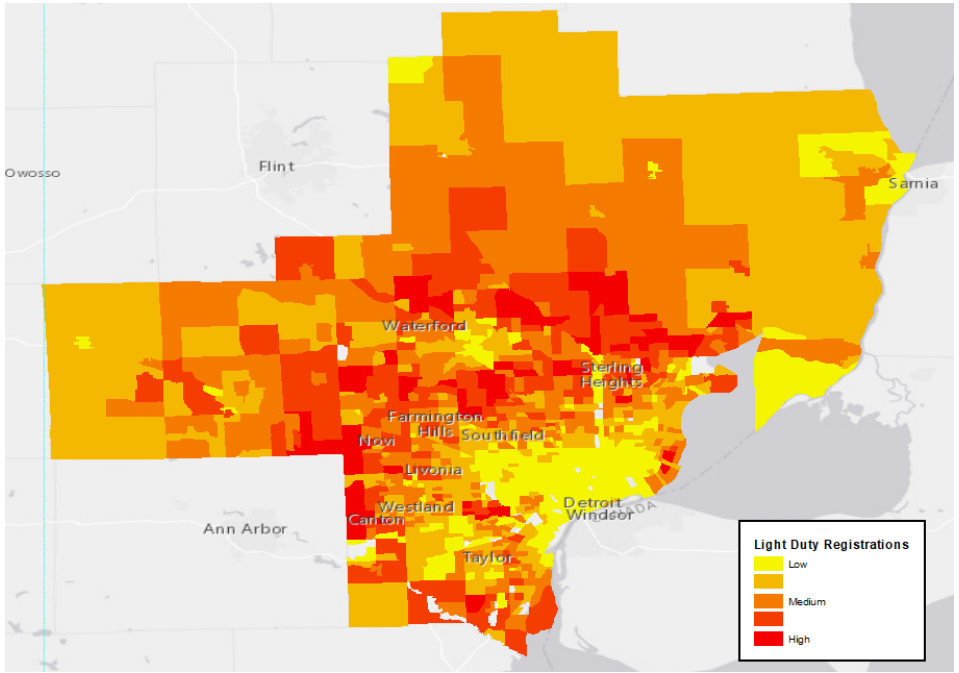
There is a selection of key drivers we consider in developing the micro-level light-duty EV forecast

State/Regional Forecast Drivers

Census Tract level:

- Historical Registrations and Share
- Demographic Growth
  - Household Volume
  - Household Income
- EV Purchase Predictors

Registration density for light-duty vehicles



Source: Mobility Global

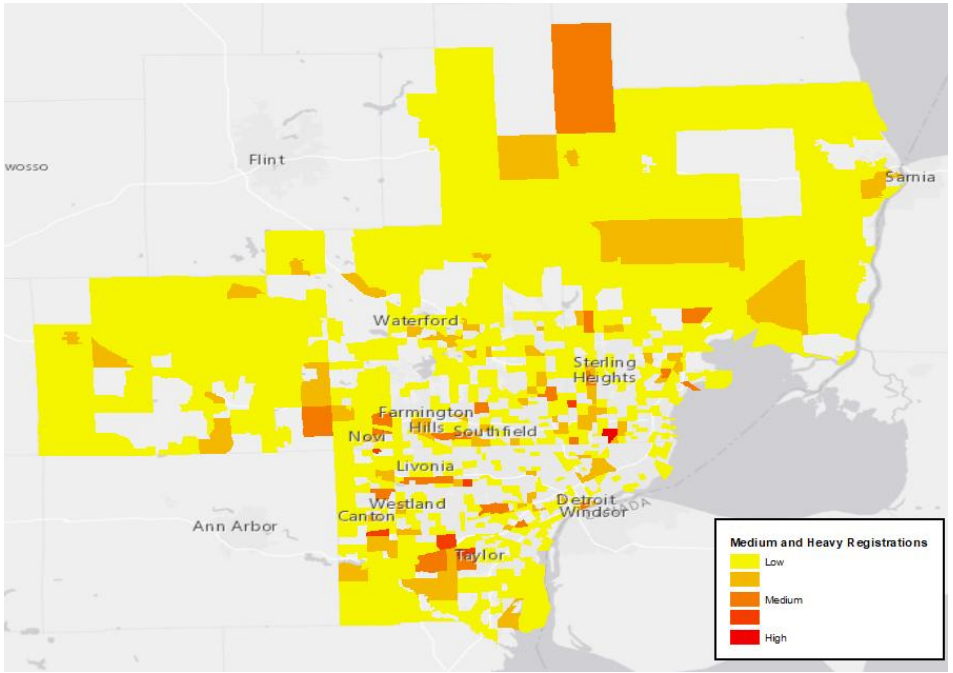
There is a selection of key drivers we consider in developing the micro-level medium- and heavy-duty EV forecast

State/Regional Forecast Drivers

Census Tract level:

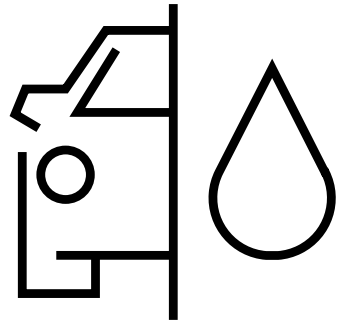
- Historical Registrations: segment and fuel type
- MHDV VIO
- Where the vehicle is used vs where the vehicle is sold
- EV-Fleet transition incentives

Registration density for medium- and heavy-duty vehicles



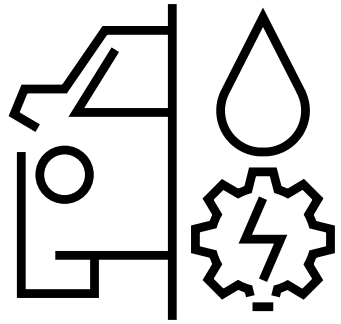
Source: Mobility Global

We use purchase predictor drivers such as income and age to forecast household adoption of EVs, Hybrid and ICE vehicles



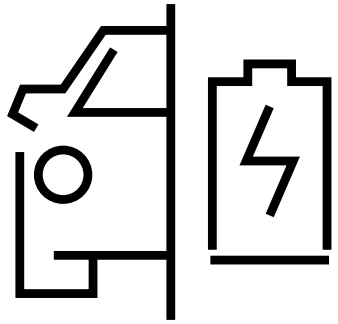
Internal Combustion Buyer Household

- HH Income $150K+: 29%
- Under 55: 50%
- Multicultural: 33%



Hybrid HHs Buyer Household

- HH Income $150K+: 38%
- Under 55: 51%
- Multicultural: 40%



EV HHs Buyer Household

- HH Income $150K+: 47%
- Under 55: 64%
- Multicultural: 48%

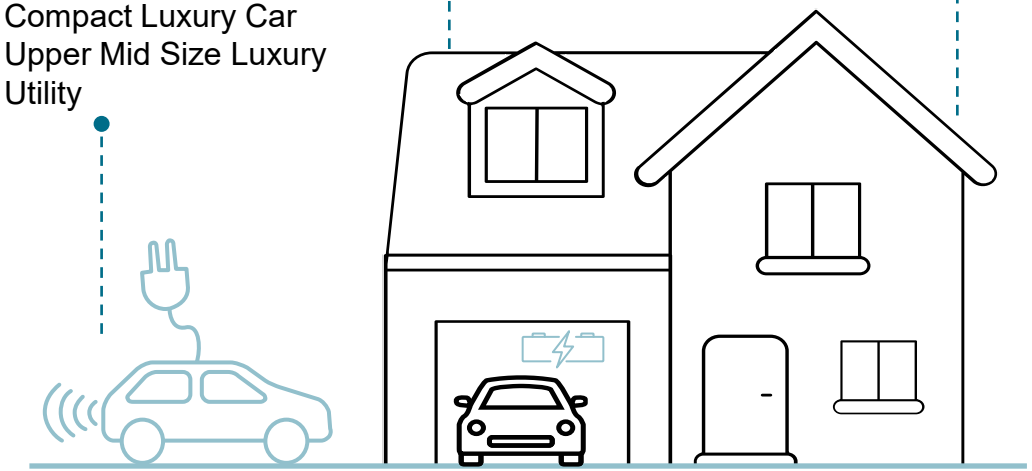
Source: Mobility Global. Retail New Vehicle Registrations Rolling 12 months through May 2026

In contrast to gas vehicle buyers, EV households have much higher incomes and younger age, which limits EV growth potential until more affordable vehicles are available

EV Purchase Patterns
- New vehicle every 2 years: 23%
- Own 2+ new: 46%

Top Electric Vehicle Segments ~72% of new purchases
- Compact Luxury Utility
- Compact Utility
- Compact Luxury Car
- Upper Mid Size Luxury Utility

EV Owner Household Profile
- 62%: HHI $100K+
- 42%: Age 35-54
- 77%: Live in a Top-50 Metro Area



Gas Purchase Patterns
- New vehicle every 2 years: 16%
- Own 2+ new: 32%

Gas Owner Household Profile
- 36%: HHI $100K+
- 27%: Age 35-54
- 50%: Live in a Top-50 Metro Area

Top Gasoline Segments ~50% of new purchases
- Compact Utility
- Upper Mid Size Utility
- Full Size Half Ton Pickup
- Subcompact Plus Utility

Note: Range extenders enter the market in 2026 and could present a new household dynamic.
Source: Mobility Global: Net-To-New CYTD July 2026. New Vehicle Registrations CYTD May 2026. Household profile based on Retail Vehicles in Operation Q12026. EV = Battery Electric Vehicles. Gas Purchase Patterns = Gas-powered vehicles without a plug-in hybrid powertrain.

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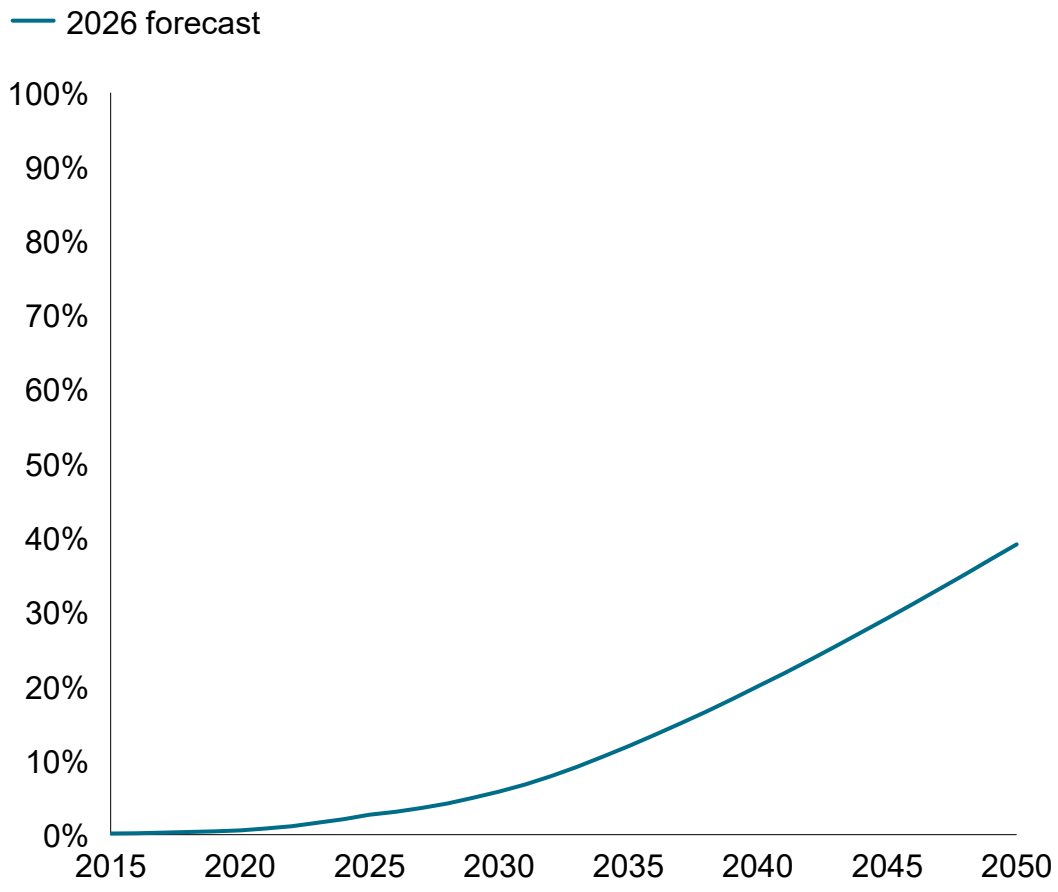
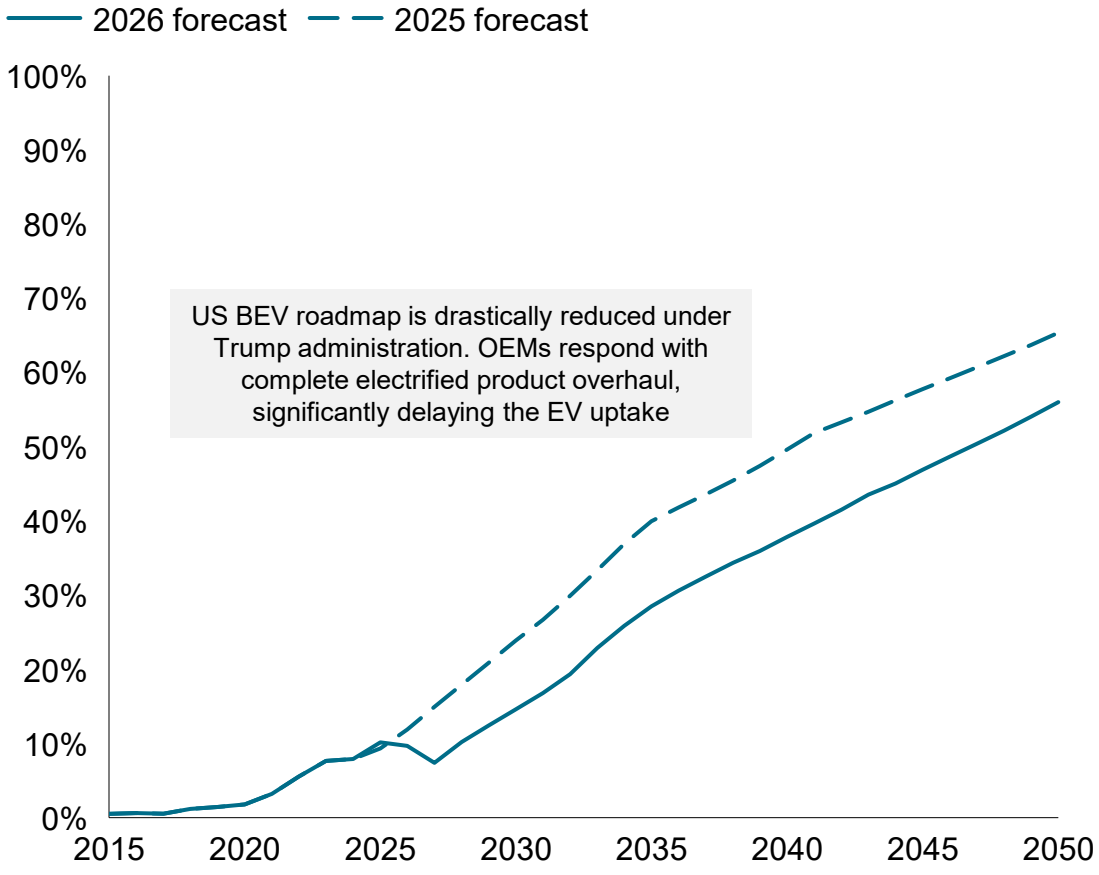
We will update base case assumptions for US light vehicle sales and penetration metrics for this year's forecast

US light-duty EVs as total on-road light vehicle fleet[1]



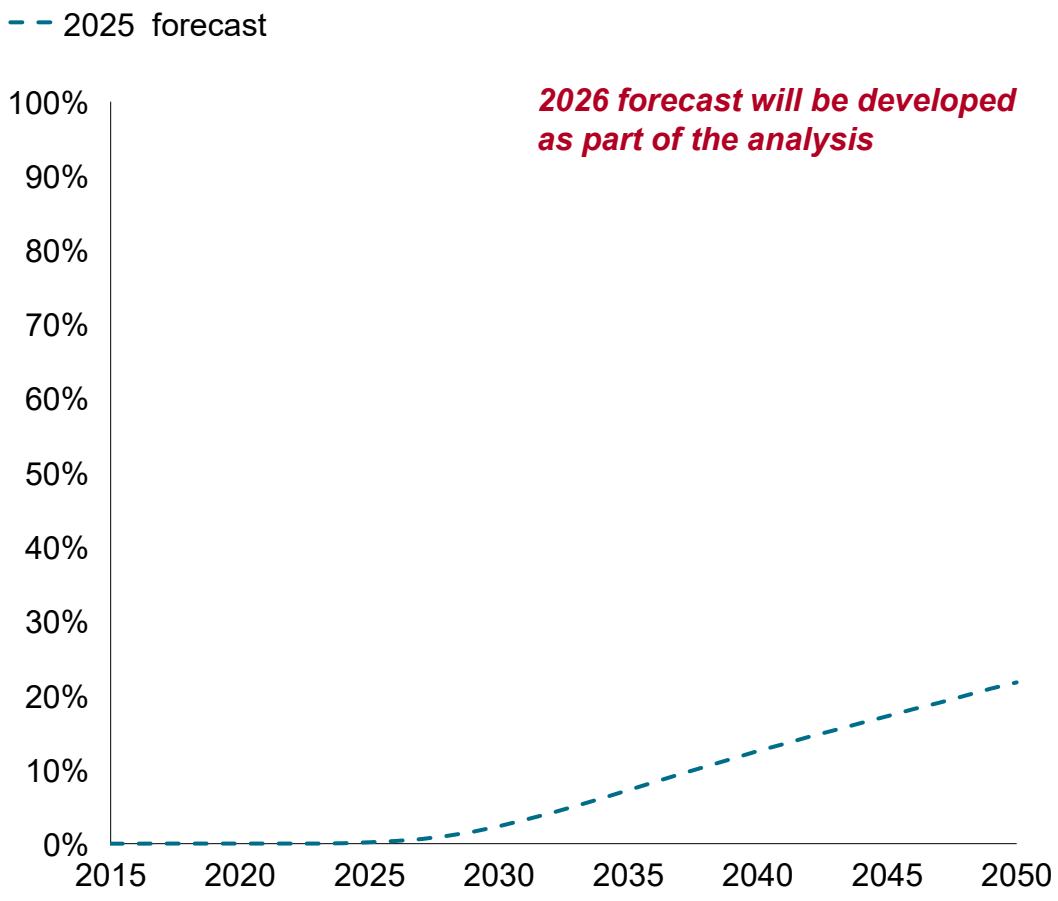
US light-duty EV sales as percent of light vehicle sales[1]



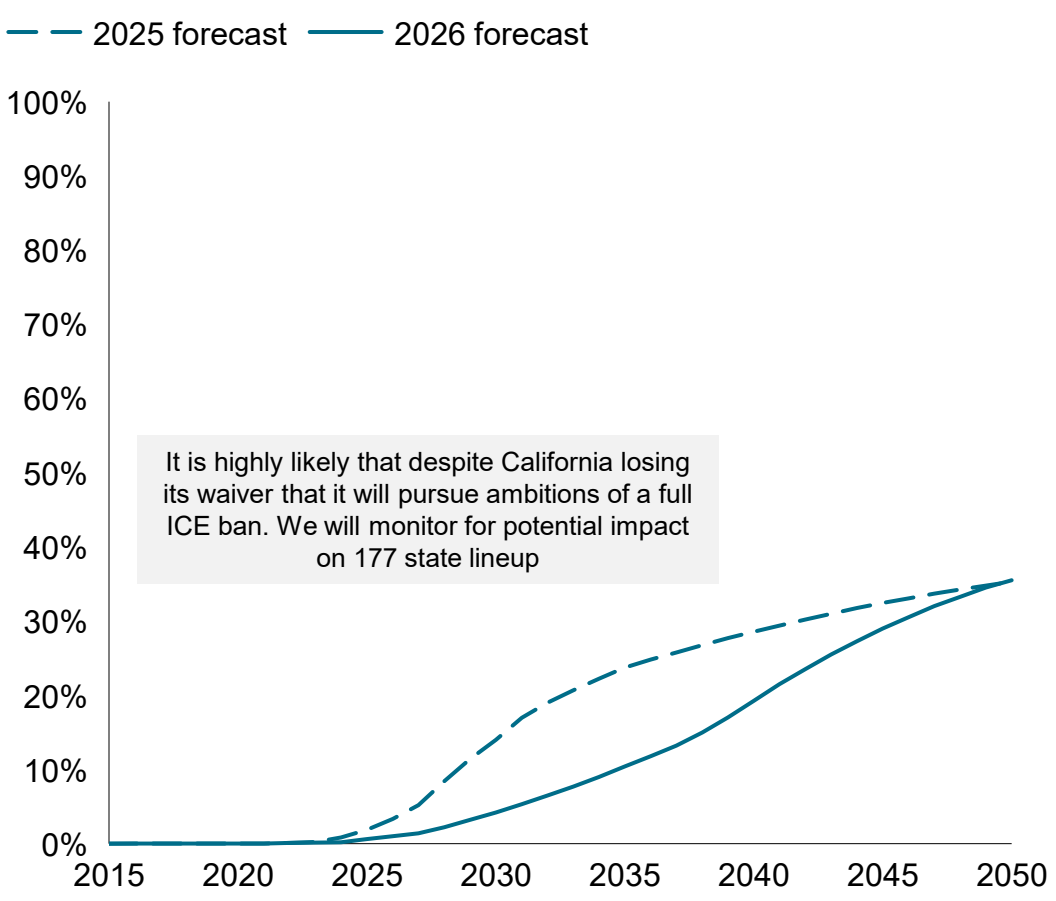
Values will be updated during the project
1. Includes battery-electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs)
Source: Mobility Global

We will also update base case assumptions for US MDHDV sales and penetration metrics; *S&P will refer to used MH registrations for a more accurate reading of PJM zones*

US Medium/Heavy duty EVs as total on-road light vehicle fleet[1]



US Medium/Heavy duty EV sales as percent of light vehicle sales[1]



Values will be updated during the project.
1. Includes battery-electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs)
Source: Mobility Global

Light-duty and medium- and heavy-duty vehicle assumptions: Policy and regulations

Type of vehicle applicability	Assumptions and inputs	Value	Sources
Light-duty	EV national ambitions abandoned, and CAFE is revised	Goal: Revised CAFE standards (MPG) to climb to 34.5 miles per gallon by 2031. EPA regulations rescinded S&P Global Forecast for ~10-11% sales to be BEV in 2030	Mobility Global
Light-duty	Sub-national	Sub-national ambitions greatly restricted with the California waiver removal and assumed to be frozen until a change in federal policy occurs	Mobility Global
Medium and heavy-duty	Sub-national	Sub-national ambitions greatly restricted with the California waiver removal and assumed to be frozen until a change in federal policy occurs	Mobility Global
Medium and heavy-duty	Vehicle types by function	EV penetration rates by vehicle class will be developed as part of the 2026 analysis	Mobility Global

Source: Mobility Global

Light-duty vehicle assumptions: Electric vehicle utilization

Type of vehicle applicability	Assumptions and inputs	Value	Sources
Light-duty	Miles driven (weekday/weekend)	AEC, DL, ME, PECO, PENELEC, PPL: 9,592 miles/year (2026) to 10,445 miles/year (2046) AEP, BGE: 10,593 miles/year (2026) to 11,480 miles/year (2046) APS: 10,176 miles/year (2026) to 11,049 miles/year (2046) ATSI, Dayton: 10,482 miles/year (2026) to 11,365 miles/year (2046) ComEd: 10,259 miles/year (2026) to 11,135 miles/year (2046) DEOK: 10,649 miles/year (2026) to 11,538 miles/year (2046) Dominion: 10,537 miles/year (2026) to 11,422 miles/year (2046) DPL: 10,370 miles/year (2026) to 11,250 miles/year (2046) EKPC: 10,815 miles/year (2026) to 11,710 miles/year (2046) JCPL, PSEG, RE: 9,926 miles/year (2026) to 10,790 miles/year (2046) PEPCO: 9,370 miles/year (2026) to 10,215 miles/year (2046) 75% of miles are driven during weekdays	Mobility Global

Source: S&P Global

Light-duty vehicle assumptions: Electric vehicle efficiency

Type of vehicle applicability	Assumptions and inputs	Value	Sources
Light-duty	Miles per kWh[1] (normal operating conditions[2])	2026: 2.7 miles/kWh 2046: 3.1 miles/kWh	Mobility Global
Light-duty	Loss in battery efficiency due to temperature fluctuations	43% additional energy at 23 Fahrenheit (heating) 5% additional energy at 86 Fahrenheit (cooling) Temperature assumed for the study is a 10-year historical average on a daily basis	Mobility Global, National Oceanic and Atmospheric Administration

1. Accounts for real-world performance, not EPA lab test; includes weighted average performance of car parc
2. Normal operating conditions are assumed at 77 Fahrenheit
Source: S&P Global

Light-duty vehicle assumptions: Charging infrastructure

Type of vehicle applicability	Assumptions and inputs	Value	Sources
Light-duty	Access to home and workplace charging	***2026 forecast will be developed as part of the analysis*** 2025 assumptions: 2026: 81% access to home charging 2046: 66% access to home charging	Mobility Global – Charging Infrastructure
Light-duty	Type of home charging (Level 2 vs Level 1)	***2026 forecast will be developed as part of the analysis*** 2025 assumption: 80% Level 2 charging	Mobility Global – Charging Infrastructure
Light-duty	Charging strategy (for drivers with access to home charging)	2026: 94% Immediate / 6% Delayed 2046: 65% Immediate / 35% Delayed	S&P Global Energy

Source: S&P Global, NREL

Light-duty vehicle assumptions: Charging behavior

The light duty charging shapes are a combination of different charging strategies

Charging strategy	Home charging	Description	Preferred charging time	Type of charger
Immediate	Yes	Starts to charge as soon as gets home, regardless of cost	Evening	Level 2: 80% Level 1: 20%
TOU – As soon as possible (ASAP)	Yes	Starts to charge as soon as on-peak pricing ends	Dynamic based on pricing	Level 2
TOU – As cheap as possible (ACAP)	Yes	Charges during super off-peak hours	Dynamic based on pricing	Level 2
Work and public charger	No	Relies on public and workplace charging, starts to charge as soon as arrives to work	Morning through midday	Mostly Level 2 and DCFC
Ride hailing	50%	Typically relies on public charging, charges throughout the day	Middle of the day	Mostly Level 2 and DCFC

Source: S&P Global, NREL

Medium and heavy-duty assumptions: EV utilization and efficiency

Type of vehicle applicability	Assumptions and inputs	Value	Sources
Medium and heavy-duty	Miles driven (weekday/weekend)	Delivery van: 19,345 miles/year (2026) to 28,288 miles/year (2046); 96% of miles driven during weekdays School bus: 11,680 miles/year (2026) to 12,045 miles/year (2046); 96% of miles driven during weekdays Transit bus: 41,975 miles/year (2046) to 44,530 miles/year (2046); 88% of miles driven during weekdays Medium truck: 21,535 miles/year (2026) to 22,630 miles/year (2046); 71% of miles driven during weekdays Short-haul truck: 35,040 miles/year (2026) to 37,230 miles/year (2046); 96% of miles driven during weekdays Long-haul truck: 85,410 miles/year (2026) to 90,520 miles/year (2046); 88% of miles driven during weekdays	Mobility Global
Medium and heavy-duty	Miles per kWh (normal operating conditions[1])	Delivery van: 1.48 miles/kWh (2026) to 1.96 miles/kWh (2046) School bus: 0.89 miles/kWh (2026) to 1.13 miles/kWh (2046) Transit bus: 0.48 miles/kWh (2026) to 0.59 miles/kWh (2046) Medium truck: 0.59 miles/kWh (2026) to 0.74 miles/kWh (2046) Short-haul truck: 0.46 miles/kWh (2026) to 0.57 miles/kWh (2046) Long-haul truck: 0.46 miles/kWh (2026) to 0.57 miles/kWh (2046)	Mobility Global
Medium and heavy-duty	Loss in battery efficiency due to temperature fluctuations	Additional energy at 23 Fahrenheit (heating): 24% (delivery vans), 17% (transit buses), 87% (school buses), 6% (medium trucks), 28% (short-haul and long-haul trucks) Additional energy at 86 Fahrenheit (cooling): 9% (delivery vans), 7% (transit buses), 3% (school buses), 6% (medium trucks), 6% (short-haul and long-haul trucks)	Mobility Global, National Renewable Energy Laboratory, CALSTART MHD EV Deployment Data

1. Normal operating conditions are assumed at 77 Fahrenheit
Source: S&P Global

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Vehicle classification

Type of EV vehicle	Definition
Medium- and heavy-duty trucks (MHDT)	MHDTs refer to, with some regional nuance, vehicles in the US Department of Transportation's gross vehicle weight rating (GVWR) categories 4-8 (more than 14,001 lb)
Medium-duty trucks (MDTs)	Medium or medium-duty vehicles refer to those in GVWR categories 4-7 (14,001-33,000 lb)
Heavy-duty trucks (HDTs)	Heavy or heavy-duty vehicles refer to those in GVWR category 8 (more than 33,001 lb)
Long-haul HDTs	HDT with a sleeper cab, not requiring to return to depot at the end of the day
Short-haul HDTs	HDT with a day cab for regional transportation
Transit Buses	Medium/Heavy Duty vehicles for the transportation of people in transit systems (incl. inter-city coaches)
School Buses	Medium/Heavy Duty vehicles for the transportation of pupils and students to educational facilities
Delivery Vans	Commercial vans for transporting goods (all GVWR categories, primarily Class 2, 3 and 4)
Light Duty Vehicles (LDV)	Passenger vehicles including SUVs and pickup trucks (GVWR categories 2-3, up to 14,000 lb)

Sources: S&P Global

Acronyms

ACC: Advanced Clear Car

ACT: Advanced Clean Truck

BEV: Battery Electric Vehicle

CAFE: Corporate Average Fuel Economy

CARB: California Air Resources Board

DCFC: Direct Current Fast Charging

EPA: Environmental Protection Agency

EV: Electric Vehicle

GHG: Greenhouse Gas

HEV: Hybrid Electric Vehicle

ICE: Internal Combustion Engine

IRA: Inflation Reduction Act

kWh: Kilowatt Hour

LDV: Light Duty Vehicle

NACS: North American Charging Standard

NHTSA: National Highway Traffic Safety Administration

MaaS: Mobility as a Service

MHD/MHDV: Medium and Heavy Duty Vehicle

PHEV: Plug in Hybrid Electric Vehicle

MPG: Miles per Gallon

MWh: Megawatt Hour

S-177 States: 177 states that choose to pursue California legislation as opposed to national

REX/REEV: Range Extender Electric Vehicle

TOU: Time of Use

VIO: Vehicles in operation

VMT: Vehicle miles traveled

ZEV: Zero Emission Vehicle

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