

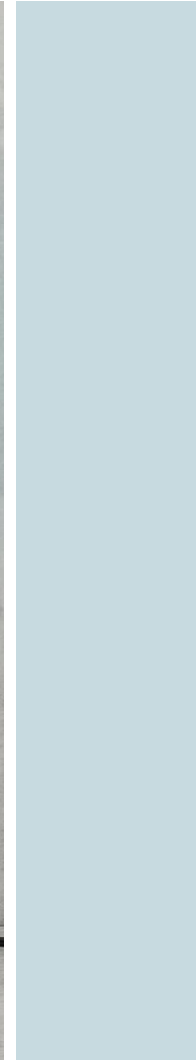
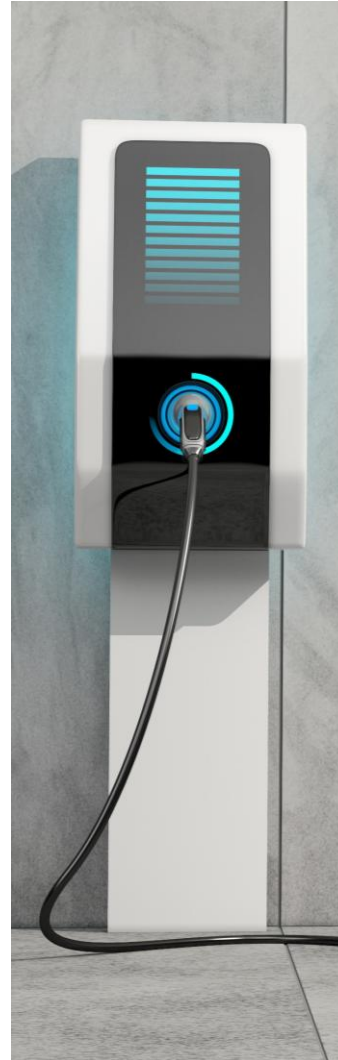
CERA Consulting

Electric Vehicle Charging Power Demand Forecast

PJM Interconnection

September 2026

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



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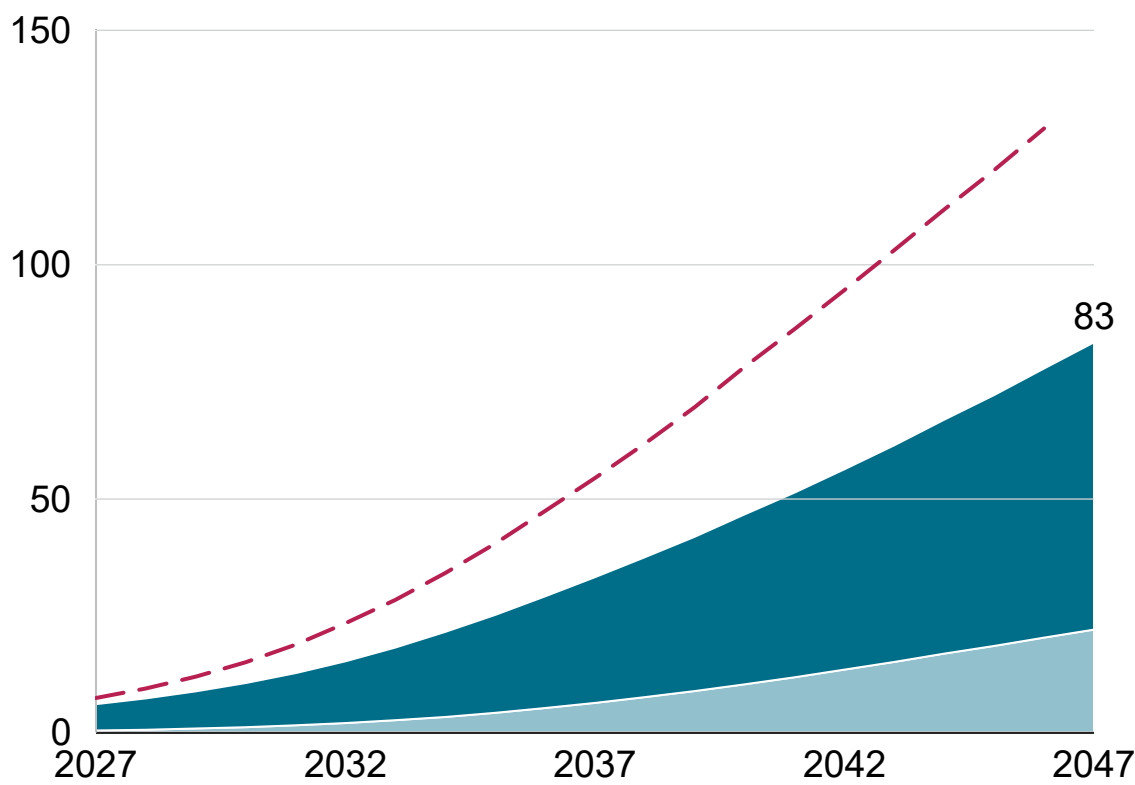
Total EV load in PJM continues to increase; however, the outlook has been revised down compared to 2025 due to slower BEV growth

Total annual EV load – PJM

TWh

Light Duty Medium and Heavy Duty

2025 Study

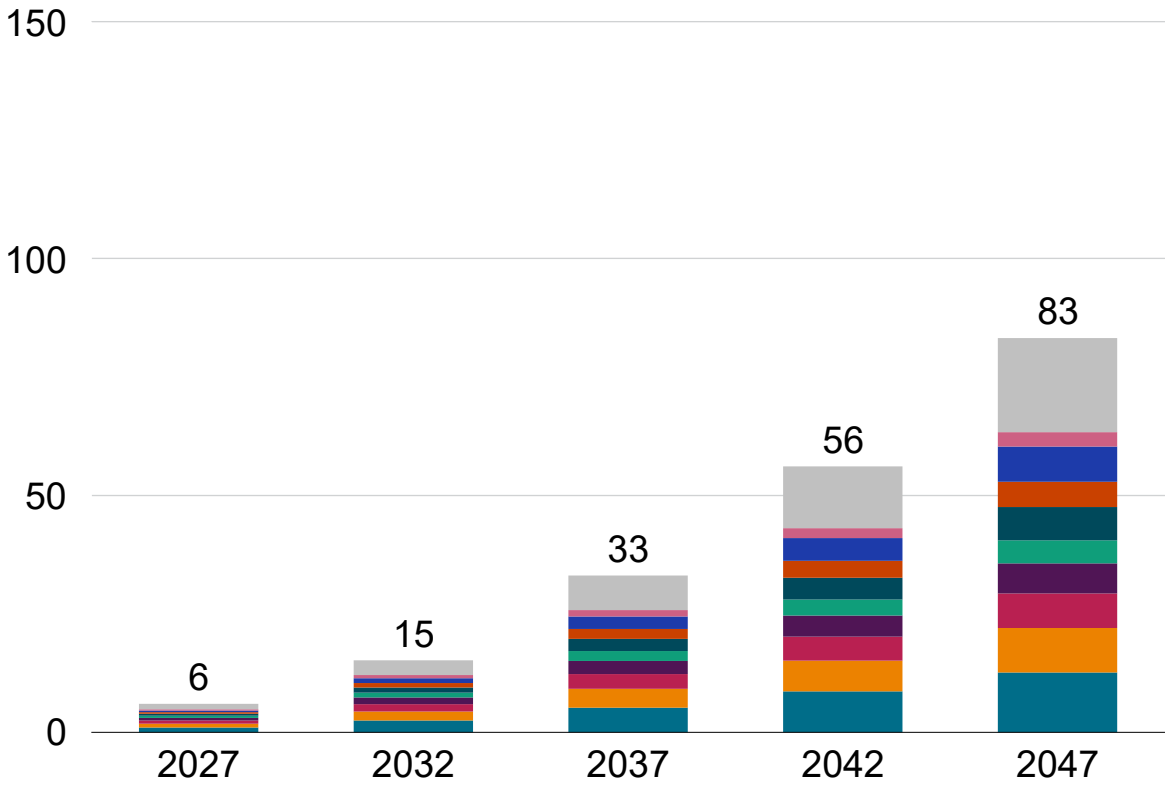


Total annual EV load by PJM zone

TWh

ComEd PSEG BGE PECO PEPCO

Dominion JCPL ATSI AEP Other



Note: Refer to Appendix for light-, medium- and heavy-duty electric vehicle definition by vehicle class
Source: S&P Global Energy, Mobility Global
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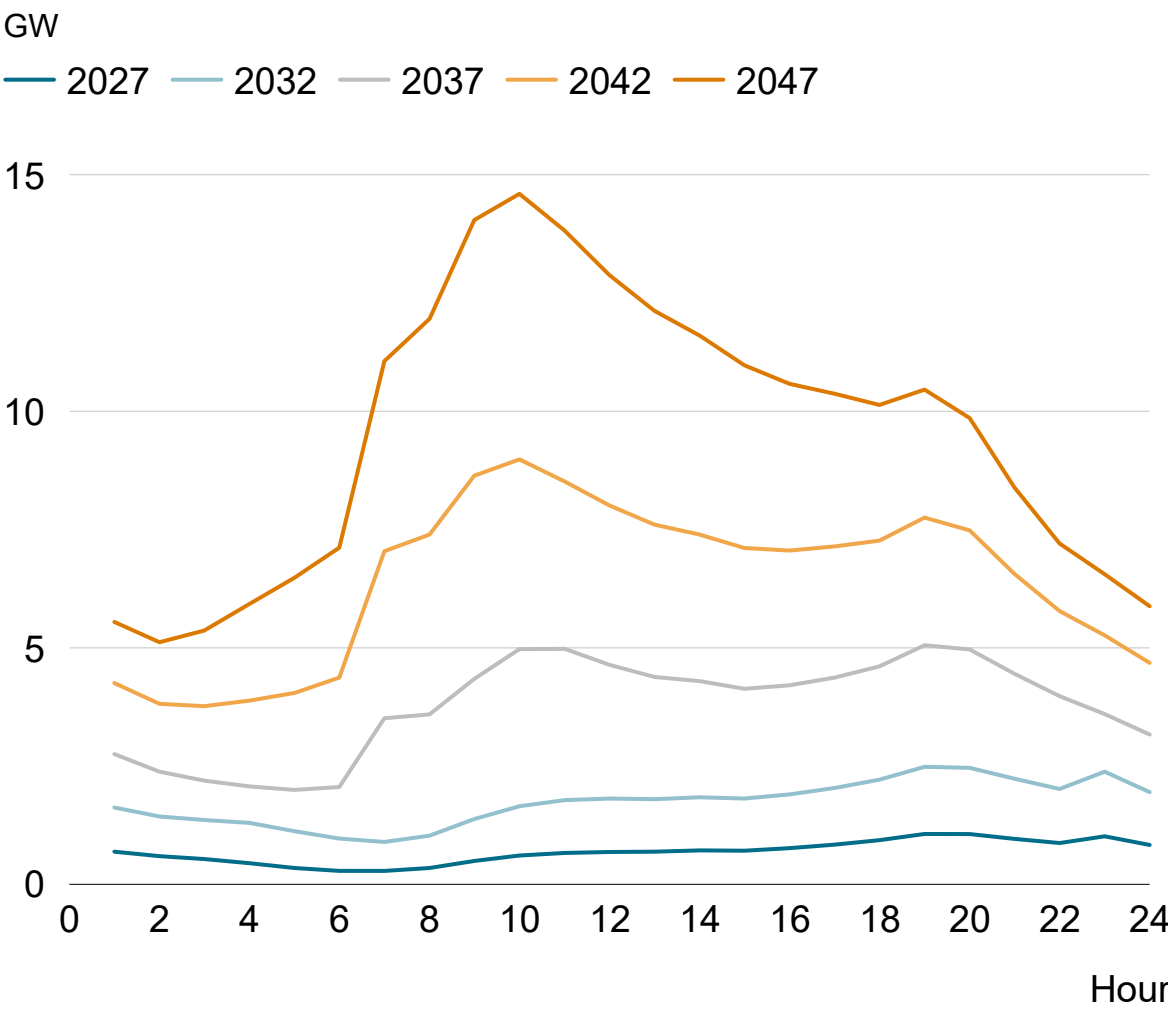


With higher penetration of managed charging and higher access to public charging, load shifts from early evening to morning and midday charging

Total EV hourly load statistics – PJM

Year	Average Load (MW)	Peak Load (MW)	Month of peak	Hour of peak
2027	689	1,312	December	19
2032	1,729	3,146	December	22
2037	3,779	6,272	October	9
2042	6,408	11,030	October	8
2047	9,499	17,760	October	8

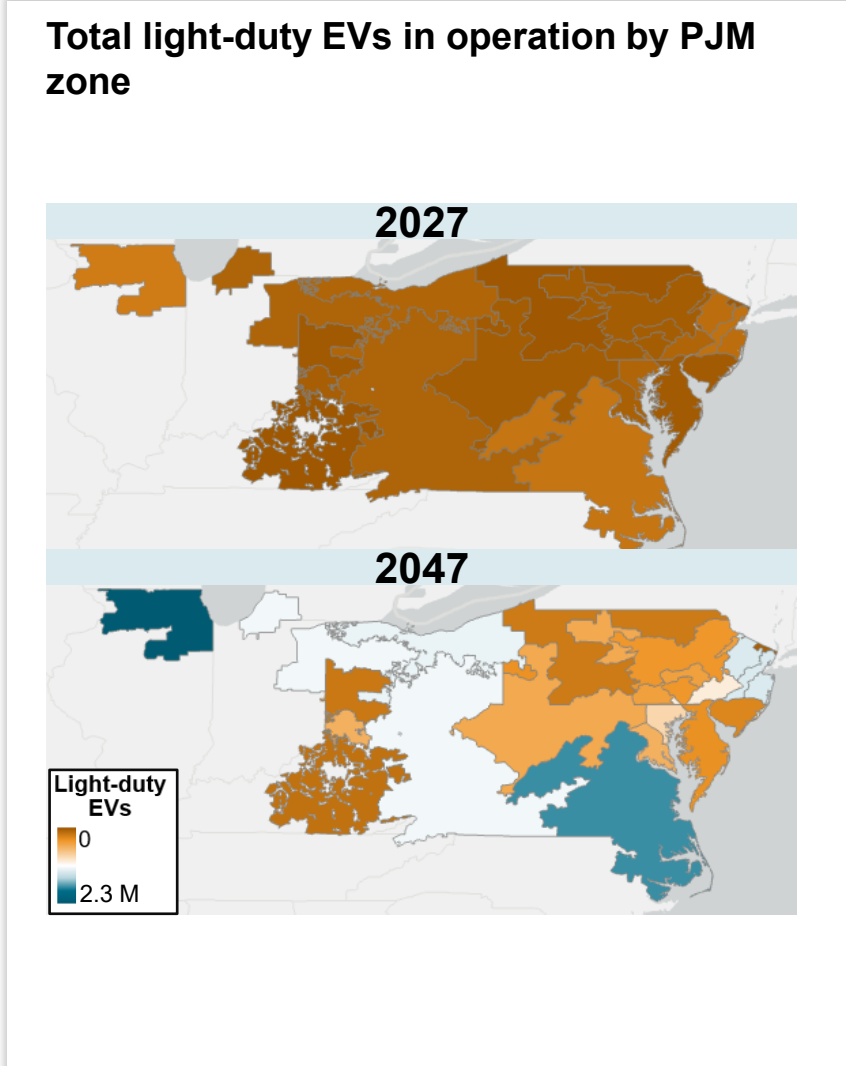
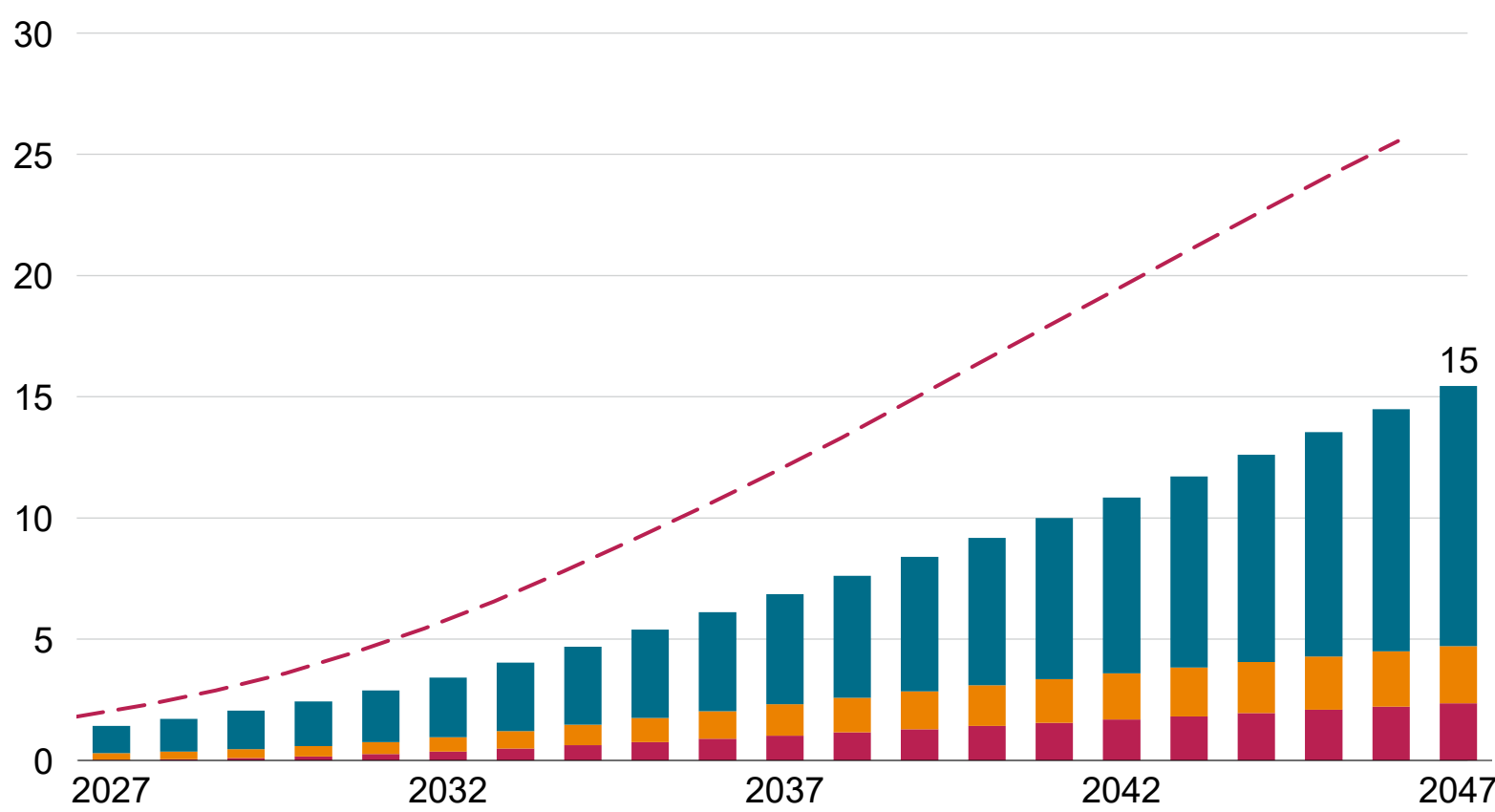
Average total EV load by hour – PJM





PJM zones with large urban areas see a higher share of light-duty EVs in operation

Total light-duty EVs in operation – PJM
Million of EVs
BEV PHEV REEV 2025 Study



Source: S&P Global Energy, Mobility Global
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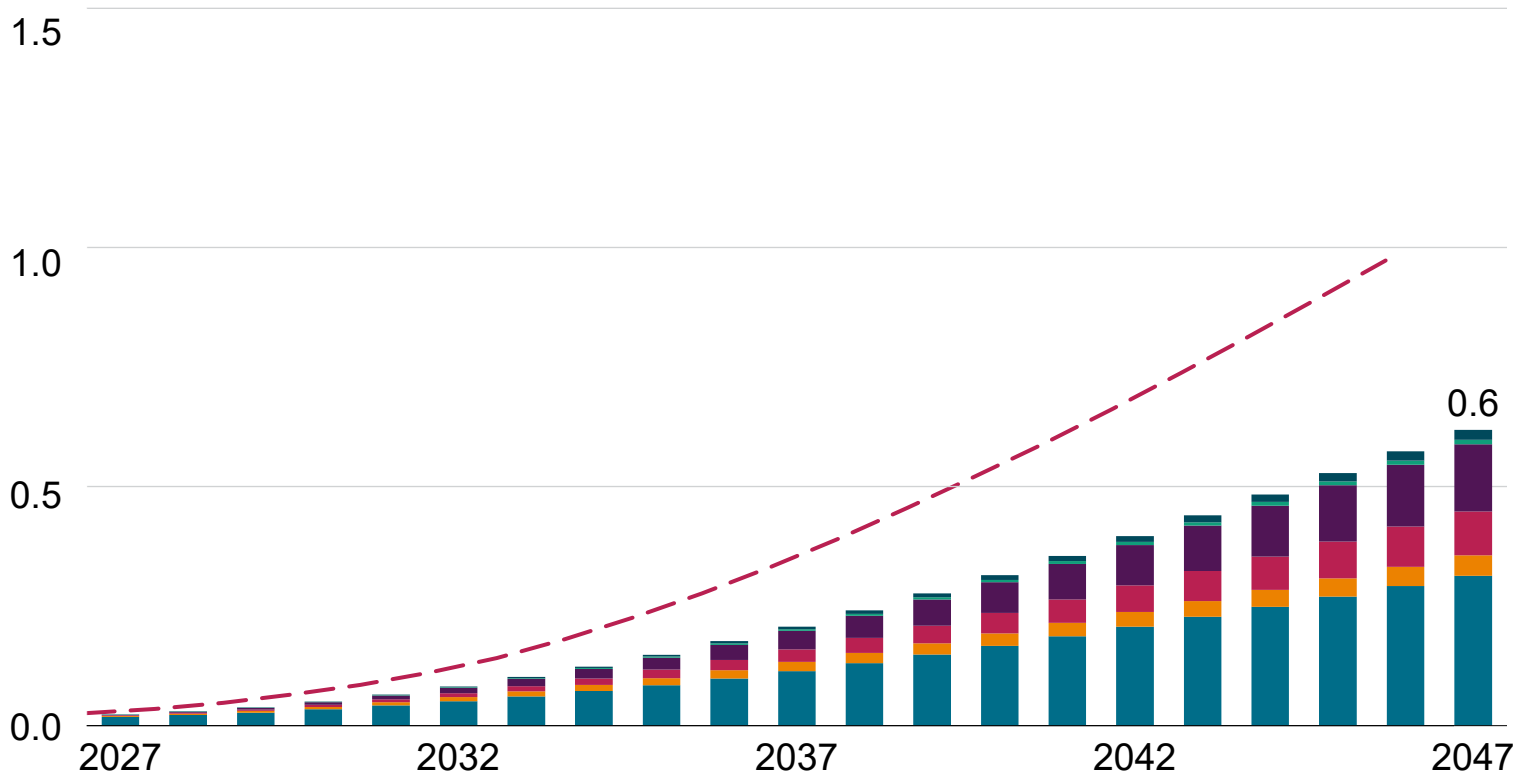


MHD EV growth has been revised down relative to the previous outlook, reaching over 600,000 vehicles in operation by 2047

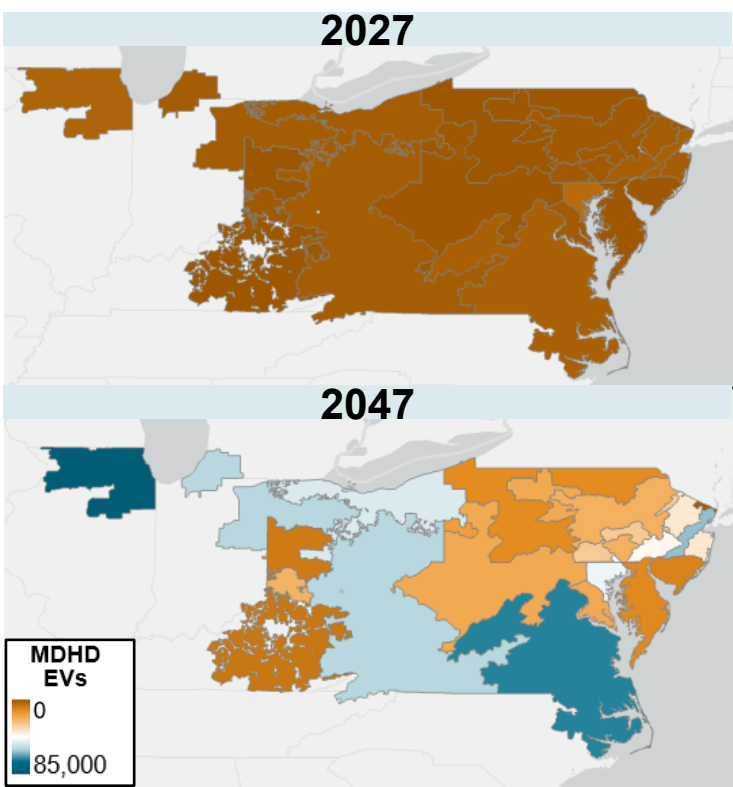
Total MHD EVs in operation – PJM

Million of EVs

- Delivery Van
- Short Haul
- Transit Bus
- 2025 Study
- School Bus
- Medium Truck
- Long Haul



Total MHD EVs in operation by PJM zone



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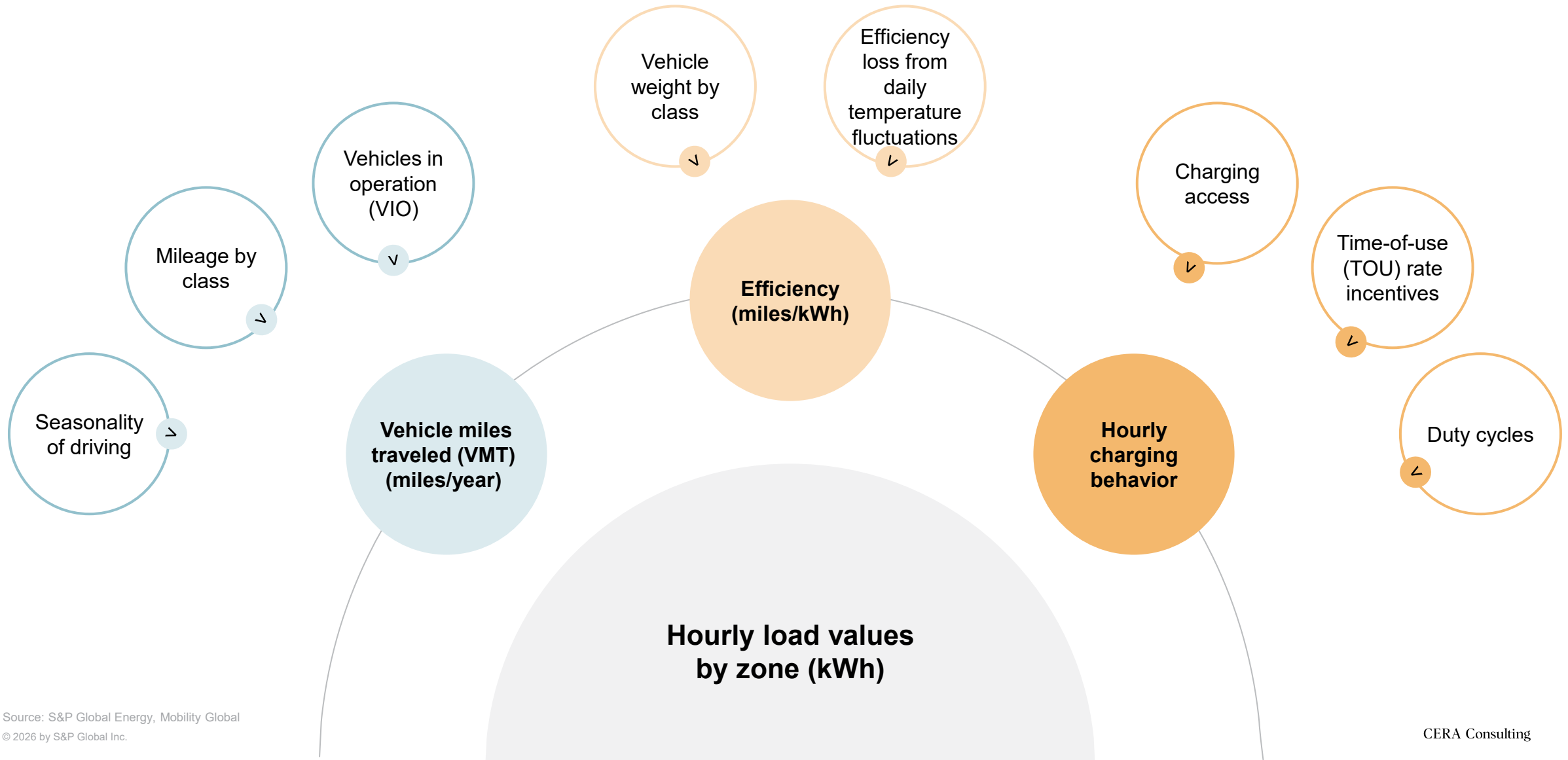
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Appendix



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





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



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 July 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)



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



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)
- Mobility Global 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)



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.



There is a number of state and regional level key drivers we consider in the EV forecast



National Forecast Drivers

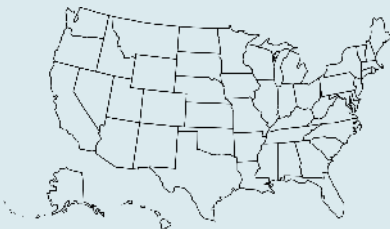


Due to EV affordability issues, EV adoption is expected to remain concentrated in affluent states until 2035

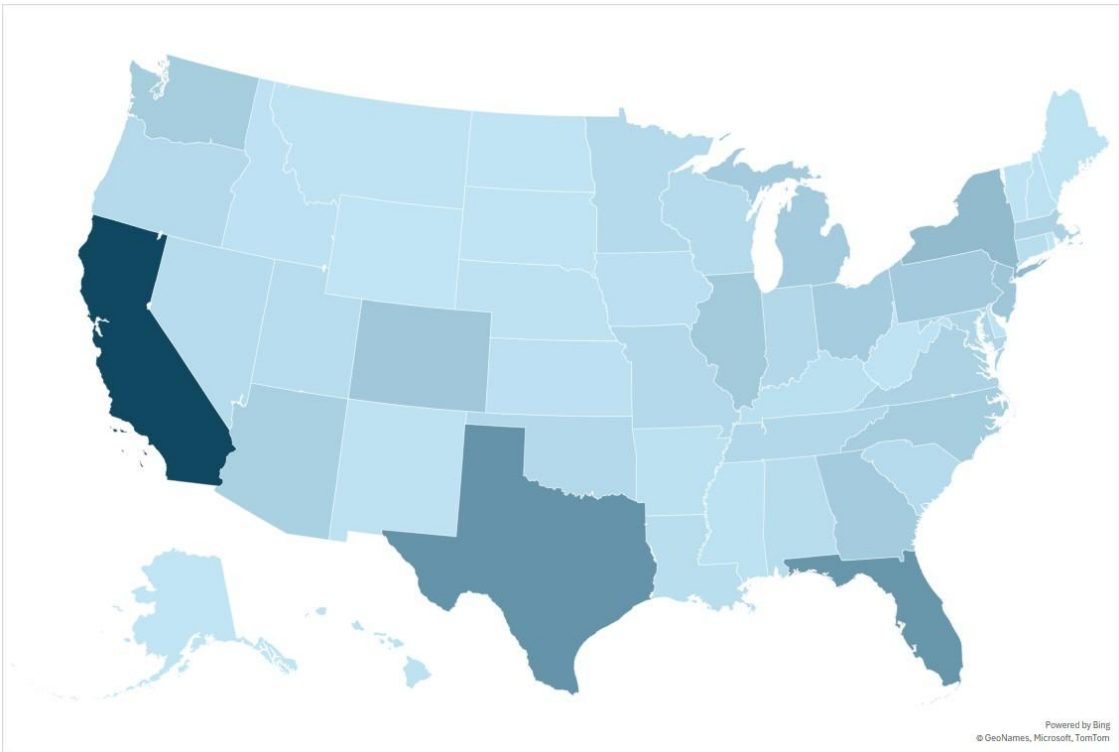


State and Region level:

- Segment preferences
- Brand performance
- Fuel-type share
- State support



2035 US ZEV sales distribution by state





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



State/Regional Forecast Drivers

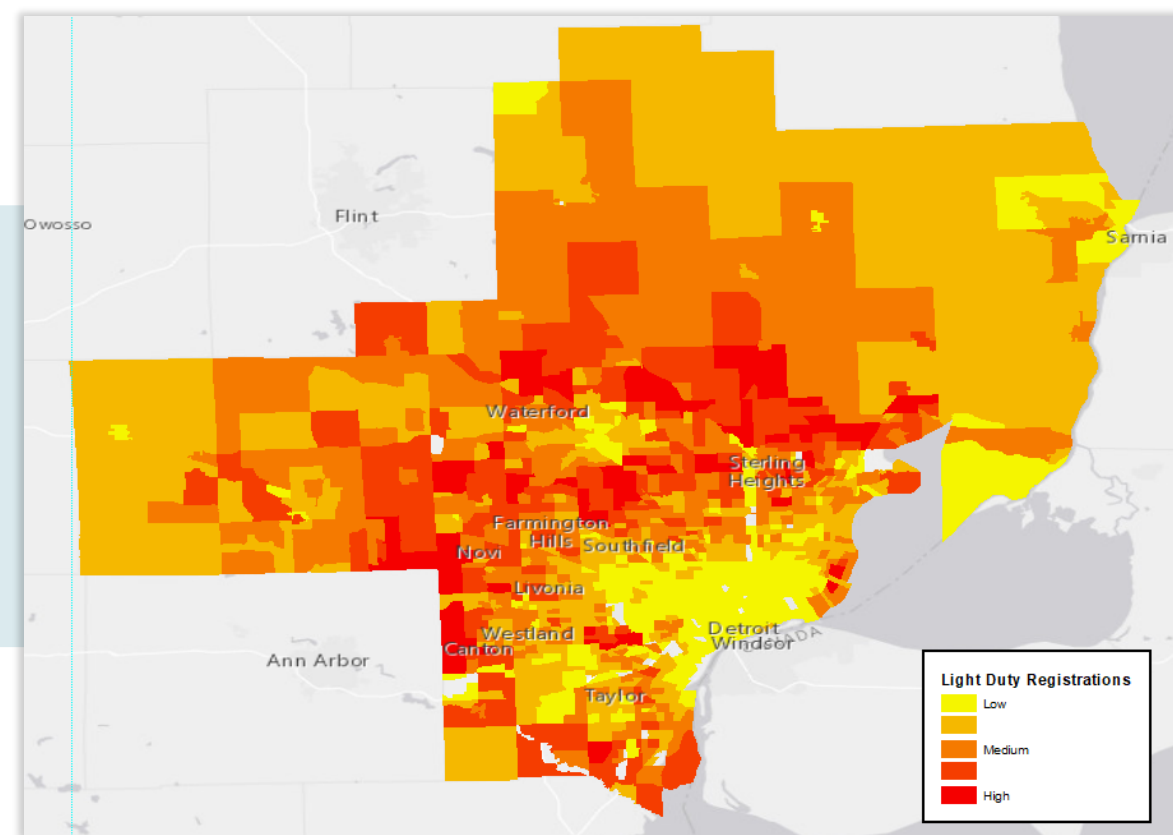


Census Tract level:

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



Registration density for light-duty vehicles





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



State/Regional Forecast Drivers

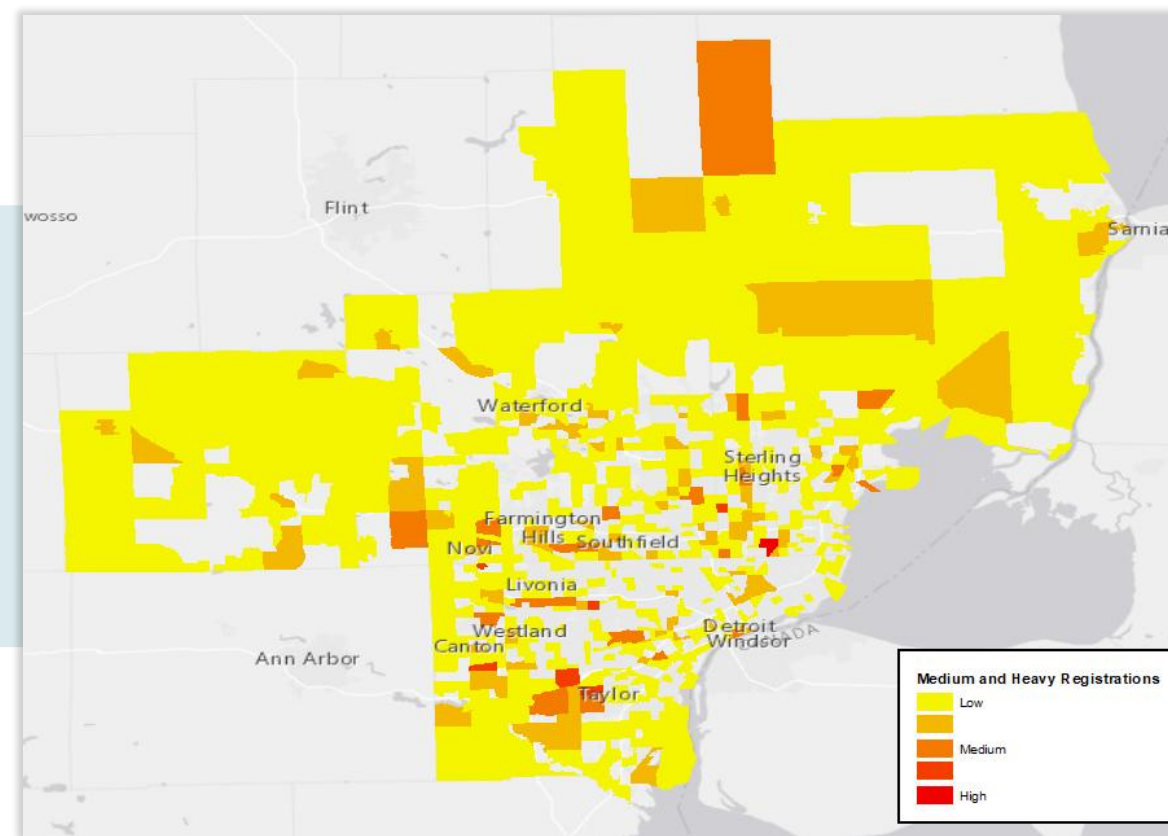


Census Tract level:

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

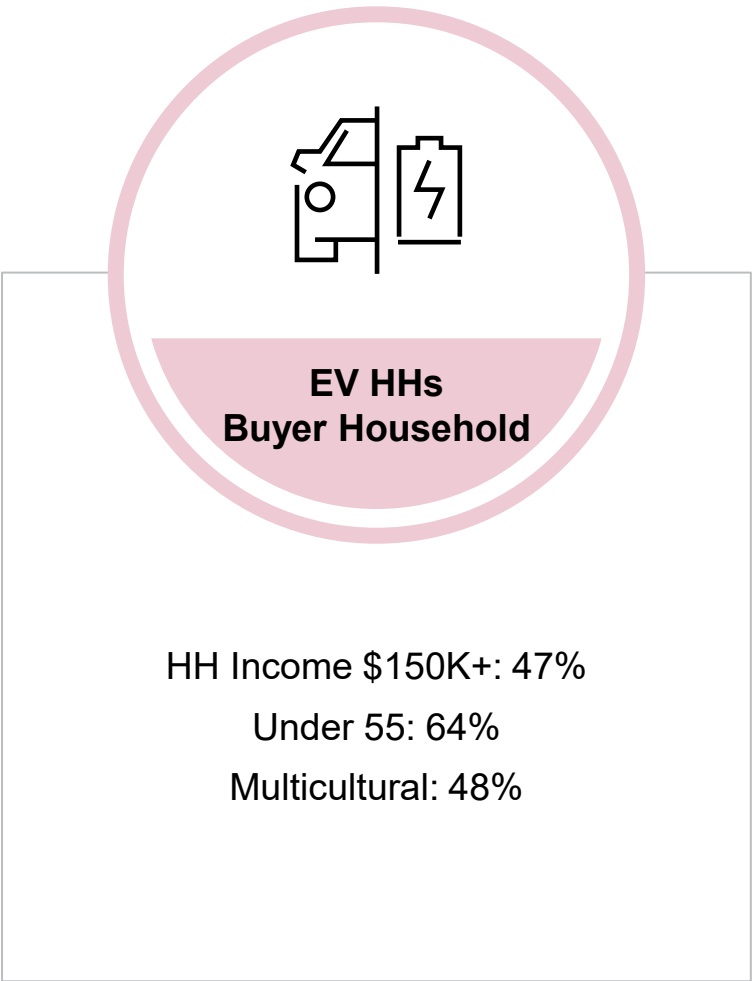
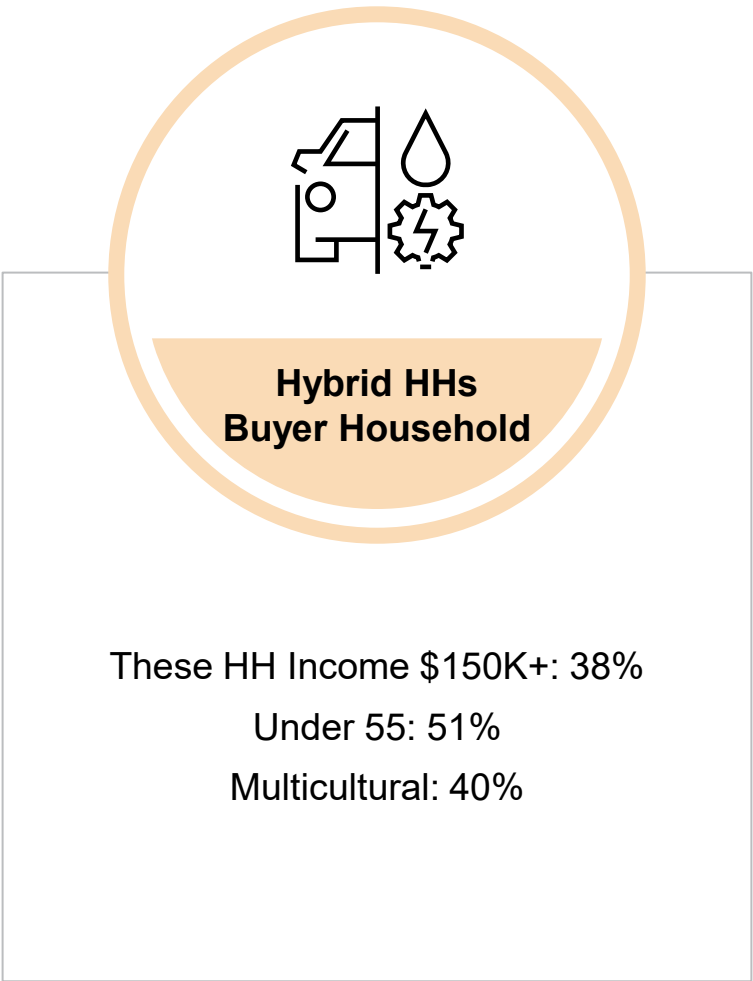
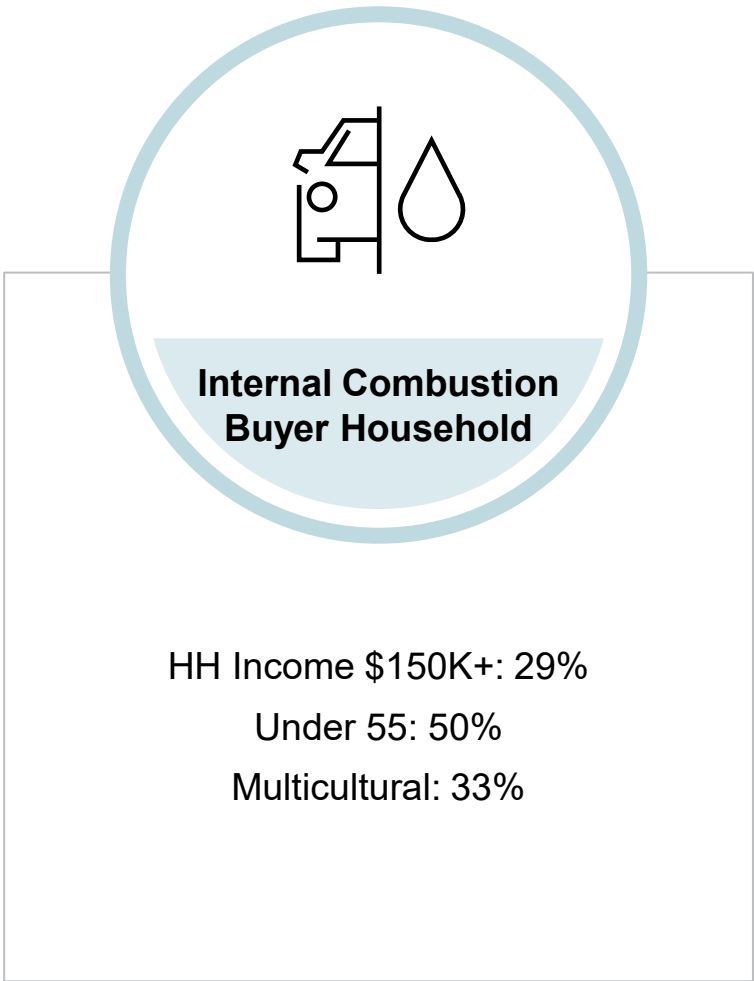


Registration density for medium- and heavy-duty vehicles





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





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

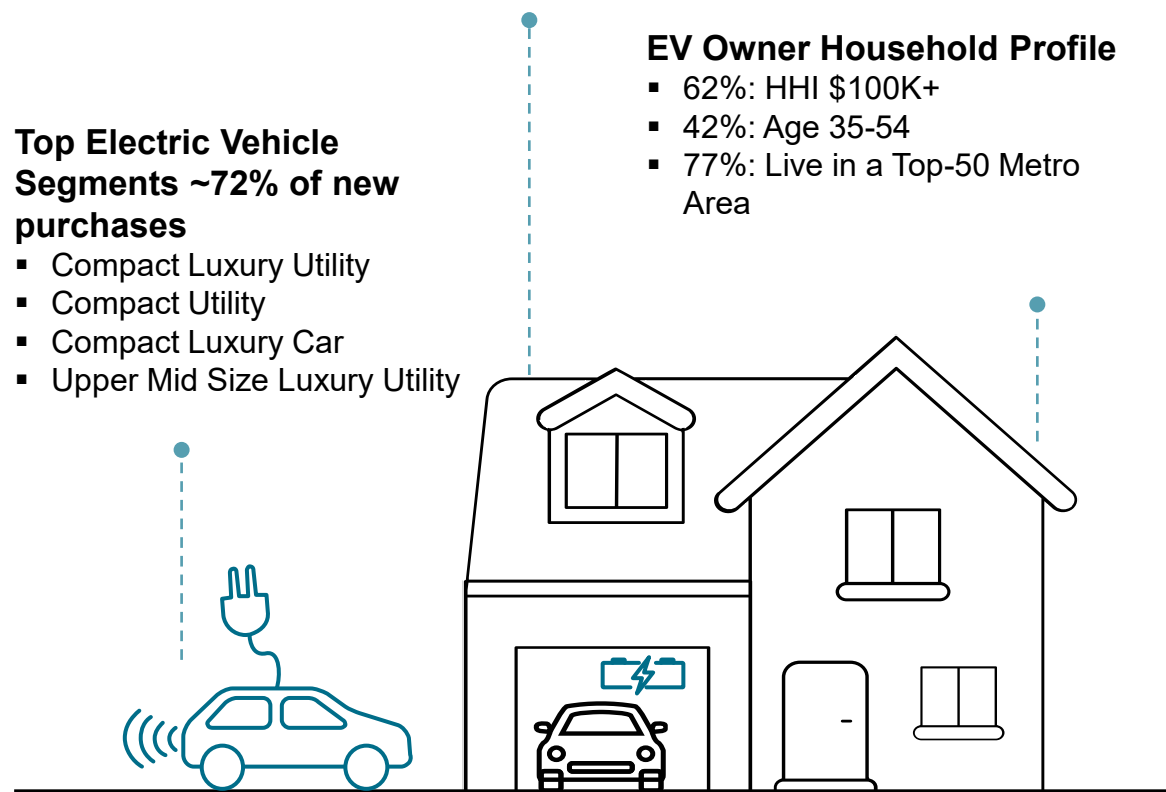
- New vehicle every 2 years: 23%
- Own 2+ new: 46%

EV Owner Household Profile

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

Top Electric Vehicle Segments ~72% of new purchases

- Compact Luxury Utility
- Compact Utility
- Compact Luxury Car
- Upper Mid Size Luxury Utility



Gas Purchase Patterns

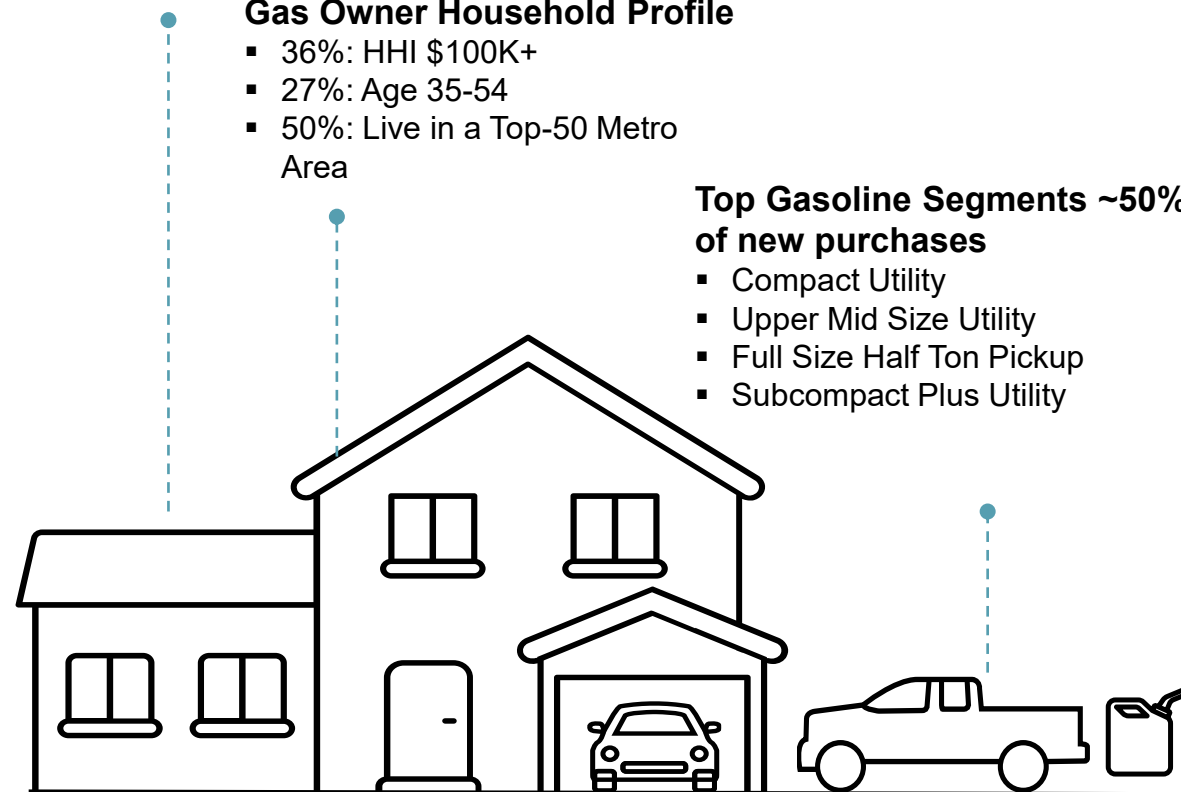
- New vehicle every 2 years: 16%
- Own 2+ new: 32%

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.

EV = Battery Electric Vehicles, Gas Purchase Patterns = Gas-powered vehicles without a plug-in hybrid powertrain.

Source: Mobility Global: Net-To-New CYTD July 2026. New Vehicle Registrations CYTD May 2026. Household profile based on Retail Vehicles in Operation Q12026.

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We used the following key assumptions to develop a forecast for electric vehicle and charging demand

Type of EV vehicles		Assumptions and inputs
Electric vehicles	Light-duty	EV national “natural demand” and performance based on expected revised CAFE standards
		EPA regulations revision
	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

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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 Energy, 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 Mobility Global forecast ~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

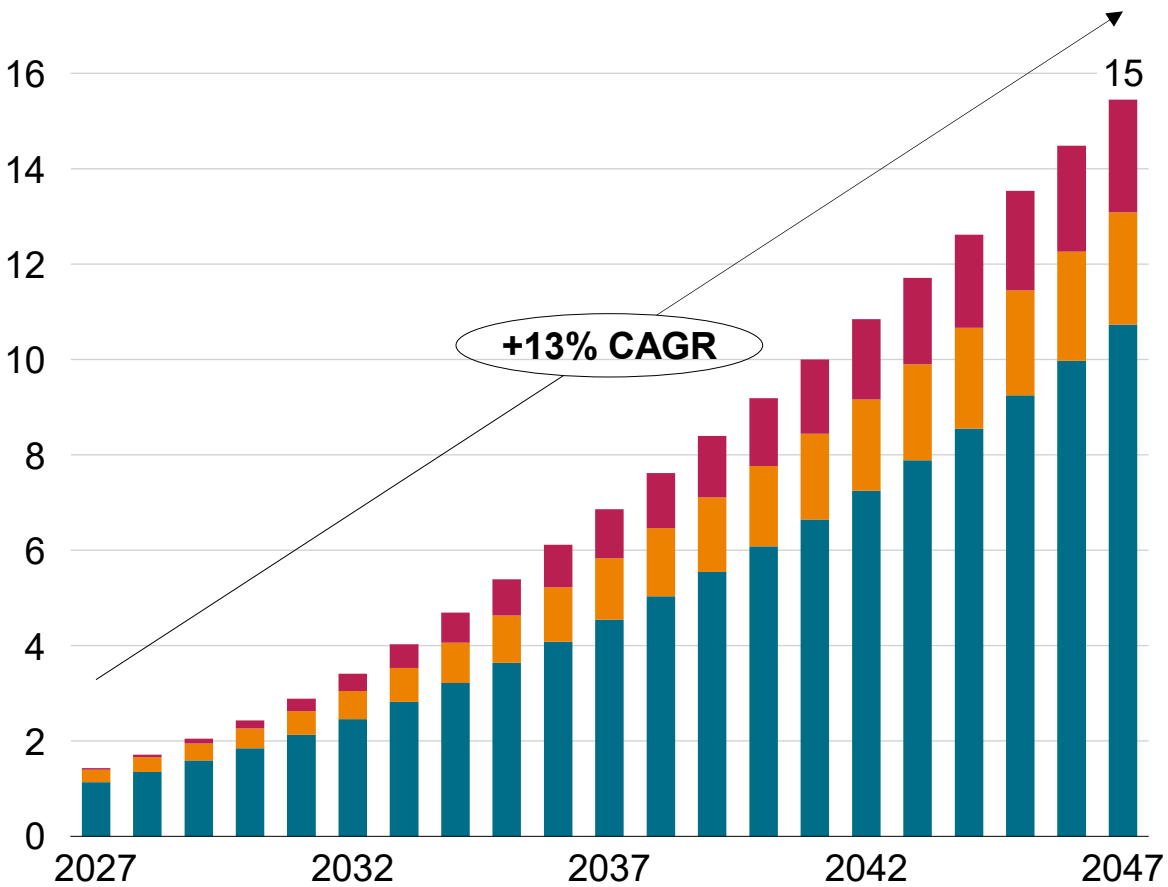


Light duty vehicle fleet in PJM is projected to grow more than tenfold over the next 20 years

Total light-duty EVs in operation – PJM

Million of EVs

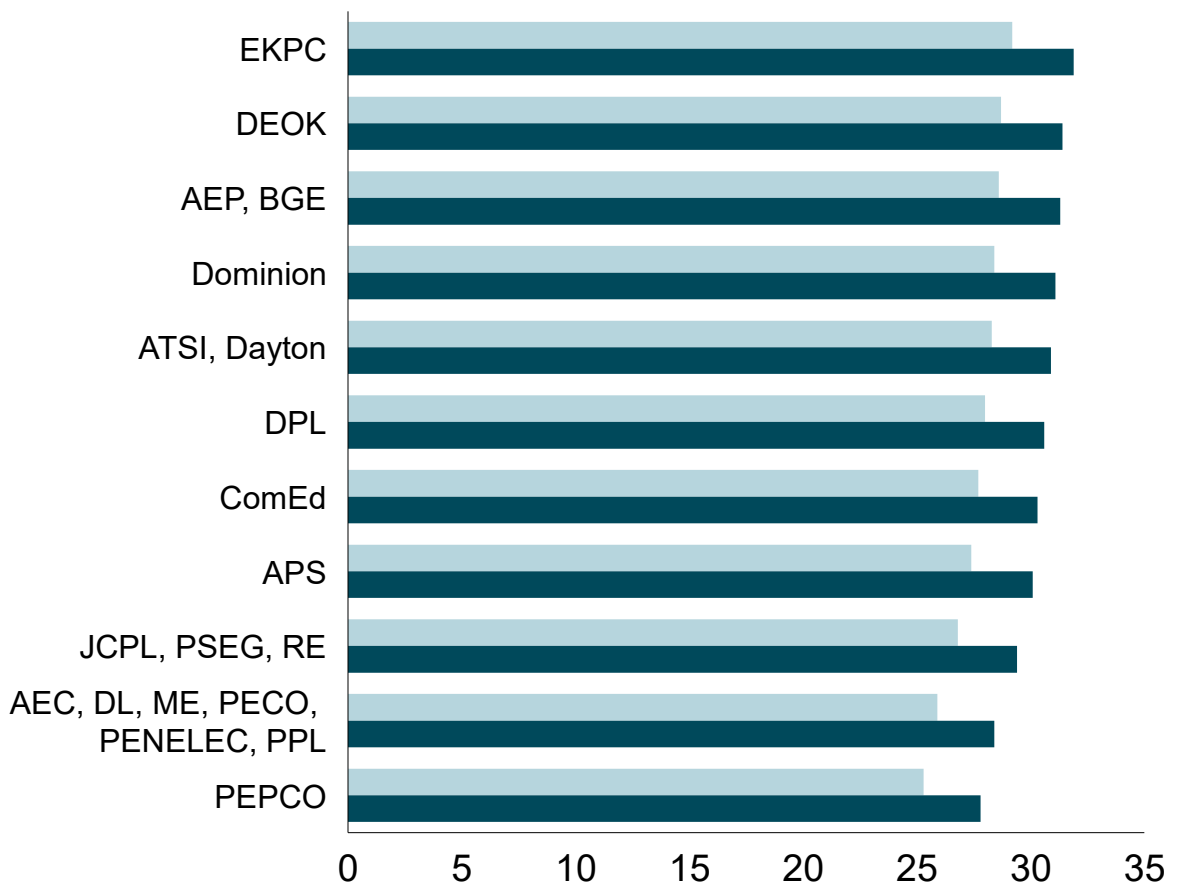
BEV PHEV REEV



Light-duty EVs vehicle miles traveled by PJM zone

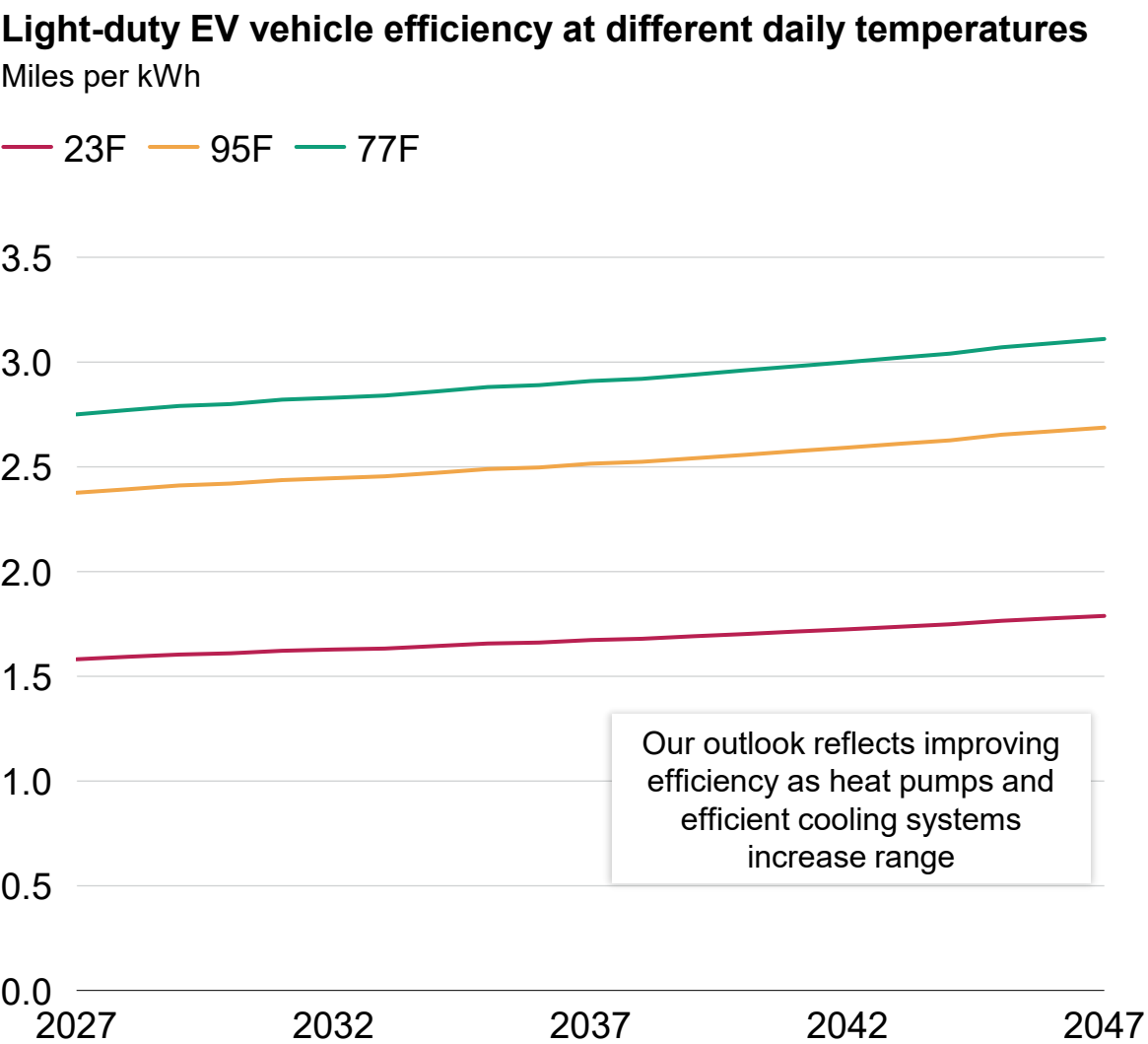
Average daily vehicle miles traveled

2027 2047

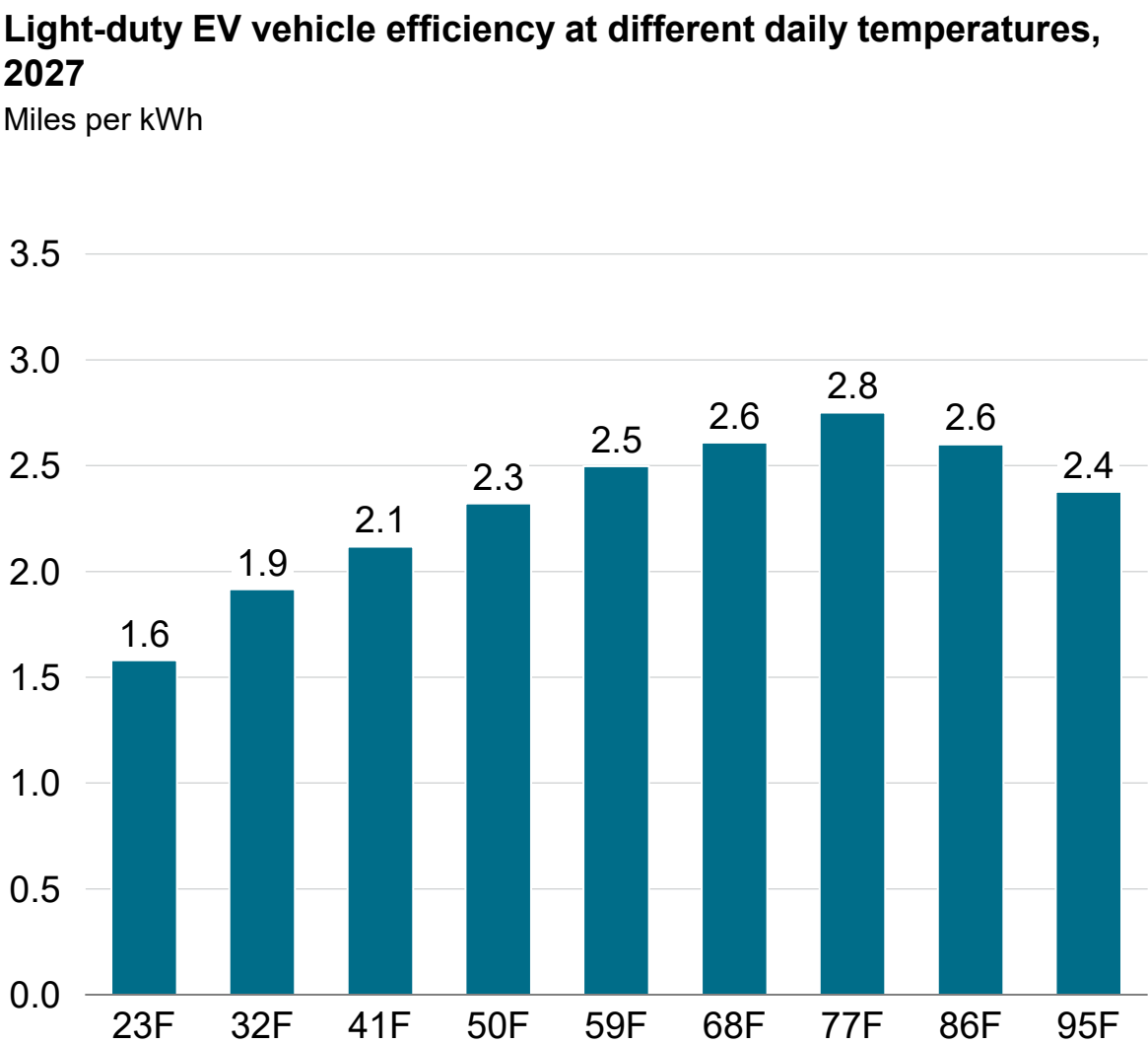




Daily temperatures outside the optimal range lower light-duty EV efficiency and raise charging needs



Our outlook reflects improving efficiency as heat pumps and efficient cooling systems increase range

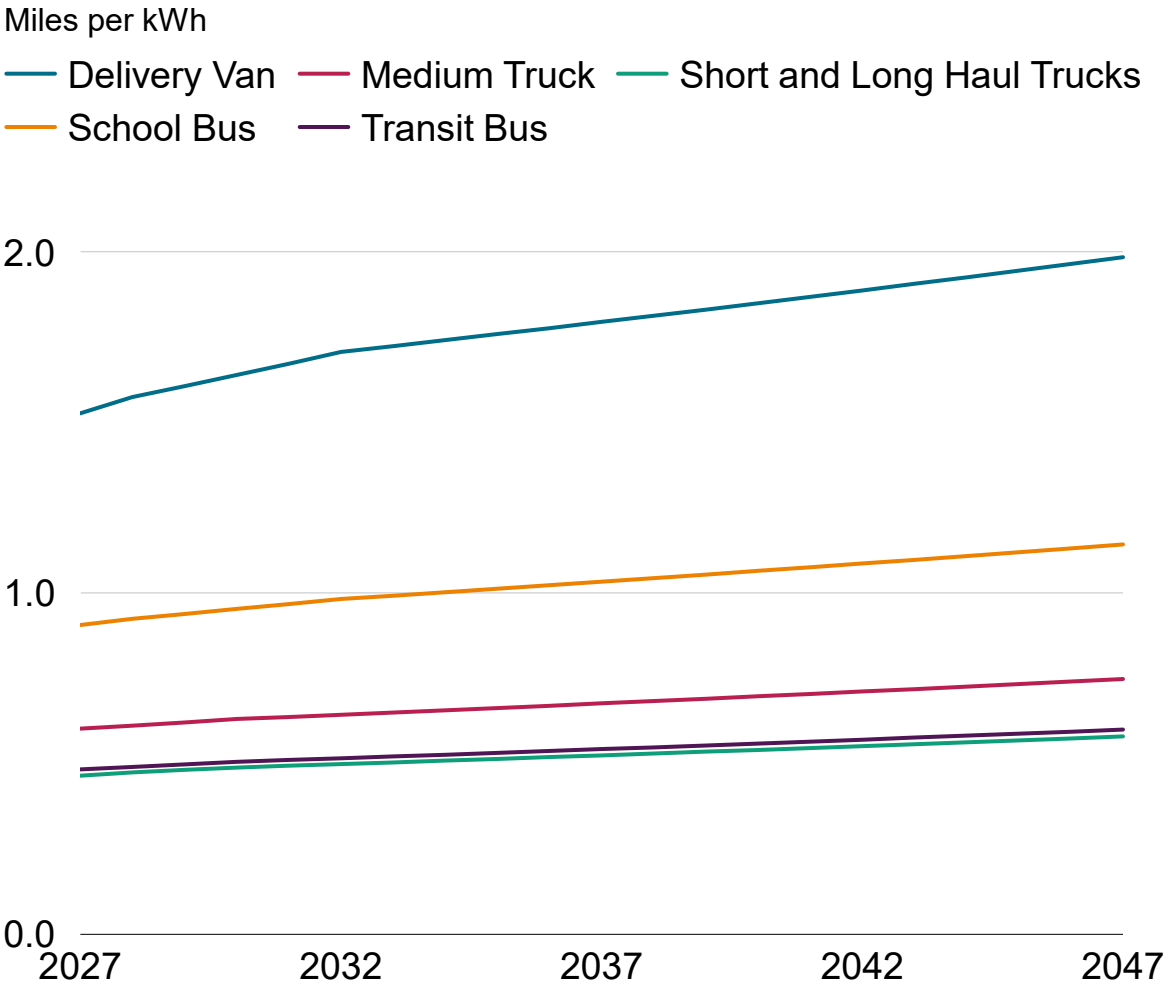


Note: Temperature assumed for the study is a 25-year historical average on a daily basis
Source: S&P Global Energy, Mobility Global, NOAA, Recurrent EV driver field survey data
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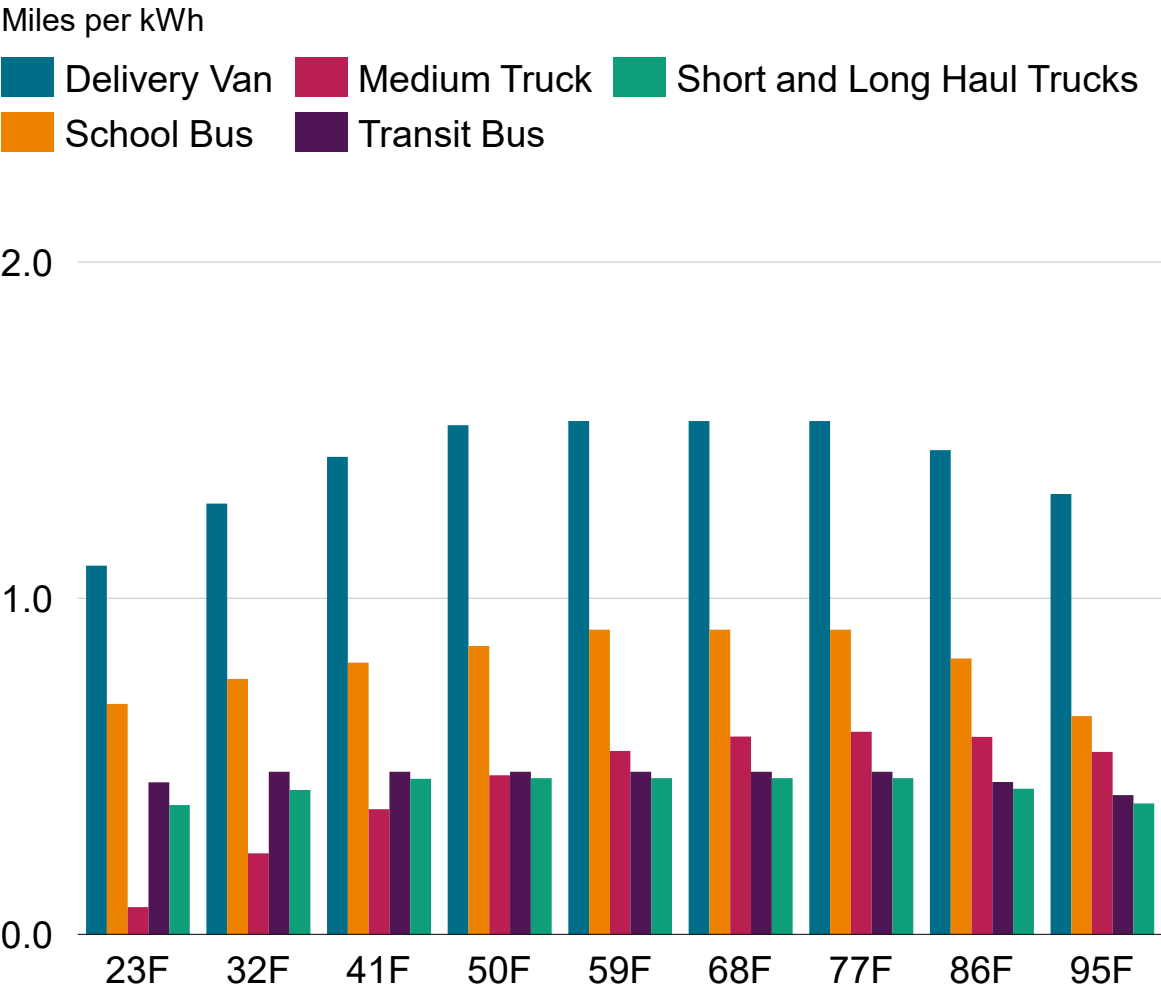


Vehicle efficiency varies among MHDV classes, with delivery vans performing best

MHD EVs vehicle efficiency in optimal temperature conditions¹



MHD EVs vehicle efficiency at different daily temperatures, 2027



1. Optimal temperature conditions are estimated at 77 Fahrenheit
Source: S&P Global Energy, Mobility Global, NLR, CALSTART
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Summary of key changes in the approach to the light-duty vehicle analysis as compared to last year's analysis

Assumption	Description	Impact on peak load	Impact on total load
Vehicles in Operation (VIO)	US LV EV penetration reaches 12% by 2035 and 29% by 2045 (compared to 39% by 2045 previously). This is a result of more severe than expected revisions to EPA and CAFE rules as well as rescission of Advanced Clean Cars and Advanced Clean Trucks rules.	Low	
Efficiency and temperature losses	▪ Updated vehicle efficiency based on latest update of Mobility Global Vehicle Performance and Compliance Database (VPaC) featuring lower share of large EVs in the medium term. ▪ Efficiency losses for cold/hot weather temperatures based on data from real-world driving performance and Mobility Global vehicle simulation datasets, accounting for heat pump and refrigerant medium application rates out of Mobility Global Component Forecast Analytics (CFA) database.	Low	
Vehicles Miles Traveled (VMT)	VMT data for PJM zone states updated based on latest Mobility Global VMT granular datasets. National VMT is expected to decline by 1.6% in 2026 as a result of elevated fuel prices and continue to grow at a pace of about 0.3% per year from a present ~10,900 miles per year to ~11,700 miles per year by 2050, with MaaS (Mobility as a Service) increasing from a present ~40,000 miles per year to ~48,000 miles per year.	Low	
Access to home charging	Increased long-term access to home charging to 72% in 2047 (previously 66% in 2046) based on new data on housing structure (single v. multi family), home ownership/rental, vehicles per household, electrical access by housing type, and BEV adoption within housing categories.	Medium	
Charging behavior	Adjusted the share of immediate charging: ▪ Weekdays to 85% in 2026 (previously 90% in 2025) and 60% in 2047 (previously 65% in 2046) ▪ Weekends to 90% in 2026 (previously 95% in 2025) and 60% in 2047 (previously 65% in 2046)	Medium	
Charging behavior	Adjusted as-soon-as-possible (ASAP) and as-cheaply-as-possible (ACAP) charging start and end times based on the updated wholesale power price forecast from the S&P Global Integrated House View	High	



Summary of key changes in the approach to the medium- and heavy-duty vehicle analysis as compared to last year’s analysis

Assumption	Description	Impact on peak load	Impact on total load
Vehicles in Operation (VIO)	▪ Less significant changes to MHV in the short to medium term, but lower adoption of EVs in logistics as infrastructure and battery cost projection have been revised based on the latest Mobility Global Reinventing the Truck Study (RTT, Dec 2025). ▪ We now have a BEV VIO of 2% in 2035 and 10% in 2045 for Class 8 (we previously had 2% in 2035 and 14% in 2045). ▪ Similarly for Class 4-7 we have BEV VIOs of 2% in 2035 and 12% in 2045 (we previously had 2% for 2035 and 27% for 2045). ▪ For Commercial Vans BEV VIO of 8% in 2035 and 23% in 2045 (previously 13% in 2035 and 45% in 2045).	Low	
Vehicle Miles Traveled (VMT)	▪ Updated vehicle miles travelled data for delivery vans based on RTT study as well as latest trends in last mile delivery operations. Adjustment of daily miles travelled for vans from 53 miles to 44 miles in 2026 and unchanged at 77 miles in 2046. ▪ Adjustment of daily miles travelled for Class 8 short-haul from 96 miles to 72 miles in 2026 and from 102 miles to 119 miles in 2046.	Low	



Light-duty vehicle assumptions: Charging infrastructure

Type of vehicle applicability	Assumptions and inputs	Value	Sources
Light-duty	Access to home and workplace charging	▪ 2027: 82% access to home charging ▪ 2046: 72% access to home charging	Mobility Global – Charging Infrastructure
Light-duty	Type of home charging (Level 2 vs Level 1)	▪ 80% Level 2 charging	Mobility Global – Charging Infrastructure
Light-duty	Charging strategy (for drivers with access to home charging)	▪ 2027: 85% Immediate / 15% Delayed (weekday) ▪ 2027: 90% Immediate / 10% Delayed (weekend) ▪ 2047: 60% Immediate / 40% Delayed	S&P Global Energy



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 driver 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



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: 9,444 miles/year (2027) to 10,382 miles/year (2047)	Mobility Global S&P Global Energy
		AEP: 10,429 miles/year (2027) to 11,411 miles/year (2047)	
		BGE: 10,429 miles/year (2027) to 11,413 miles/year (2047)	
		APS: 10,018 miles/year (2027) to 10,982 miles/year (2047)	
		ATSI, Dayton: 10,319 miles/year (2027) to 11,296 miles/year (2047)	
		ComEd: 10,100 miles/year (2027) to 11,296 miles/year (2047)	
		DEOK: 10,484 miles/year (2027) to 11,468 miles/year (2047)	
		Dominion: 10,374 miles/year (2027) to 11,353 miles/year (2047)	
		DPL: 10,210 miles/year (2027) to 11,184 miles/year (2047)	
		EKPC: 10,648 miles/year (2027) to 11,639 miles/year (2047)	
		JCPL, PSEG, RE: 9,772 miles/year (2027) to 10,725 miles/year (2047)	
		PEPCO: 9,225 miles/year (2027) to 10,154 miles/year (2047)	
75% of miles are driven during weekdays			

Zone-level vehicle miles driven values are based on state-level values from the Mobility Global forecast
Source: S&P Global Energy, Mobility Global
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Light-duty vehicle assumptions: Electric vehicle efficiency

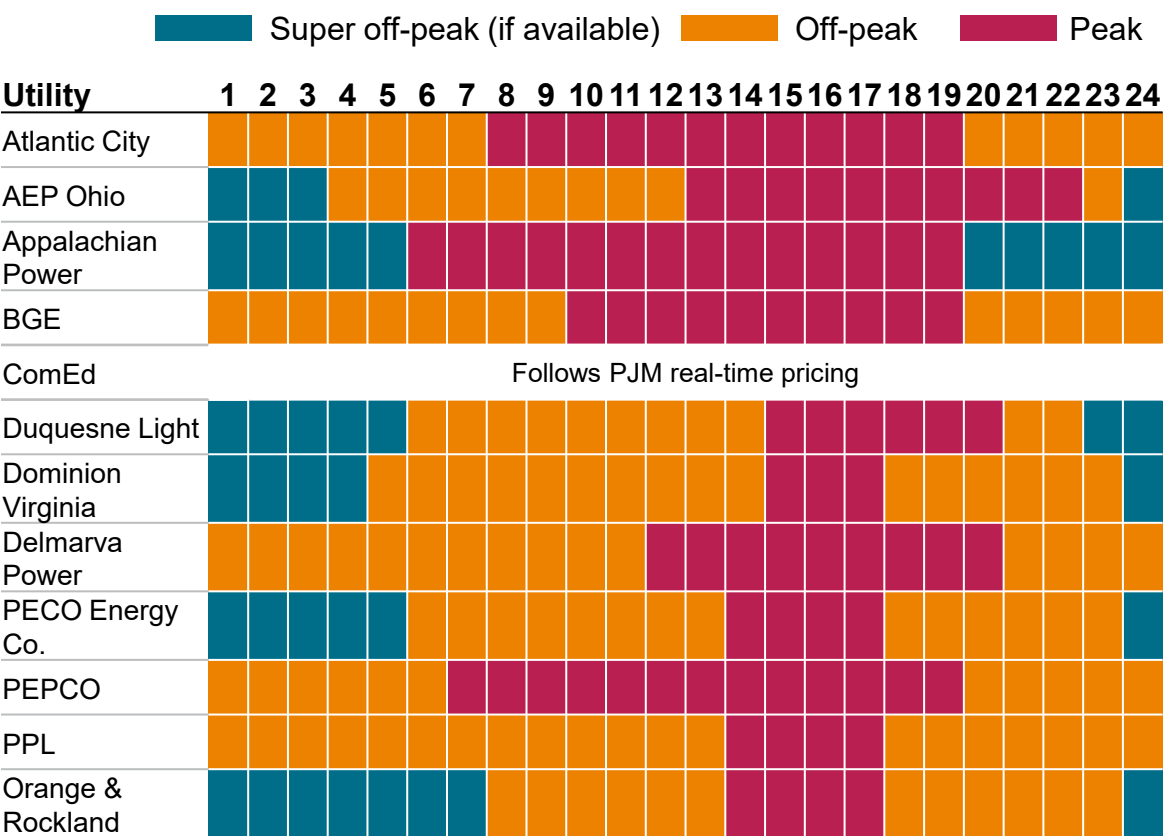
Type of vehicle applicability	Assumptions and inputs	Value	Sources
Light-duty	Miles per kWh ¹ (normal operating conditions ²)	▪ 2027: 2.8 miles/kWh ▪ 2047: 3.1 miles/kWh	Mobility Global
Light-duty	Loss in battery efficiency due to temperature fluctuations	▪ 43% additional energy at 23 Fahrenheit (heating) ▪ 5% additional energy at 86 Fahrenheit (cooling) ▪ Temperature assumed for the study is a 25-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 Energy, Mobility Global
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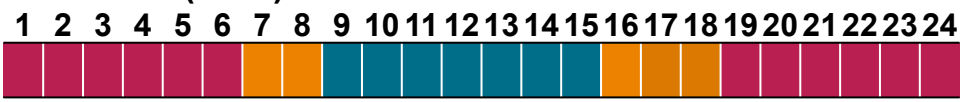


Utilities currently incentivize charging during the night and early morning; going forward, TOU rates will evolve to incentivize EV charging during the day to due to solar penetration

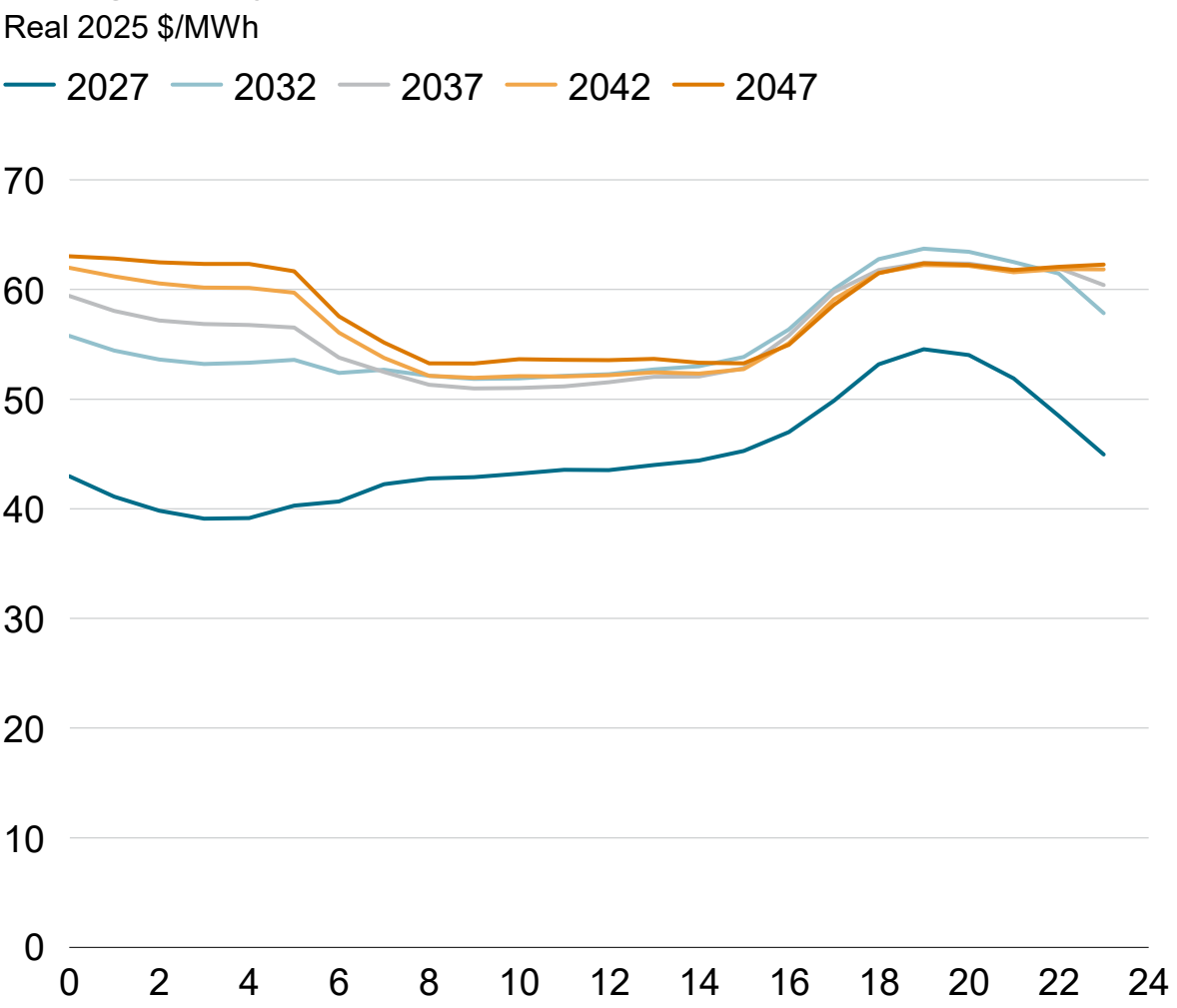
Selected PJM utilities with time-of-use (TOU) rate structure – 2026



Expected time-of-use (TOU) rate structure in PJM utilities – 2047



Average hourly PJM East wholesale prices





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: 16,621 miles/year (2027) to 27,010 miles/year (2047); 96% of miles driven during weekdays - School bus: 11,081 miles/year (2027) to 11,427 miles/year (2047); 96% of miles driven during weekdays - Transit bus: 40,487 miles/year (2027) to 42,951 miles/year (2047); 88% of miles driven during weekdays - Medium truck: 17,779 miles/year (2027) to 23,940 miles/year (2047); 71% of miles driven during weekdays - Short-haul truck: 25,926 miles/year (2027) to 41,632 miles/year (2047); 96% of miles driven during weekdays - Long-haul truck: 62,050 miles/year (2027) to 110,814 miles/year (2047); 88% of miles driven during weekdays	Mobility Global
Medium and heavy-duty	Miles per kWh (normal operating conditions ¹)	- Delivery van: 1.53 miles/kWh (2027) to 1.99 miles/kWh (2047) - School bus: 0.91 miles/kWh (2027) to 1.14 miles/kWh (2047) - Transit bus: 0.48 miles/kWh (2027) to 0.60 miles/kWh (2047) - Medium truck: 0.60 miles/kWh (2027) to 0.75 miles/kWh (2047) - Short-haul truck: 0.47 miles/kWh (2027) to 0.58 miles/kWh (2047) - Long-haul truck: 0.47 miles/kWh (2027) to 0.58 miles/kWh (2047)	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 Energy, Mobility Global

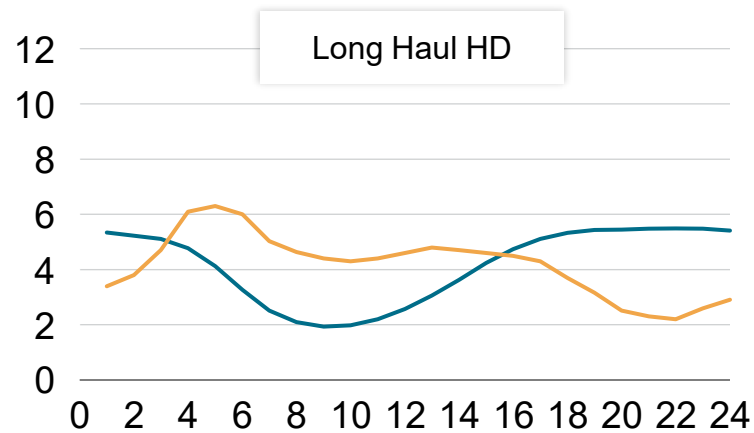
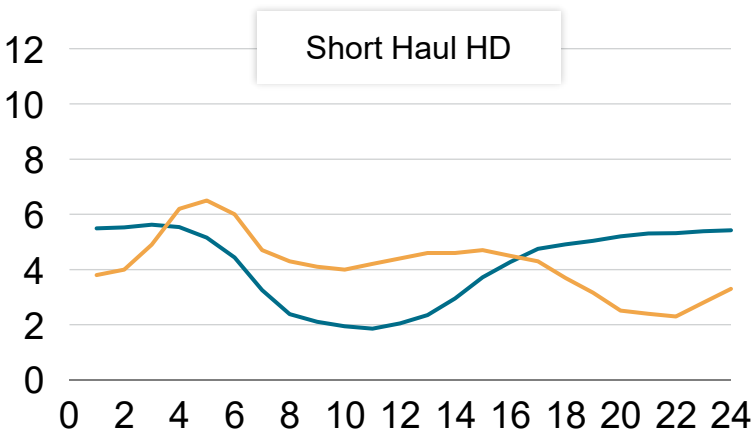
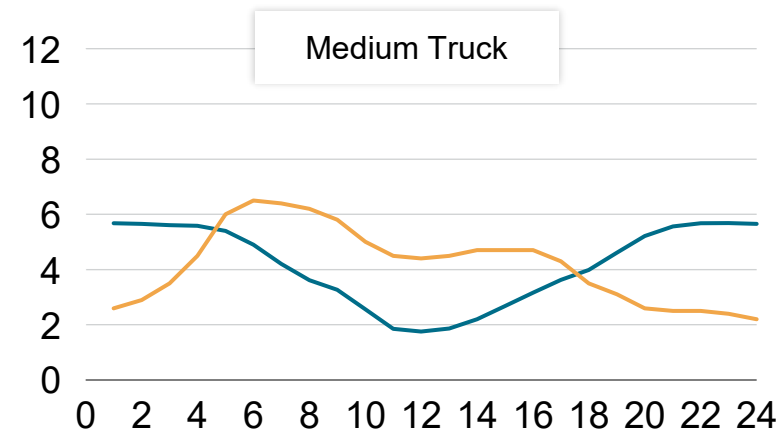
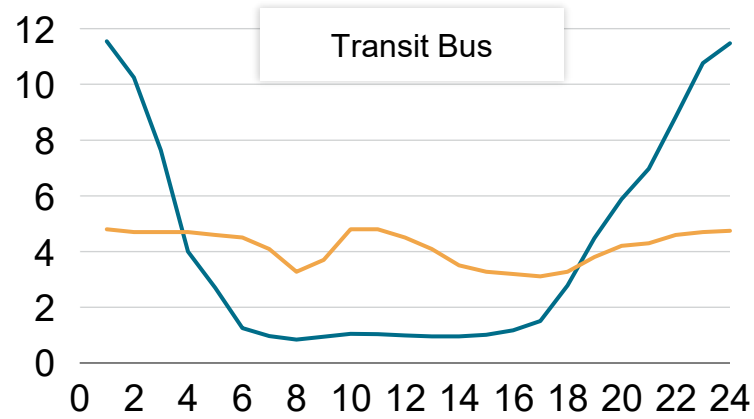
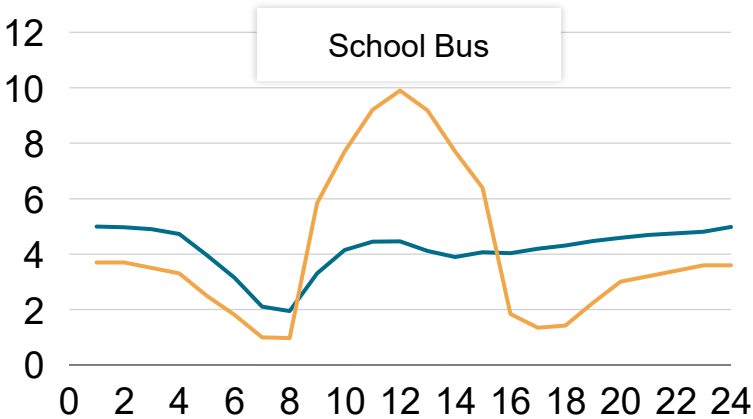
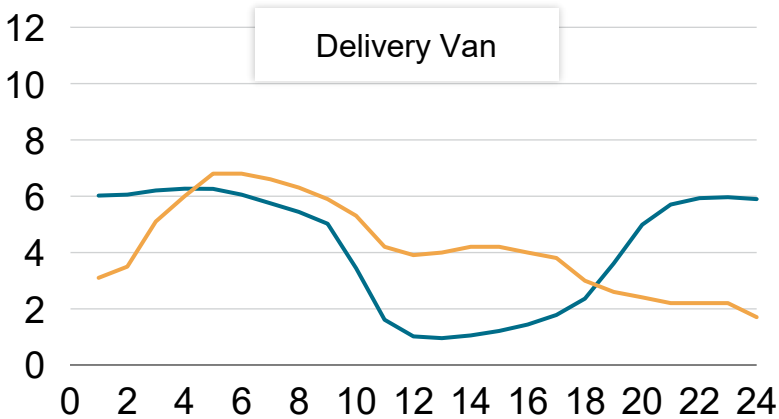


MHDV charging shapes are specific to the types of vehicles and their duty cycle; going forward, load shapes will react to higher managed charging penetration and electricity prices

Medium and heavy-duty charging profile

Percentage of daily charging (%)

— 2027 — 2047



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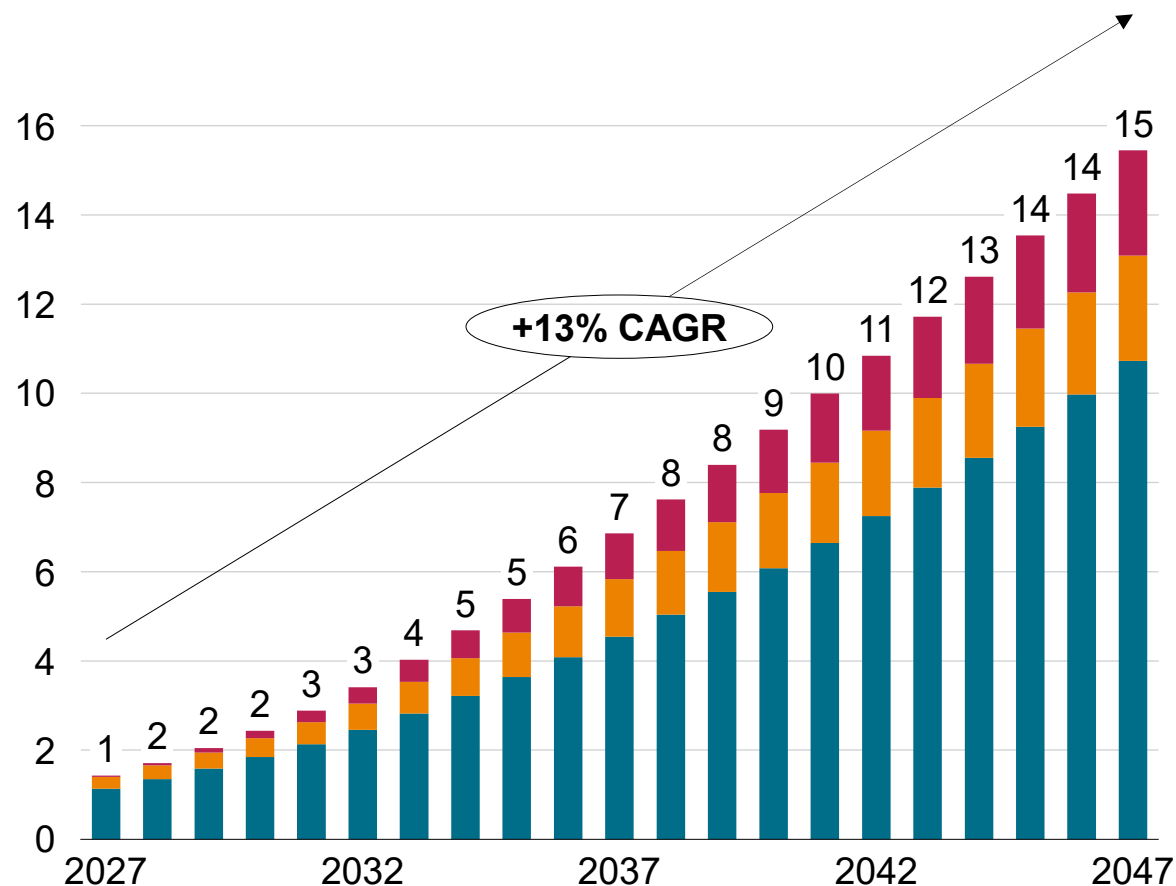


PJM light-duty EV fleet will reach over 15 million vehicles by 2047, with BEVs accounting for 70% of the total

Total light-duty EVs in operation – PJM

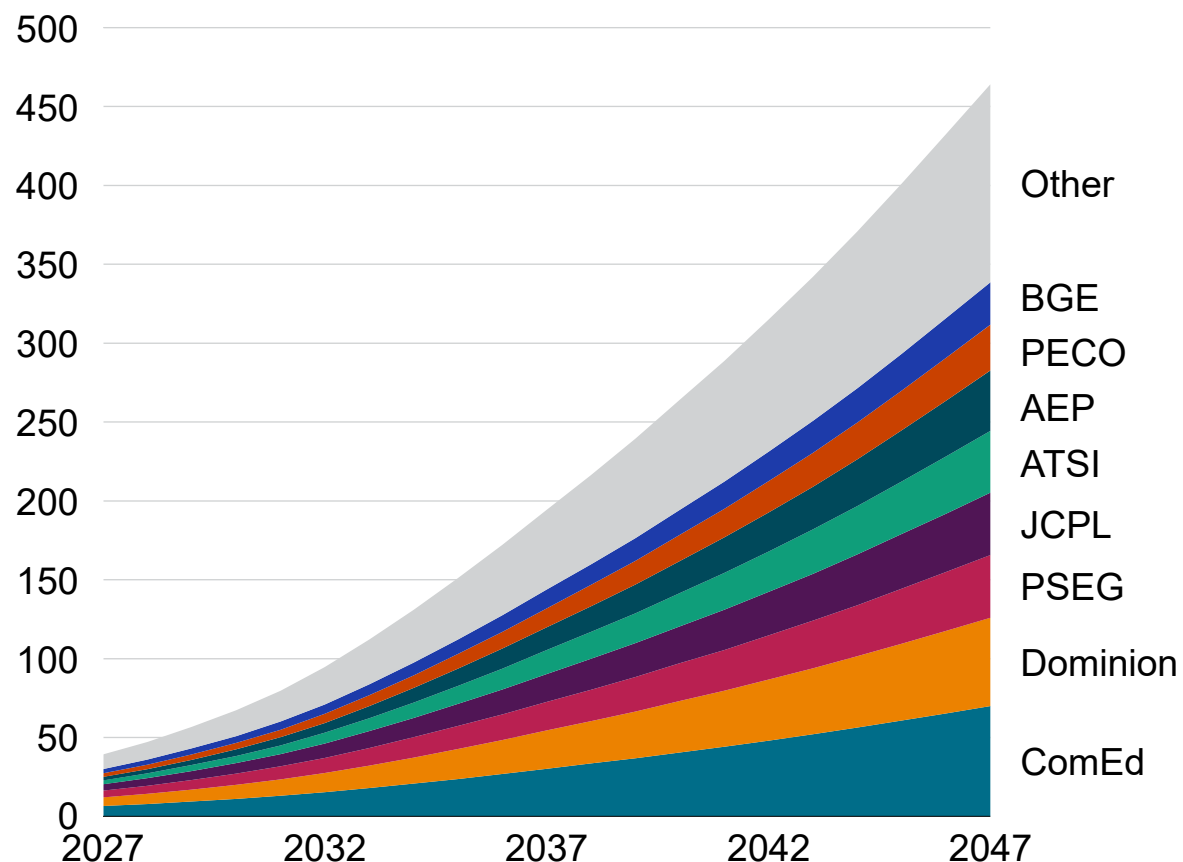
Million of EVs

BEV PHEV REEV



Light-duty EVs daily vehicle miles traveled – PJM

Million daily vehicle miles traveled



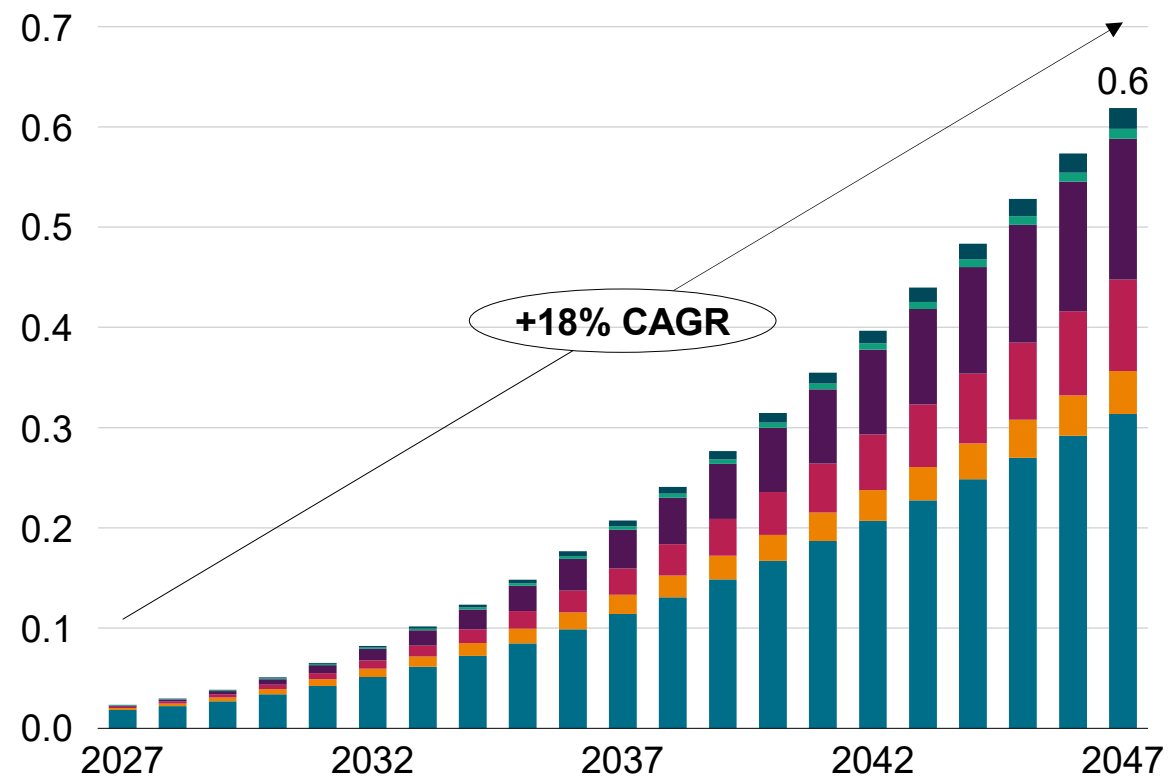


Vehicle adoption and usage vary sharply by MHDV class

MHD EVs by type – PJM

Million of EVs

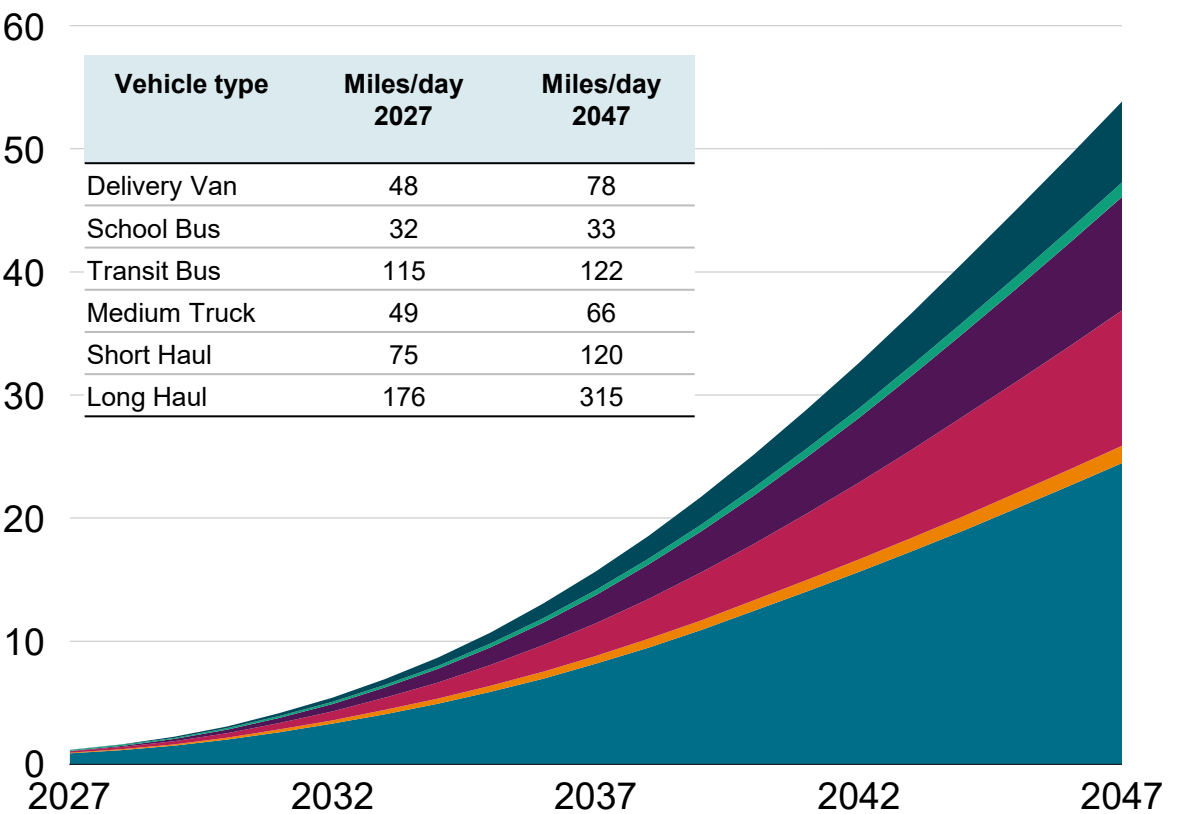
- Delivery Van
- Short Haul
- Transit Bus
- School Bus
- Medium Truck
- Long Haul



MHD EVs vehicle miles traveled – PJM

Million daily vehicle miles traveled

- Delivery Van
- Short Haul
- Transit Bus
- School Bus
- Medium Truck
- Long Haul



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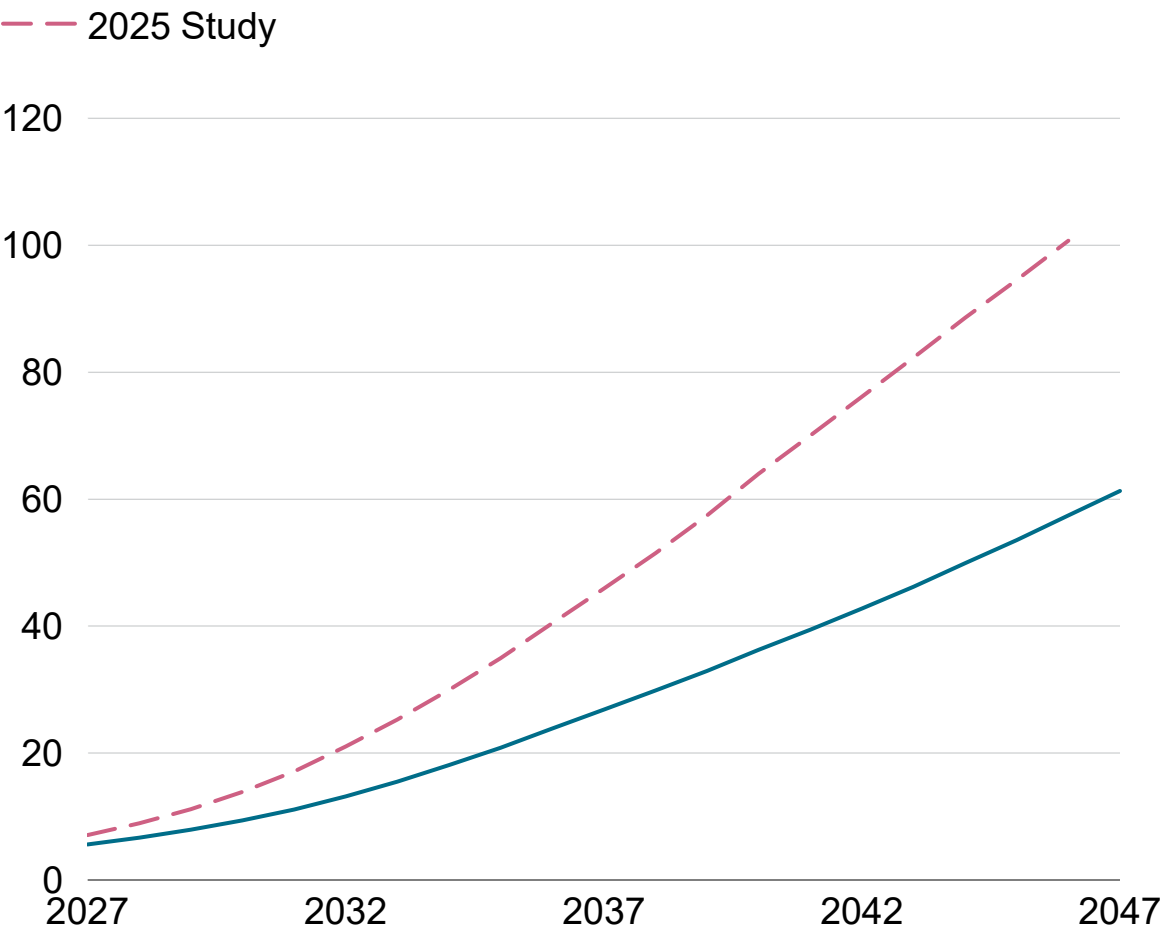
Charging demand forecast

Appendix

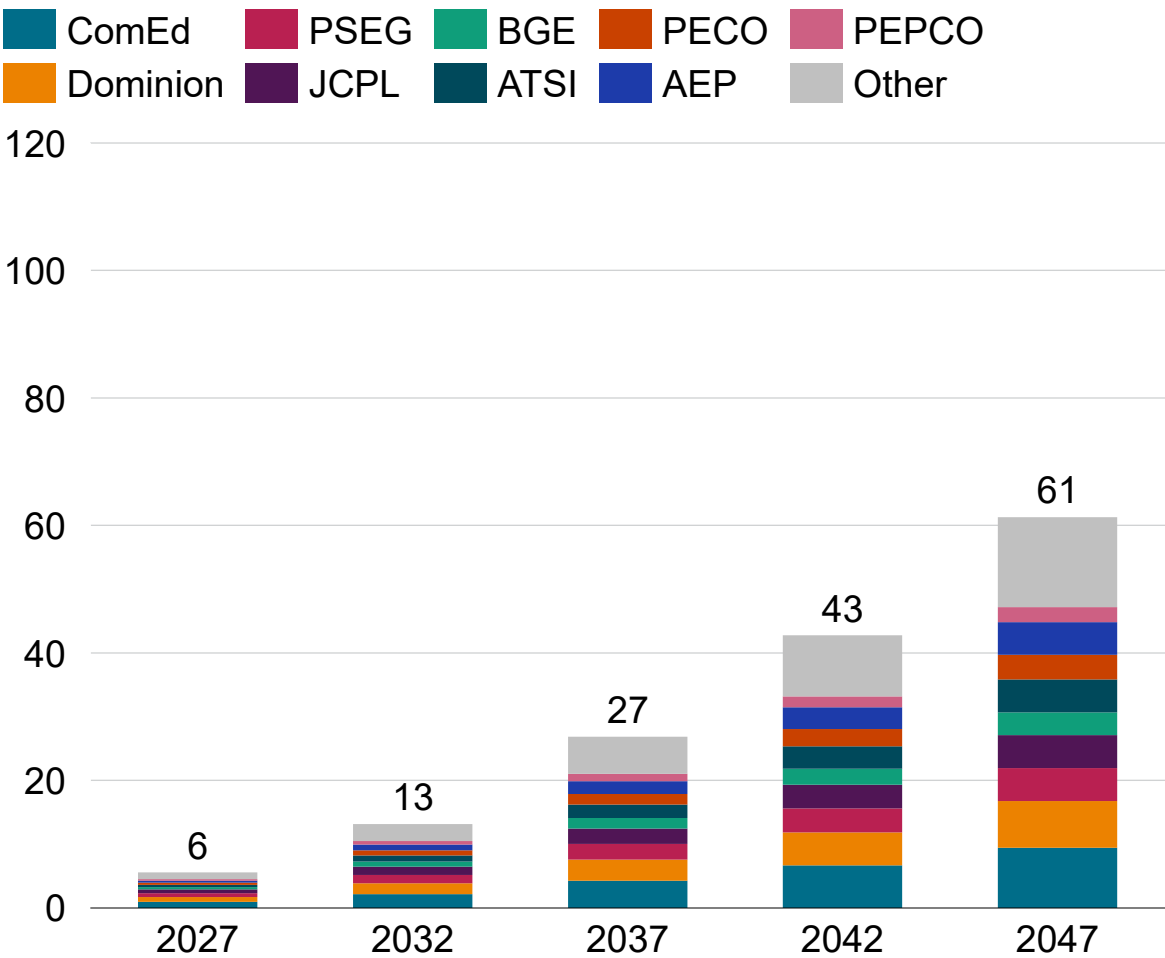


Load from light-duty vehicles is forecasted to surpass 60 TWh by 2047, led by zones with high urban density

Total yearly light duty EV load – PJM
TWh



Total yearly light duty EV load by PJM zone
TWh



Source: S&P Global Energy, Mobility Global
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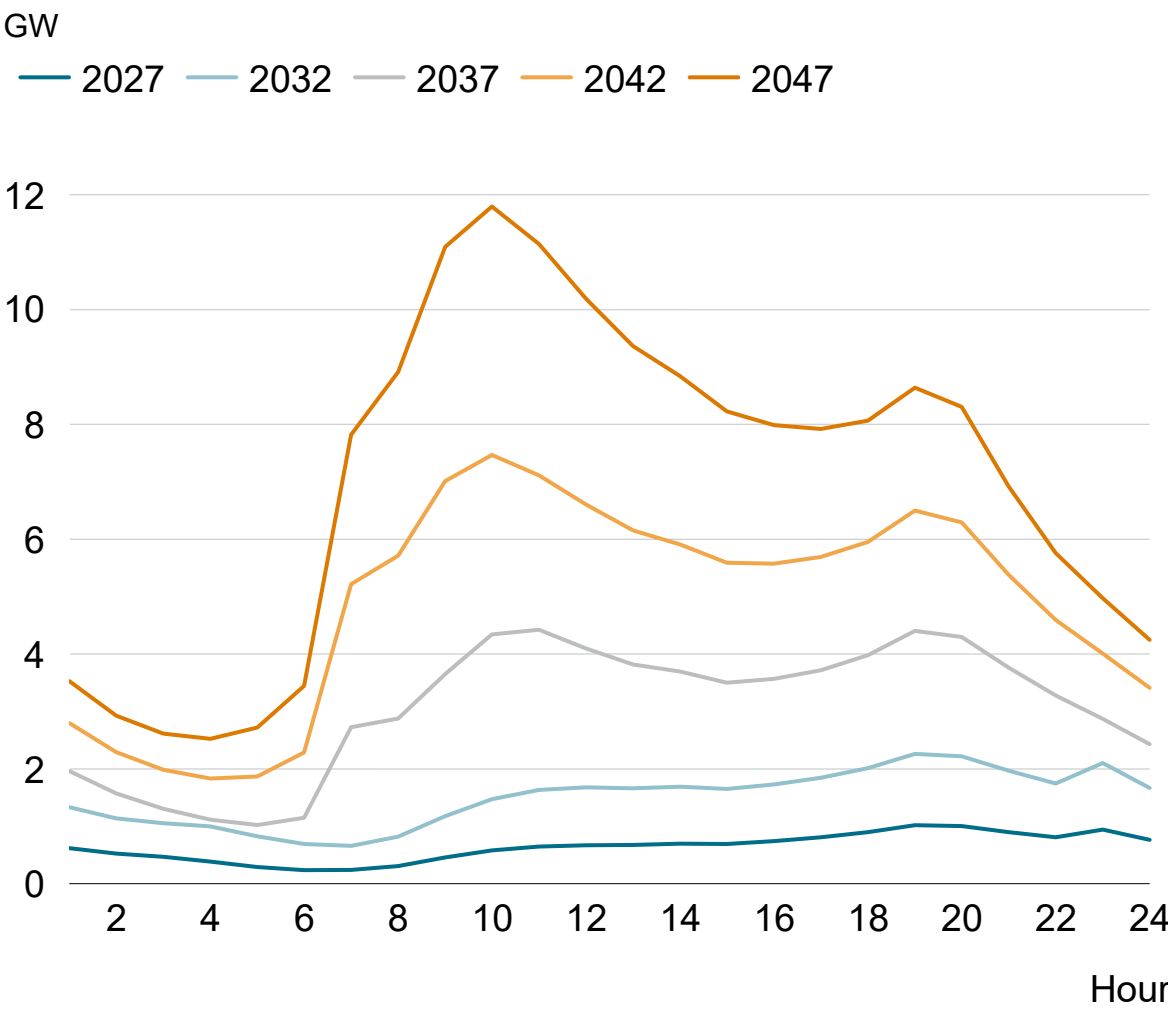


We developed 8,760 load shapes for the next 20 years for each zone based on the light-duty EV forecast

Light-duty EV hourly load statistics – PJM

Year	Average Load (MW)	Peak Load (MW)	Month of peak	Hour of peak
2027	640	1,238	December	18
2032	1,500	2,745	October	22
2037	3,064	5,419	October	9
2042	4,884	8,977	October	9
2047	6,997	14,087	October	9

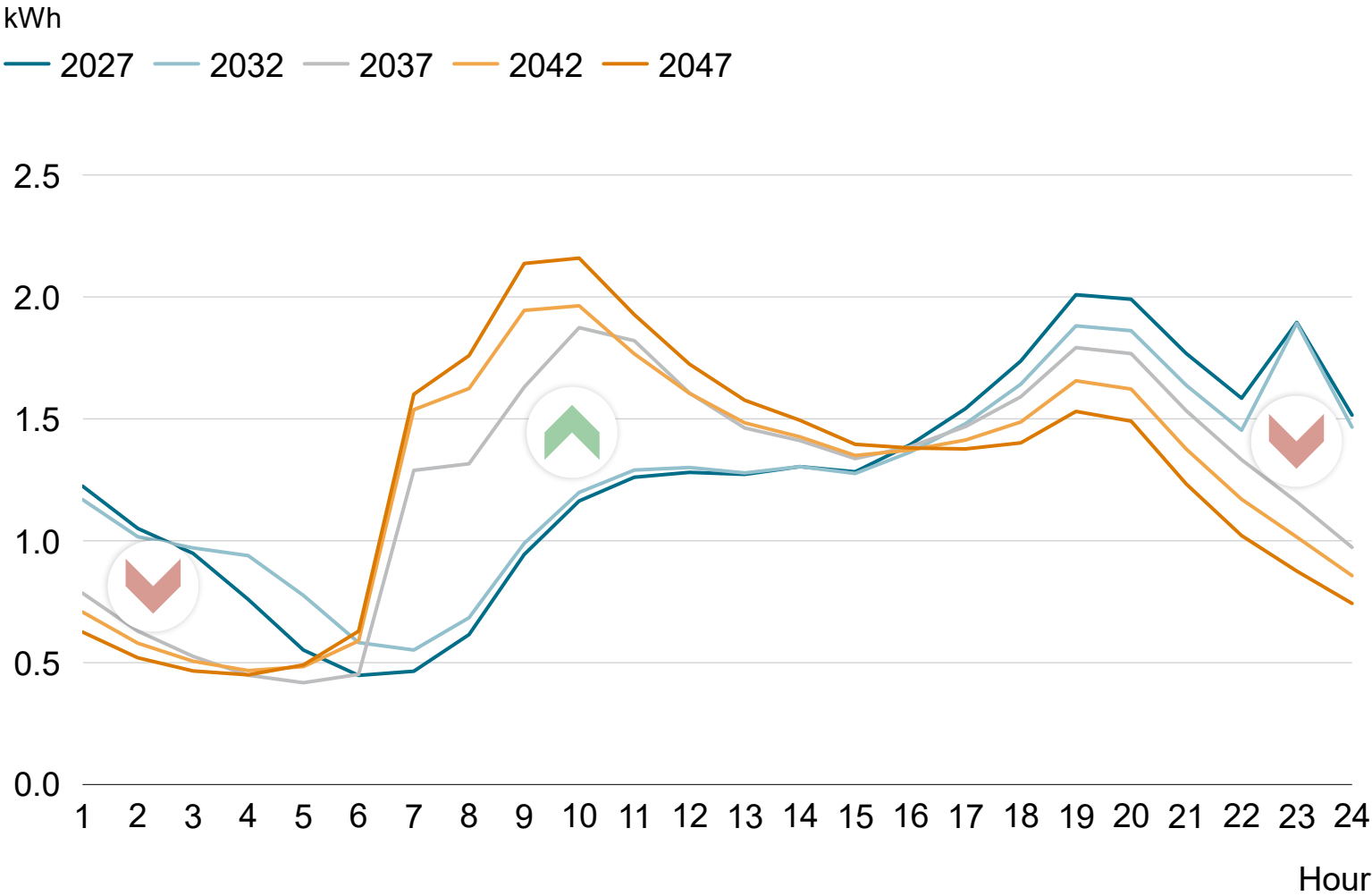
Average hourly light-duty EV load – PJM





As charging behavior evolves, EVs will charge less during the evening and more in the morning and middle of the day

Light duty EV average weekday charging profile



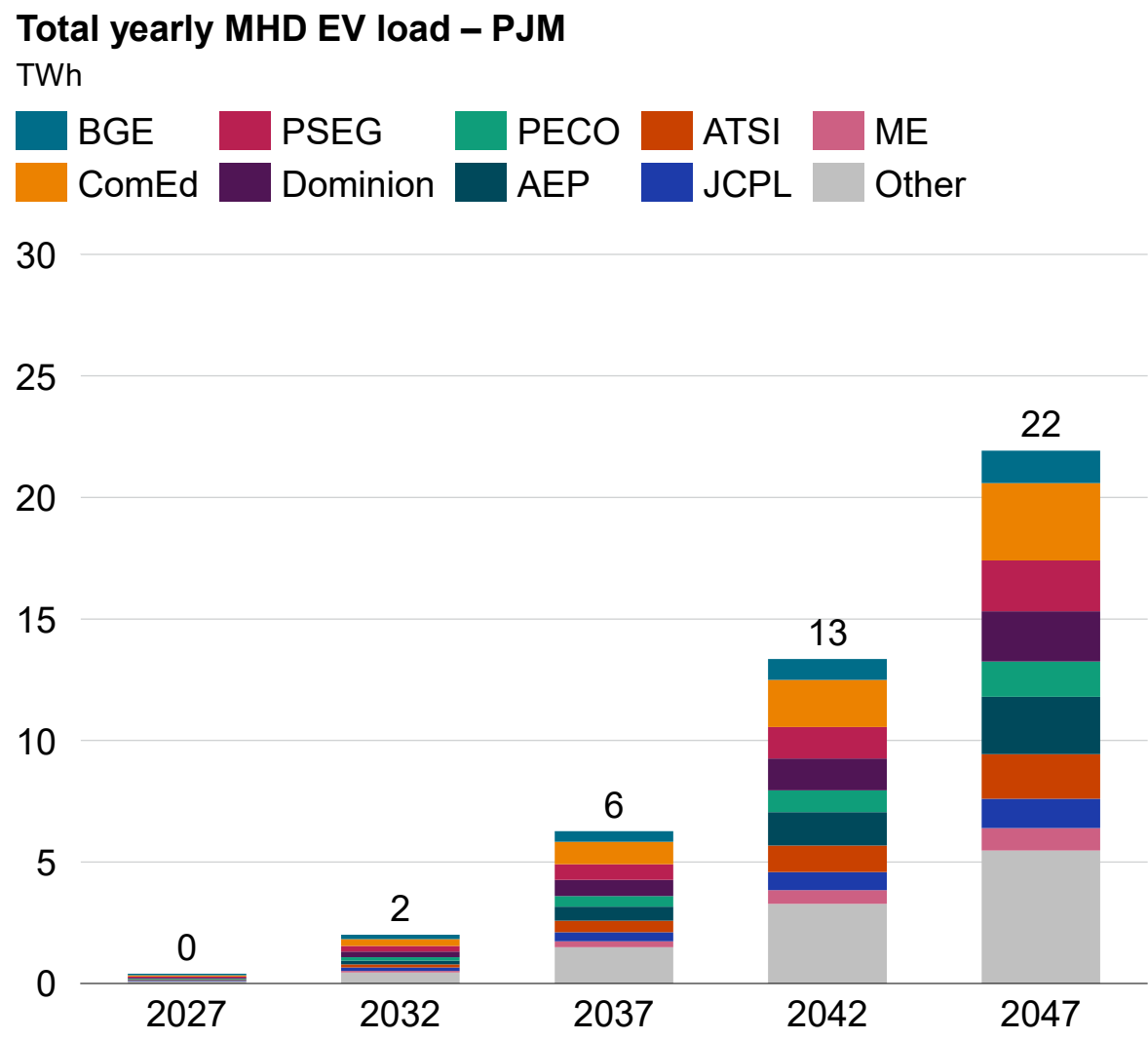
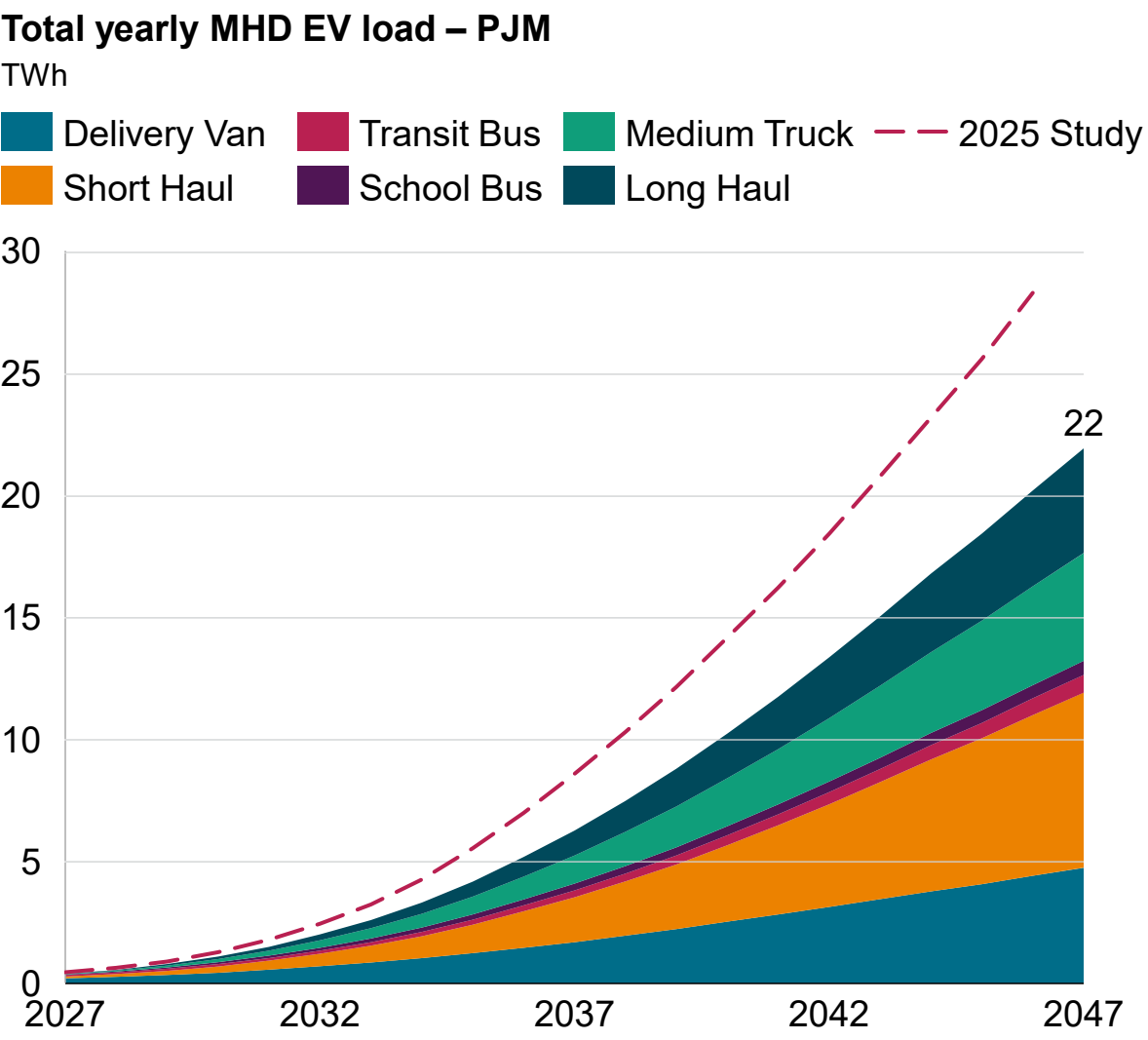
Note: Assuming 30 miles per day driven and no mileage loss from temperature
Source: S&P Global Energy, Mobility Global
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Key trends impacting the load shape

- **Time of use (TOU) rates**
 - Over time, time of use rates will push customers to avoid charging immediately when they get home in the evening, gradually lowering the 18-21h peak
- **Solar PV penetration**
 - In the mid 2030s, increasing solar PV penetration will cause prices to drop during daylight hours, incentivizing charging during the early morning and displacing late night charging
- **Greater EV adoption among different classes of owners**
 - As EV adoption increases, a larger share of owners will drive an EV without home charging infrastructure, driving up load during early working hours as drivers utilize workplace and public charging



Load from MHDV is forecasted to reach 22 TWh by 2047, with delivery vans, short-haul and medium trucks contributing the largest shares



Source: S&P Global Energy, Mobility Global
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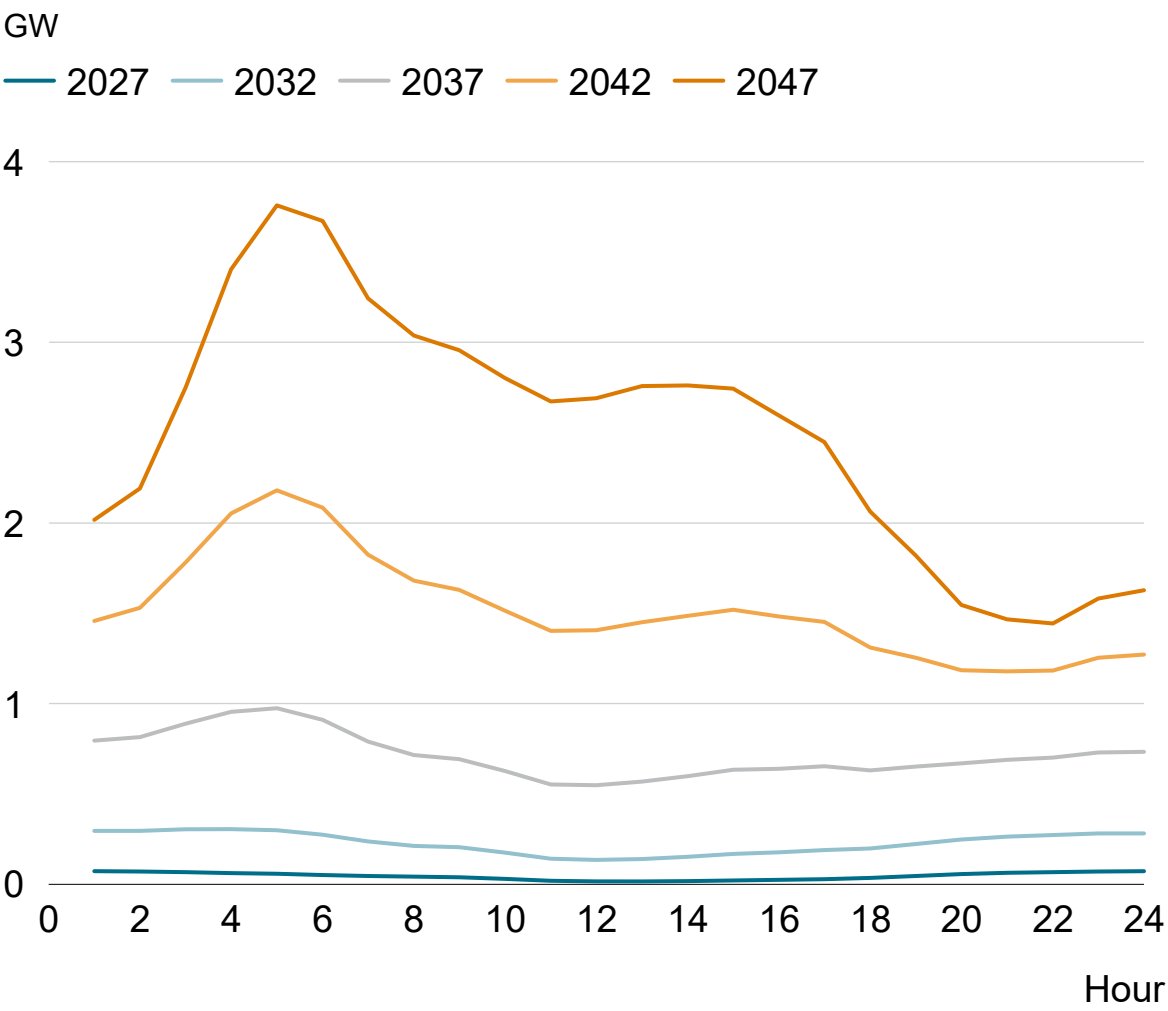


We developed 8,760 load shapes for the next 20 years for each zone based on the MHD EV forecast

MHD EV hourly load statistics – PJM

Year	Average Load (MW)	Peak Load (MW)	Month of peak	Hour of peak
2027	46	109	December	24
2032	228	449	December	3
2037	715	1,380	December	4
2042	1,524	3,005	December	4
2047	2,502	5,100	December	4

Average MHD EV load by hour – PJM



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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)



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

FEOC: Foreign Entity of Concern

GHG: Greenhouse Gas

HEV: Hybrid Electric Vehicle

ICE: Internal Combustion Engine

IRA: Inflation Reduction Act

kWh: Kilowatt Hour

LDV: Light Duty Vehicle

MaaS: Mobility as a Service

MHD/MHDV: Medium and Heavy Duty Vehicle

MPG: Miles per Gallon

MWh: Megawatt Hour

NACS: North American Charging Standard

NHTSA: National Highway Traffic Safety Administration

OBBA: One Big Beautiful Bill Act

OEM: Original Equipment Manufacturer

PHEV: Plug in Hybrid Electric Vehicle

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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