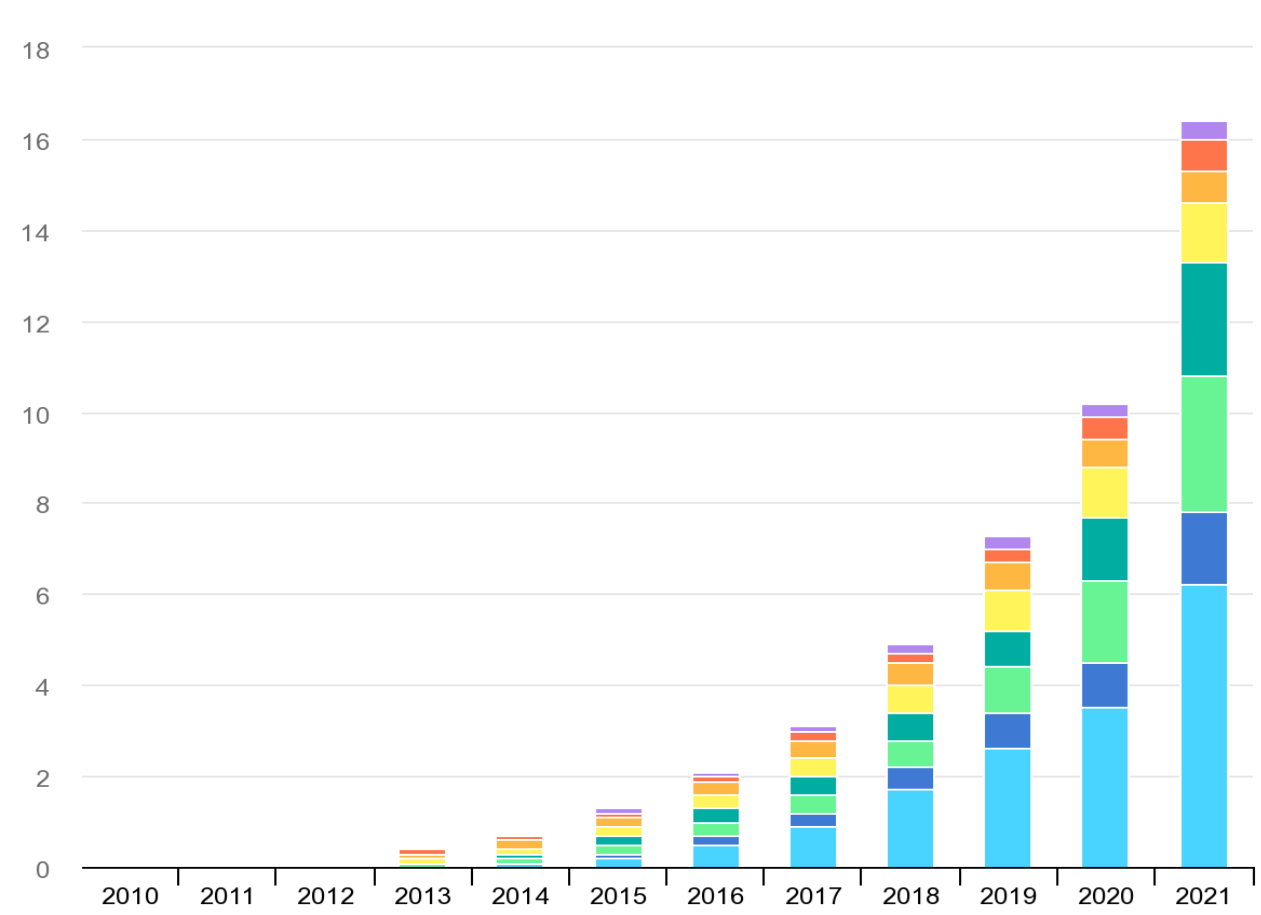
Global Trends and Fleet Electrification Across Sectors

March 30, 2023

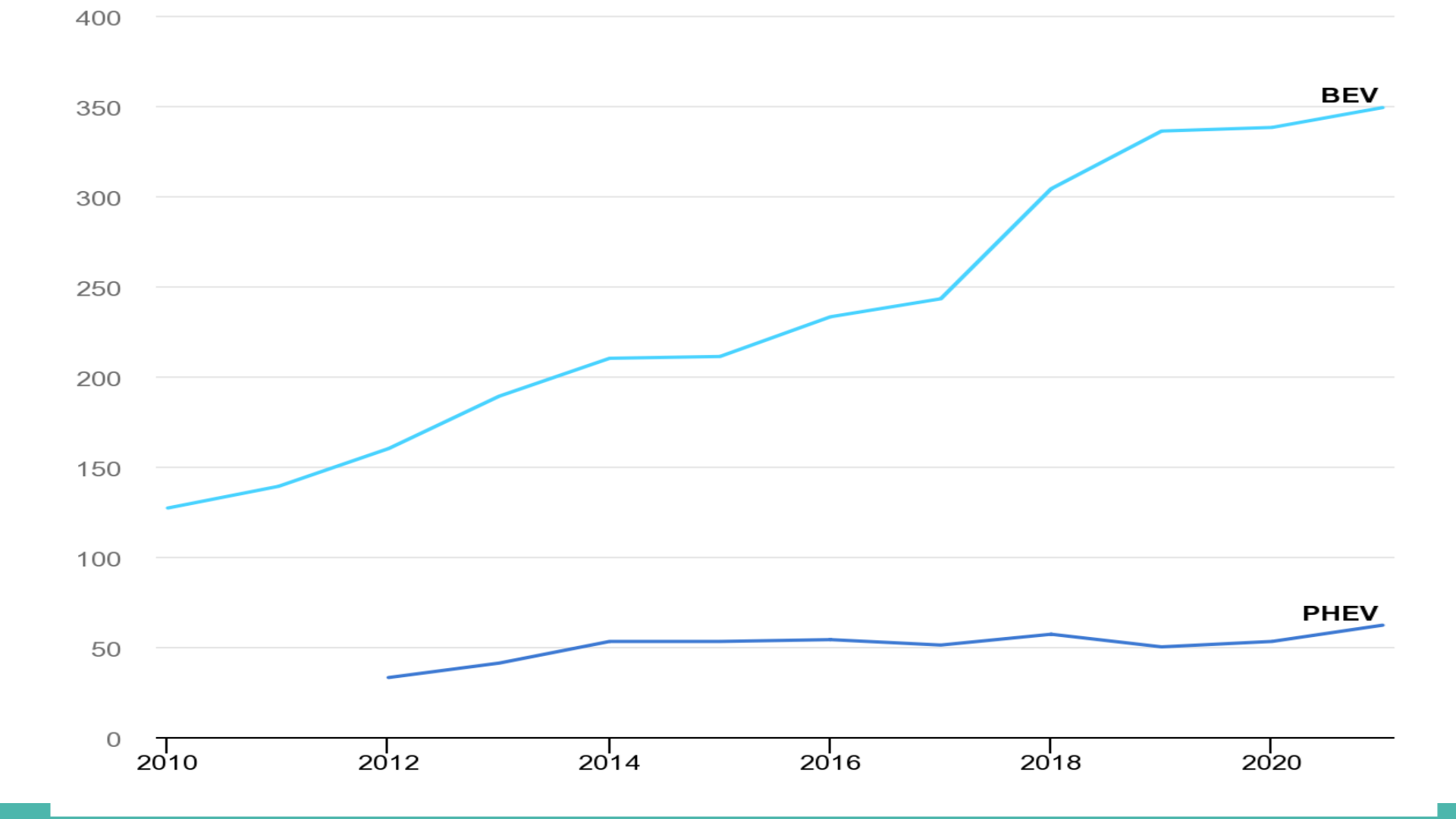


Over 16.5 million electric cars were on the road in 2021, a tripling in just three years

China BEV · China PHEV · Europe BEV · Europe PHEV · United States BEV · United States PHEV · Other BEV · Other PHEV

IEA Global EV Outlook

- After increasing in 2020 despite a depressed car market, sales of electric cars – battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) – **nearly doubled year-on-year to 6.6 million in 2021**.
- This brought the total number of electric cars on roads to over **16.5 million**.
- BEVs accounted for most of the increase (about 70%).
- Electric car sales accounted for 9% of the global car market in 2021 – four-times their market share in 2019. **All the net growth in global car sales in 2021 came from electric cars.**


400
350
300
250
200
150
100
50
0
2010
2012
2014
2016
2018
2020
BEV
PHEV

IEA Global EV Outlook

After two years of consecutive decline of 10%, electric car sales increased in the United States in 2021. About **630,000** electric cars were sold – more than in 2019 and 2020 combined – bringing the total stock of electric cars to over **2 million**. About 75% of new EV sales were BEVs, up from 55% just five years ago, resulting in a higher share of BEVs relative to PHEVs today over the total EV stock (65%) than in 2015-2016 (about 50%). Relative to other regions, the overall car market recovered faster from the pandemic in the United States, but **electric cars still doubled their share to 4.5% in 2021**.

IEA Global EV Outlook

- Globally, there were over 450 electric car models available in 2021, an increase of more than 15% relative to 2020 offerings and more than twice the number of models available in 2018.

IEA Global Outlook

- Toyota, the world's largest car manufacturer, announced the roll-out of 30 BEV models and a goal of reaching 3.5 million annual sales of electric cars by 2030. Lexus aims to achieve 100% BEV sales globally in 2035.
- Volkswagen announced that all-electric vehicles would exceed 70% of European and 50% of Chinese and US sales by 2030, and that by 2040, nearly 100% should be zero emissions vehicles.
- Ford expects one-thid of its sales to be fully electric by 2026 and 50% by 2030, building on the success of its F-150 electric model, and to move to all-electric in Europe by 2030.
- Volvo committed to becoming a fully electric car company by 2030.
- BMW aims for 50% of its vehicles sold to be fully electric by 2030 or earlier.
- General Motors aims for 30 EV models and for installed BEV production capacity of 1 million units in North America by 2025 and for carbon neutrality in 2040.
- Hyundai targets sales of 1.9 million BEVs annually by 2030 to secure a 7% global market share, and to end sales of ICE vehicles in Europe in 2035.
- Kia aims to increase sales of BEVs to 1.2 million in 2030.

IEA Global Outlook

- Globally, decreasing EV prices and increasing driving ranges in 2021 relative to 2020 have resulted in a 10% decrease in the sales-weighted average price-per-range ratio for BEVs and 14% for PHEVs.
- The highest drop for BEVs was recorded in the United States (-8%), where the price dropped by 4% while the range increased by 5% on average.
- In Europe, while BEV driving range increased by 11% on average, prices also increased, resulting in a slower price-per-range decrease (-6%).
- Excluding China, the drop was 7% for BEVs and an increase of 2% for PHEVs because average prices increased faster than the average range.

IEA Global Outlook

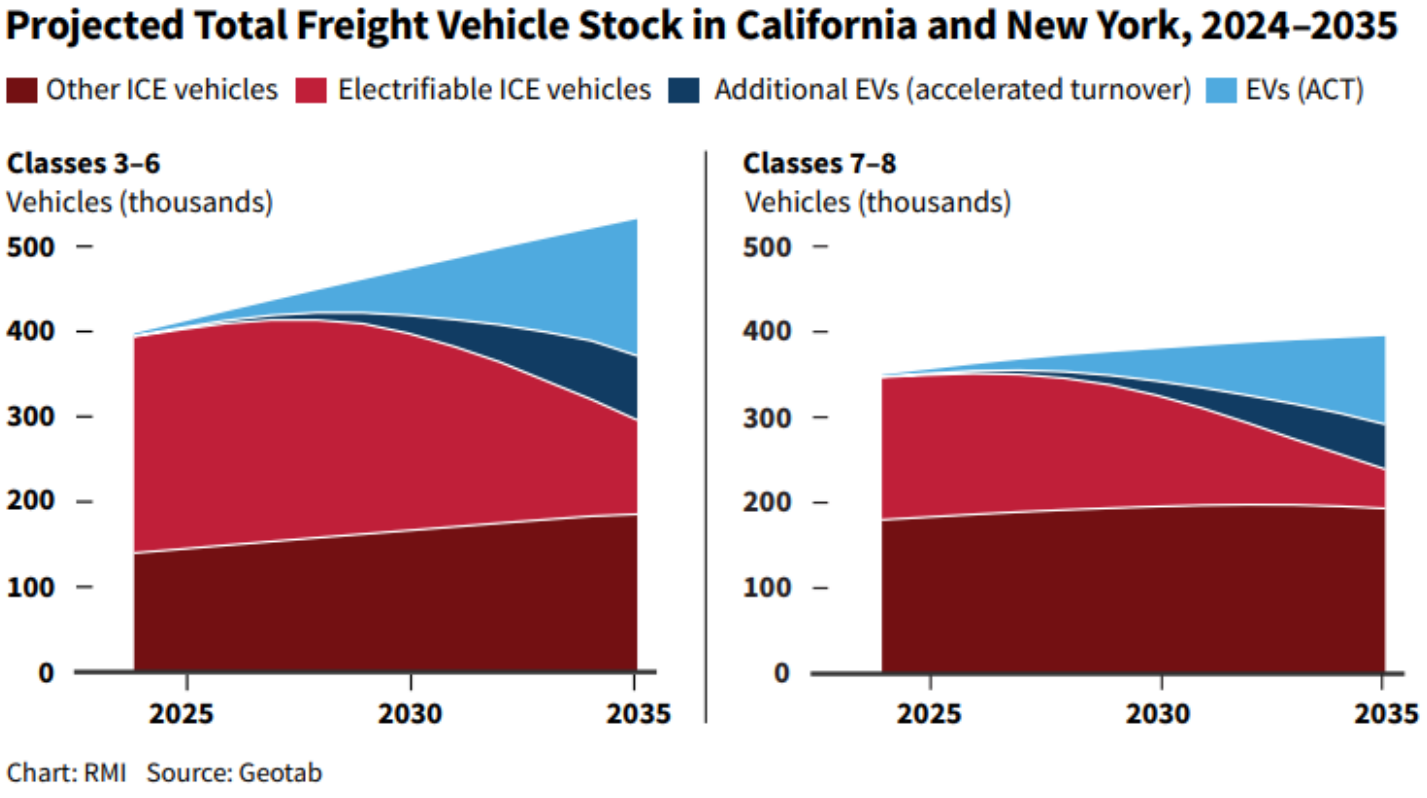
- Electric light commercial vehicle (LCV) sales worldwide increased by over 70% in 2021. At a global level, the electric LCV market share is 2%, about four times less than for passenger cars. Even in advanced EV markets, the LCV share barely exceeds 12%.
- The fact that the uptake of electric LCVs has been slower than cars in most markets to date may be attributable to a mix of factors, including less stringent fuel economy and ZEV regulations, fewer model options, and a diversity of use profiles (including lower annual mileage).

IEA Global Outlook- Heavy Duty Vehicles needs

- Depot charging
- Given the high construction and grid integration costs, the business case for very fast charging infrastructure of more than 350 kilowatts (kW), or even more than 1 megawatt (MW), may be uncertain, especially in the initial years of electric HDV market deployment.
- Battery swapping pilot programs for battery swapping are underway by various companies in China
- Electric road systems can transfer power to a truck either via inductive coils in a road, or through conductive connections between the vehicle and road, or via catenary (overhead) lines.

RMI- Charting the Course for Early Truck Electrification

- approximately 65% of medium-duty trucks (MDTs) and 49% of heavy-duty trucks (HDTs) stationed in California and New York are electrifiable, meaning they could be replaced with EVs based on current technology



What are shipping companies doing?

- UPS plans to reach carbon neutrality by 2050 and has committed to purchasing 10,000 new EVs in addition to the 1000 EV and PHEV already in their fleet
- FedEX plans to transform its entire parcel pickup and delivery (PUD) fleet to all-electric, zero-tailpipe emissions by 2040
- Amazon has over 1000 custom Rivian vans on the road and plans for 100,000 by 2030

While electrifying long-distance hauling is still a challenge, local and last-mile delivery electrification is well underway.

The Middle Mile

- UPS is investing in Freightliner eCascadia Class 8 trucks
- eCascadia has a range of 250 miles fully-loaded and eM2 (Class 7/8) has a range of 230 miles fully-loaded.
- eCascadia charges to 80% in 90 minutes, eM2 charges to 80% in 60 minutes

Electric school buses

- School buses in the United States travel more than 4 billion miles each year and transport nearly 25 million kids a day
- EPA's Clean School Bus Program provides $5 billion over five years (FY 2022-2026) to replace existing school buses with zero-emission and low-emission models.
- Two school districts in Onondaga County will receive a combined $2M for six new electric buses
- In NYS, all new school buses purchased must be electric by 2027 and 100% of school buses must be electric by 2035

P-12 Clean Green Schools Initiative

- Schools are eligible for ‘Clean Transportation Studies’ which can help districts develop fleet transition plans. The program can cover up to 100% of the study, depending on need status and disadvantaged community status.
- Other eligible projects include clean heating and cooling and capital improvements to move towards decarbonization, like retrofits and building electrification readiness projects (air sealing, insulation upgrades, window film, etc)

NYC's electric garbage trucks and street sweepers

DSNY says their new electric garbage trucks aren't up to the task of plowing snow yet, but they are pleased with the new Mack Model LR Electric when it comes to taking out the trash.

New York Truck Voucher Incentive Program (NYTVIP)

Voucher Amounts and Caps for All Vehicle Types

Vehicle Type	Fuel Type	Incremental Cost %	Voucher Amount: Vehicle Weight Class (GVWR)					
			3	4	5	6	7	8
On-Road Trucks	BEV / FCEV	95%	$ -	$100,000	$110,000	$125,000	$150,000	$185,000
Transit Buses	BEV / FCEV	100%	$ -	$100,000	$125,000	$150,000	$250,000	$385,000
Paratransit Buses	BEV / FCEV	100%	$ -	$100,000	$125,000	$150,000	$ -	$ -
School Buses	BEV	100%	$ -	$100,000	$120,000	$150,000	$200,000	$220,000
Port Cargo Handling Equipment	New BEV	90%	$170,000 across all classes					
	Repower BEV	90%	$140,000 across all classes					

2023 Ford F150 Pickup 2WD

Gasoline Vehicle

2.7 L, 6 cyl, Automatic (S10), Turbo

MSRP: $34,585 - $65,000

Regular Gasoline

21	MPG
combined city/highway	18 city 25 highway

4.8 gal/100mi

Gasoline

483 - 546 miles
Total Range

2023 Ford F-150 Lightning 4WD

Electric Vehicle

Automatic (A1)

Electricity

68	MPGe
combined city/highway	76 city 61 highway

49 kWh/100 mi

Electricity

240 miles
Total Range

2023 Ford F150 Pickup 4WD

Gasoline Vehicle

2.7 L, 6 cyl, Automatic (S10), Turbo

MSRP: $39,600 - $68,795

Regular Gasoline

20	MPG
combined city/highway	17 city 23 highway

5.0 gal/100mi

Gasoline

460 - 520 miles
Total Range

	2023 Ford F150 Pickup 2WD	2023 Ford F-150 Lightning 4WD	2023 Ford F150 Pickup 4WD
	Gasoline Vehicle	Electric Vehicle	Gasoline Vehicle
			
	2.7 L, 6 cyl, Automatic (S10), Turbo	Automatic (A1)	2.7 L, 6 cyl, Automatic (S10), Turbo
	MSRP: $34,585 - $65,000		MSRP: $39,600 - $68,795
You save or spend* Note: The average 2023 vehicle gets 28 MPG	**You SPEND** **$3,000** more in fuel costs over 5 years compared to the average new vehicle	**You SAVE** **$4,000** in fuel costs over 5 years compared to the average new vehicle	**You SPEND** **$3,750** more in fuel costs over 5 years compared to the average new vehicle
Annual Fuel Cost*	$2,450	$1,050	$2,600
Cost to Drive 25 Miles	$4.12	$1.73	$4.33
Cost to Fill the Tank	$80-$90		$80-$90
Tank Size	23.0-26.0 gallons		23.0-26.0 gallons

Thank you!