S&P Global
Mobility

Automotive Industry Outlook:

Navigating supply chain disruption and economic uncertainty in a time of industry transformation

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S&P Global Mobility provides three areas of essential intelligence

Strategy, Planning & Products

Leverages technology and data science to provide unique insights, forecasts and advisory services spanning every major market and the entire automotive value chain—from product planning to marketing, sales and the aftermarket.

30
million
lines of forecast data updated monthly

New Vehicle Sales & Marketing

automotiveMastermind helps dealers predict future buyers from their loyal, service-not-sold and conquest portfolio…all from one innovative platform.

40
million
new car offer mailings per year

Used Vehicle Sales and Service

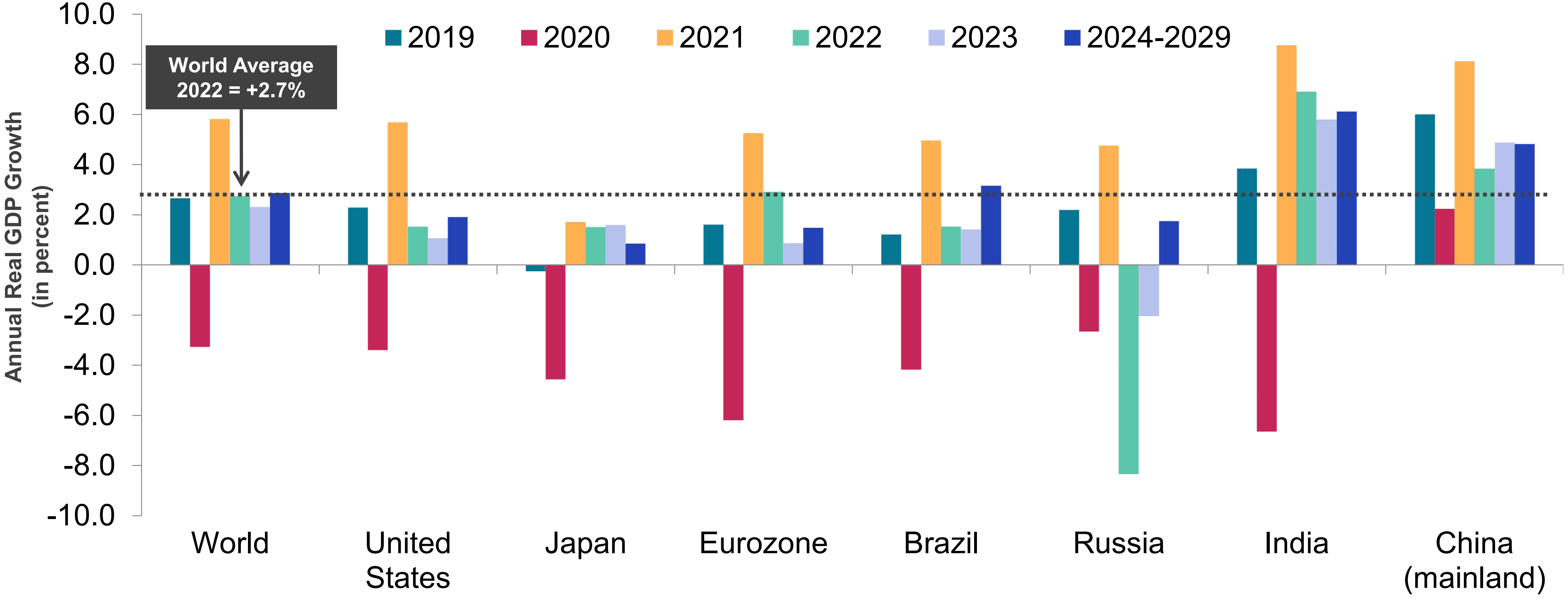
CARFAX continues to revolutionize the used car marketplace by sharing trusted vehicle history and valuation information that helps millions of people shop, buy, service and sell used cars with more confidence.

28
billion
vehicle history Records

IHS Markit now a part of S&P Global

World Economic Growth

Forecast Downgrade Reflects Increasing Efforts to Contain Inflation

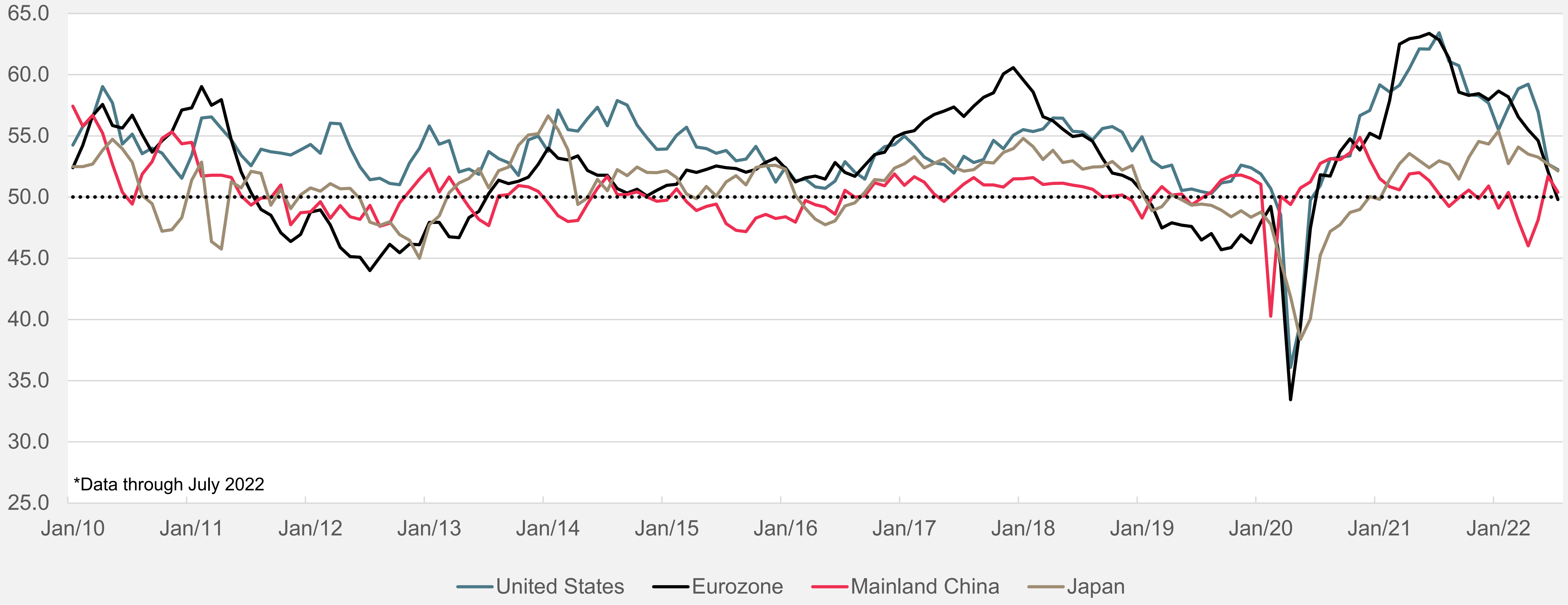


Source: S&P Global

World Economic S&P Global Manufacturing PMI®

Rising Risk of Global Recession Driving Downturn in Manufacturing Output

Purchasing Managers' Index® data



Source: S&P Global

Semiconductor Outlook: It's Complicated

Analog Chip Supply will Determine How Many Vehicles will be Built in the Near-Term

Factors Influencing Automotive Chip Supply

Demand

Number of chips per car

- Mix by vehicle segment and by propulsion system
- De-contenting for non-essential features

Mis-match of production and demand

- "Toilet paper effect". Inflation of demand by OEMs and suppliers
- Inventory
- Mix of chips ordered in advance not matching real need

How many vehicles will the fab capacity support in 2022, 2023 and beyond...?

Supply

Total capacity for chip fabrication

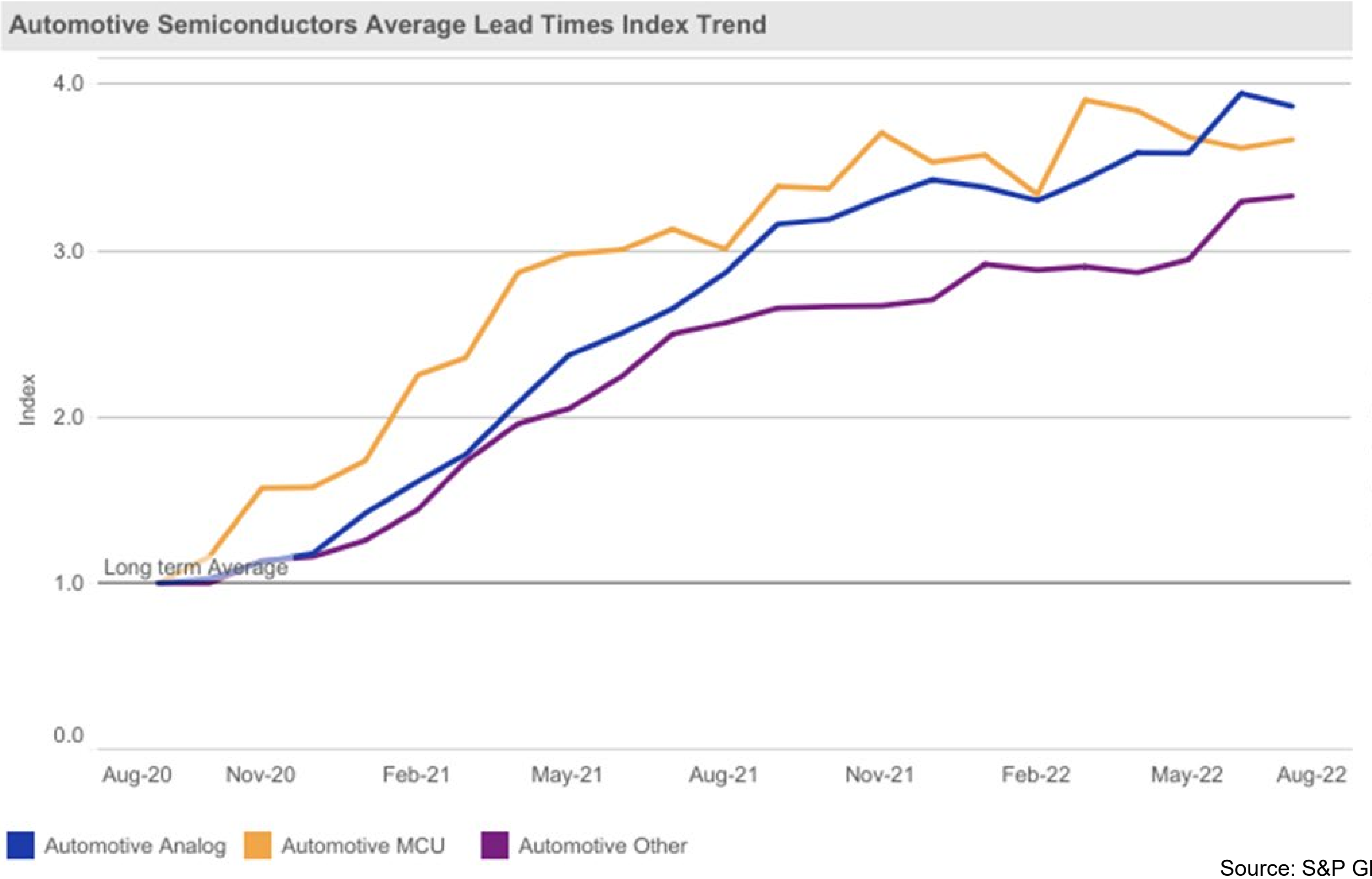
- CAPEX
- Miniaturization of chips (e.g. migration to smaller nodes)
- Short term stretched capacity (hot lots, postponing maintenance, manual lots…)

Allocation of chip fabrication capacity to automotive

- Demand from other markets especially mobile phones, consumer electronics, industrial, servers…
- Priority given by chip suppliers to automotive versus Apple, other phone suppliers…
- Political pressure

Source: S&P Global Mobility

Lead Time for Automotive Chips Still at Historic High

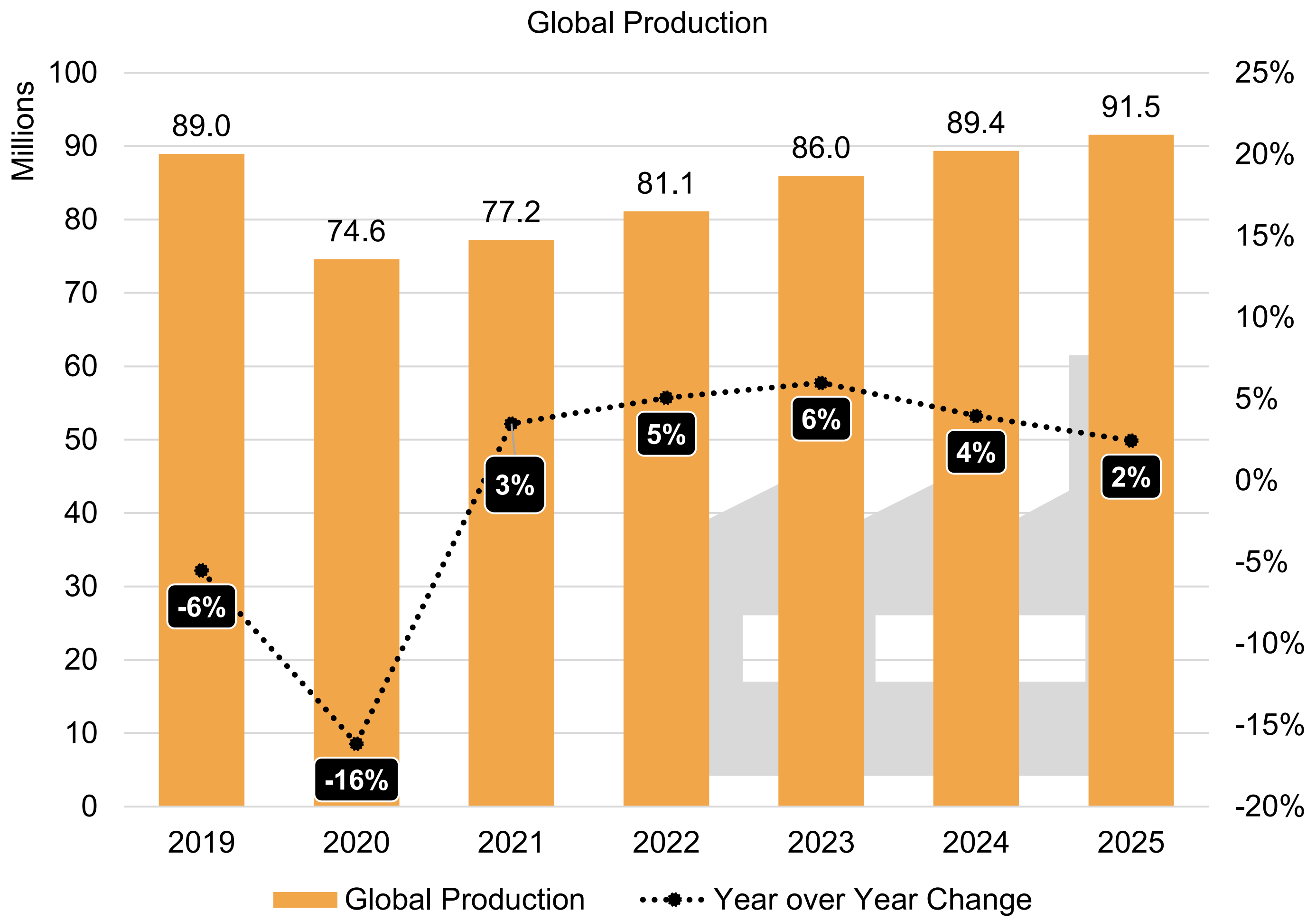


The Automotive Lead Time Index measures the lead time variation compared to long term average. An Index 3 means the Automotive chip buyers need to wait 3 times longer than normal before they receive semiconductors after placing the order.

Source: S&P Global Mobility, AutoTechInsight, August 2022

Global Light Vehicle Production Overview

2022 Raised Again: Mainland China Posts Strong Results in July, India Shows Resilience, Japan/Korea and ASEAN Gain from China Reopening; Europe and Americas Continue to Struggle. Bigger Cuts for 2023/2024



- ▲ Mainland China continues recovery on easing of lockdown 27% (y/y) increase in July LV production
- ▲ India demonstrates robust activity expected to underpin balance of this year and next
- ▲ Stronger wiring harness supplies; Ukraine situation improved alternative sourcing accelerated
- ▲ Non-automotive demand easing but displacement effects limited
- ▲ More evidence of OEMs proactively de-contenting to keep lines moving, recently mainland China

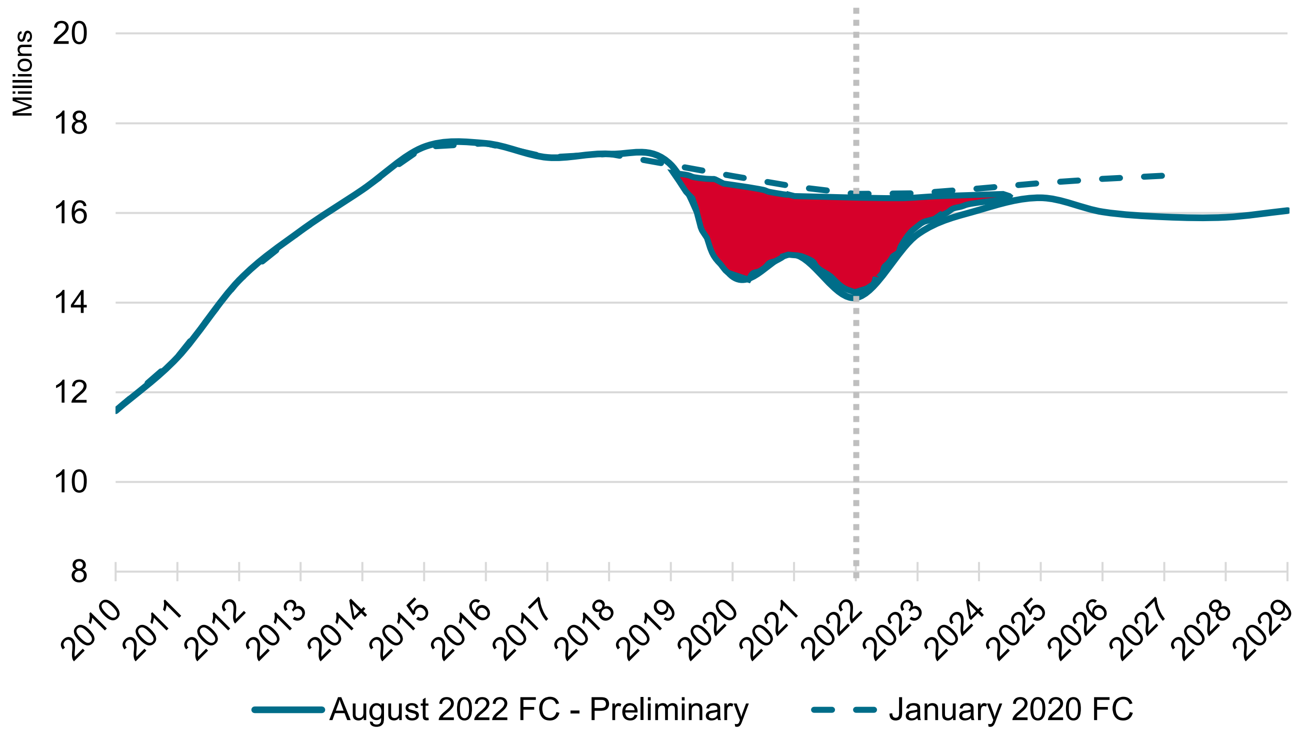
- ▼ Zero-COVID policy in mainland China in face of fast-moving Omicron variant is a major challenge that could quickly see lockdowns adopted
- ▼ Additional risks to raw materials, pricing and availability of neon gas, palladium, nickel, China lags yet to fully emerge
- ▼ Investment in analog chips limited and lead times are yet to fall; MCU supply and lead times healthier
- ▼ Short-term: Some OEMs continue to struggle with chip supply in Europe and North America
- ▼ General economic squeeze becoming more influential and earlier in the cycle

Source: S&P Global Mobility

US: Light Vehicle Sales Outlook

Supply Chain Constraints Alter Sales Recovery; Pent-up Demand is Vulnerable to Second Order Impacts from Macroeconomic Deterioration Resulting in Demand Destruction

US Light Vehicle Sales



Source: S&P Global Mobility

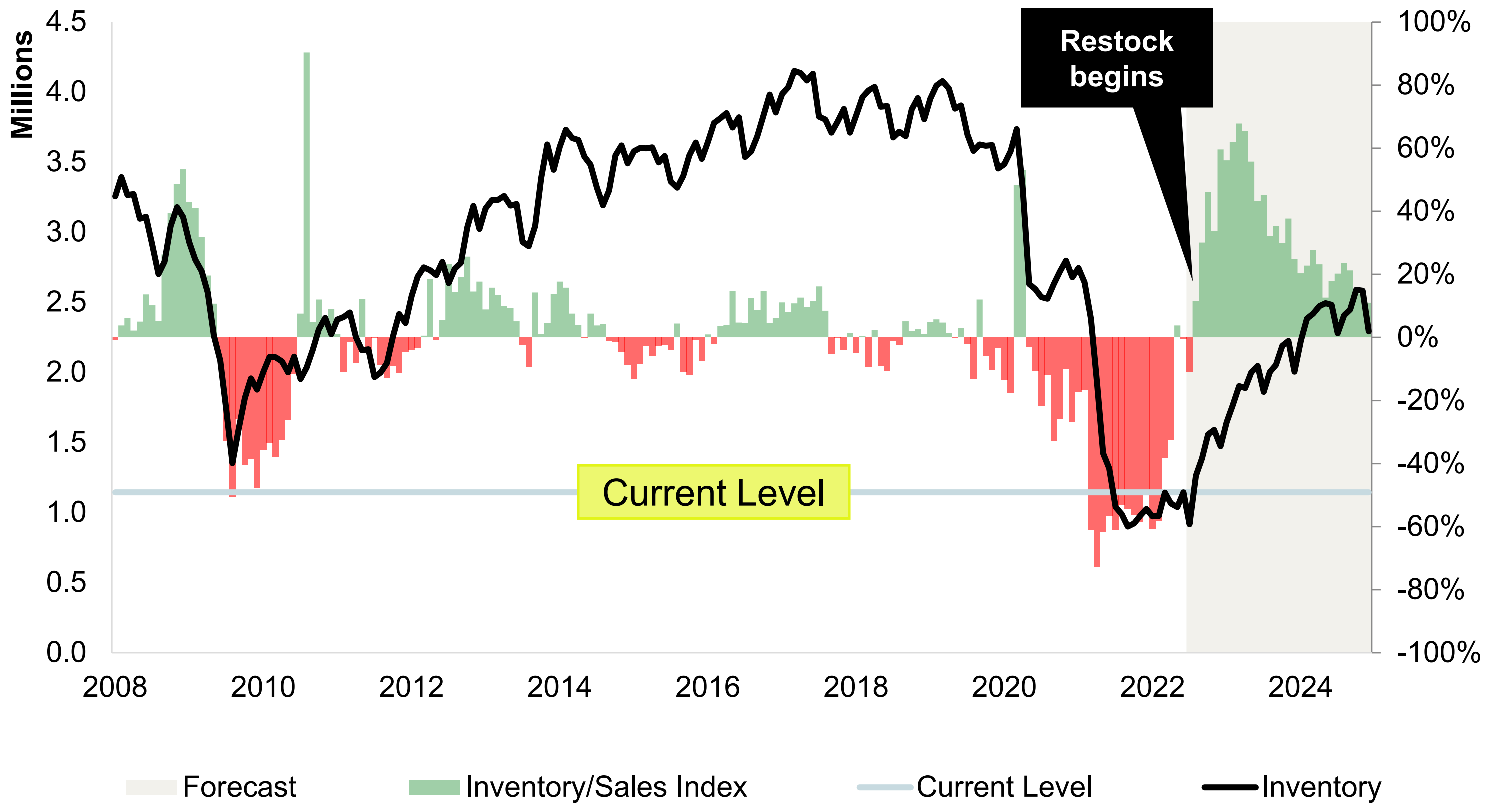
Economic issues

- US consumer outlook showing signs of stress with inflation, vehicle pricing and confidence as material concerns
- Inventory and production constraints impact sales in the near-term, **yet a faster transition from supply constrained to demand constrained is likely**
- Longer term pressure on OEM profitability
- Opportunities to find right customer based on vehicle age and scrappage
- Launches accelerate, mix increasingly attractive
- Vehicle development costs rising
  - Regulatory compliance
  - Consumer contenting
- Market conditions are shifting, yet we are already running at recessionary levels
  - Interest rates move higher
  - Affordability to become a challenge; macro environment weighs on sentiment

US Vehicle Inventory Levels

Part Shortages and Logistics Issues Extend Inventory Constraints with Sales at Recessionary Levels, yet Macro Pressures Contribute to Demand Destruction Pulling Ahead Inventory Re-stock; Average New Vehicle Prices Increase by 35% since Q1-2018

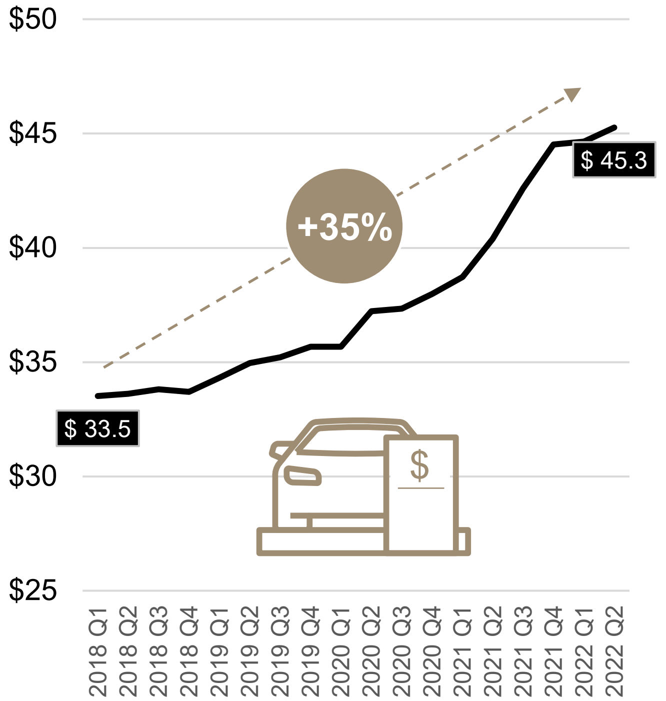
US Vehicle Inventory by Month



Source: S&P Global Mobility Light Vehicle Production Forecast; Motor Intelligence

US Avg. Light Vehicle Prices

(new cars and trucks, thousands of US dollar)

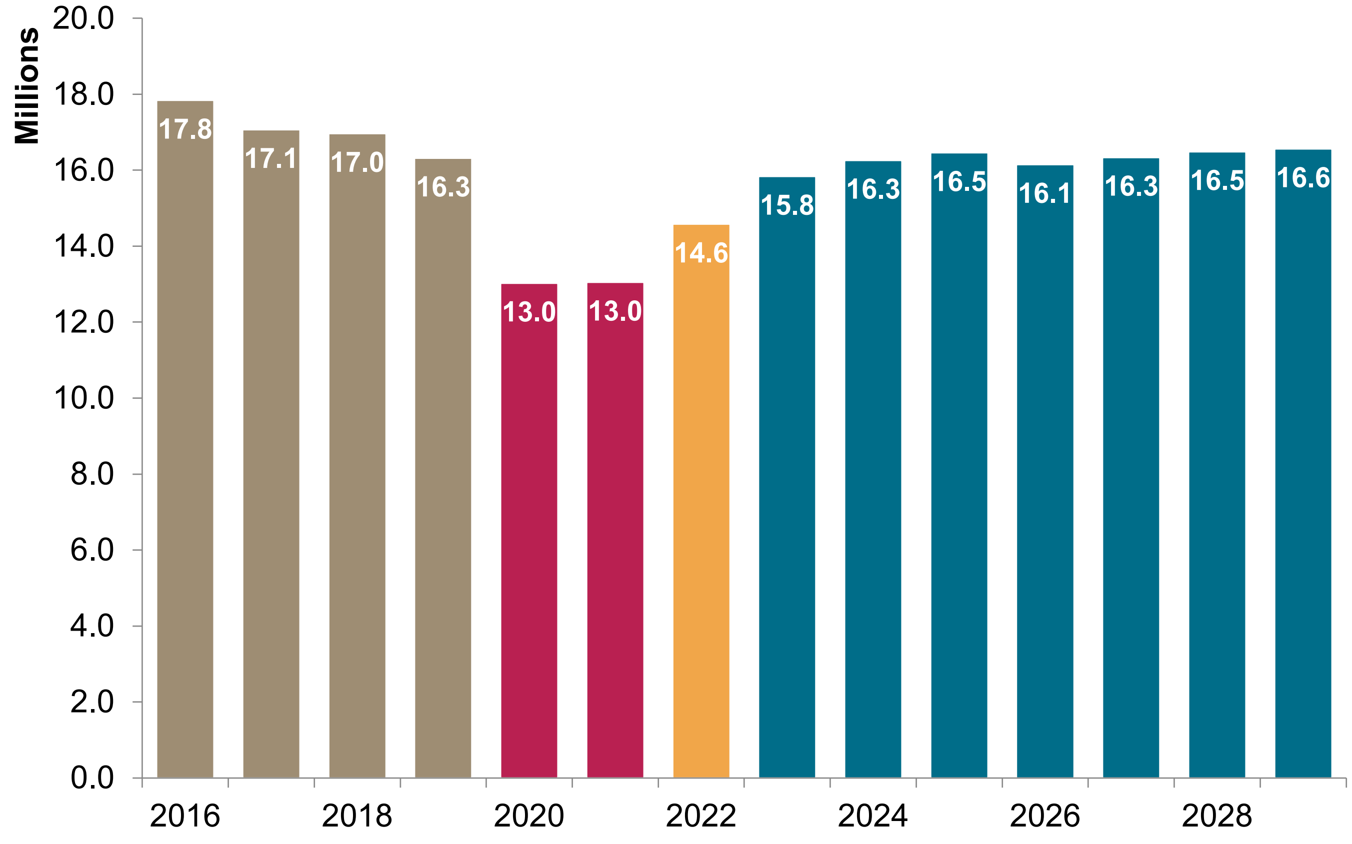


Source: S&P Global Mobility; Market Intelligence (former IHS Markit ECR)

North American Light Vehicle Production

Restoring Growth: A Longer-Term Proposition; Deteriorating Macro Conditions Shape Expectations

North American Light Vehicle Production



Source: S&P Global Mobility

Short-term

- **Supply chain, labor and logistics issues continue to impact near-term production result in continued near-term volatility**
- Demand outpaces supply, for now…
- Inventory depletion and restocking
- Strong product cadence amid issues

Long-term

- BEV development driving decisions
- Capacity expansion and maximization
  - BEVs creating transitory redundancy
  - Shift in sourcing patterns
- Growth in regionalization
  - Pressures to shorten supply chain
  - BEVs as added catalyst
- Life-cycle pressures; risk hedge: ICE vs. BEV

The Battery Electric Vehicle (BEV) Landscape is Growing Exponentially

US BEV Market

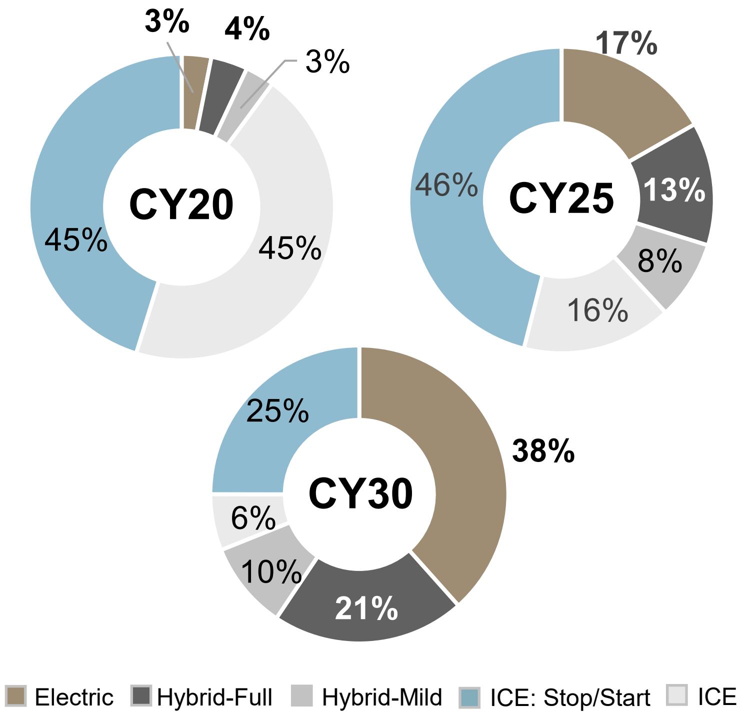
	2021	2030
Tesla Share of US EV Sales	71%	10%
California Share of US EV Sales	35%	12%
Top 90% **Brands** of US EV volume		
Models # of EV Models	26	250+
Charging Infrastructure Private, Public, Semi-Public Stations	0.94M	15.3M

Source: S&P Global; 2021 based on Total New Registrations

Powertrain Technology Outlook

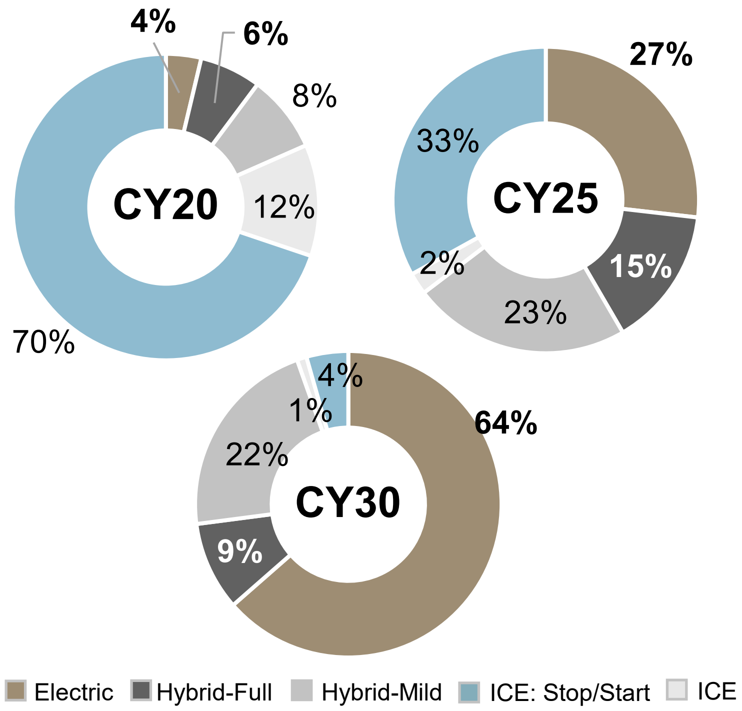
Regional Preferences and Incentives Result in a Varied Propulsion Mix; Watch the Model Count!

North America



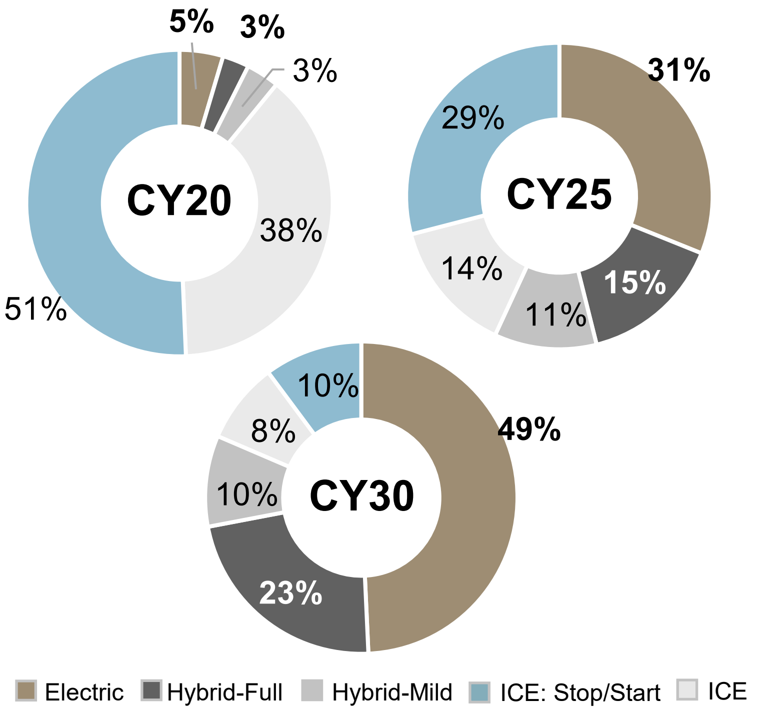
- Biden plan taking shape: NHTSA ~49 mpg fleetwide by MY2026; 40-50% BEV goal by 2030.
- PHEV and HEV production mix reduced in mid-term, improved outlook for BEV.

Europe



- Propulsion forecast intact as relief not expected for CO_2 compliance; BEV upside.
- “Fit for 55”: Tougher target reduction of 55% in 2030 from 2021 level; **100%** reduction in 2035.

Greater China



- Extended NEV subsidies/exemptions weaken pre-buy activity and boost demand in near-term.
- NEV subsidies come under increasing focus in the balance of cost vs. achieving targets

Source: S&P Global Mobility Light Vehicle Powertrain Forecasts

How are these factors impacting the aftermarket today and into the future?

Average age continues its climb and current indicators points to growth next year

283M

Passenger Cars and Light Trucks
January 2022

15.1M

New vehicles added
January 2022

4.2%

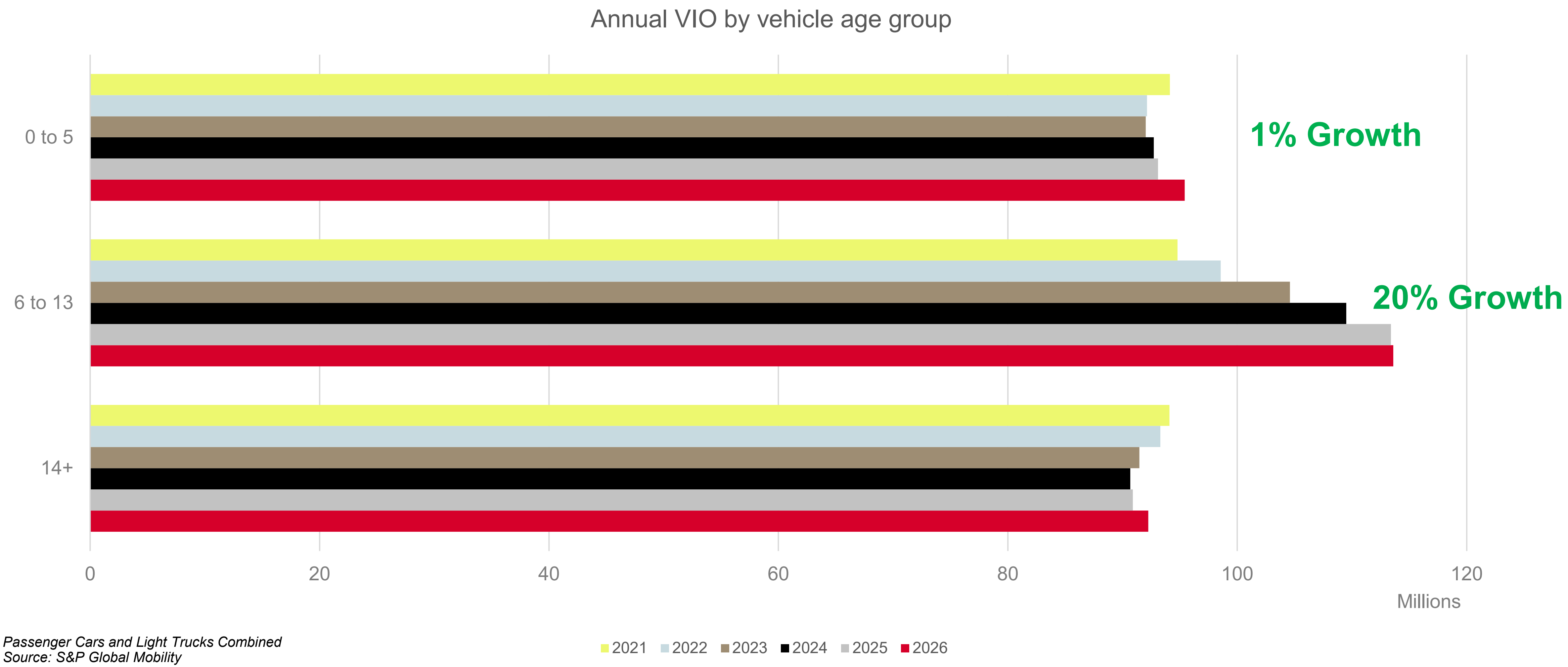
Scrappage
January 2022

12.2

Average vehicle age
January 2022

S&P Global Mobility VIO January 2022, July 2022

Age mix continuing to be more favorable through the first half of the 2020’s



Passenger Cars and Light Trucks Combined
Source: S&P Global Mobility

Vehicle miles traveled returned in 2021 and 2022 is poised for further expansion

2021	2022
12.4k	**12.5k**
Average miles traveled for Passenger Cars and Light Trucks	Average miles traveled for Passenger Cars and Light Trucks
3.4T	**3.5T**
Total US miles traveled for Passenger Cars and Light Trucks	Total US miles traveled for Passenger Cars and Light Trucks

S&P Global Mobility 2021-2022 VMT

There may be storm clouds on the horizon in 2022 if gas prices stay high

2022

12.5k

Average miles traveled for Passenger Cars and Light Trucks

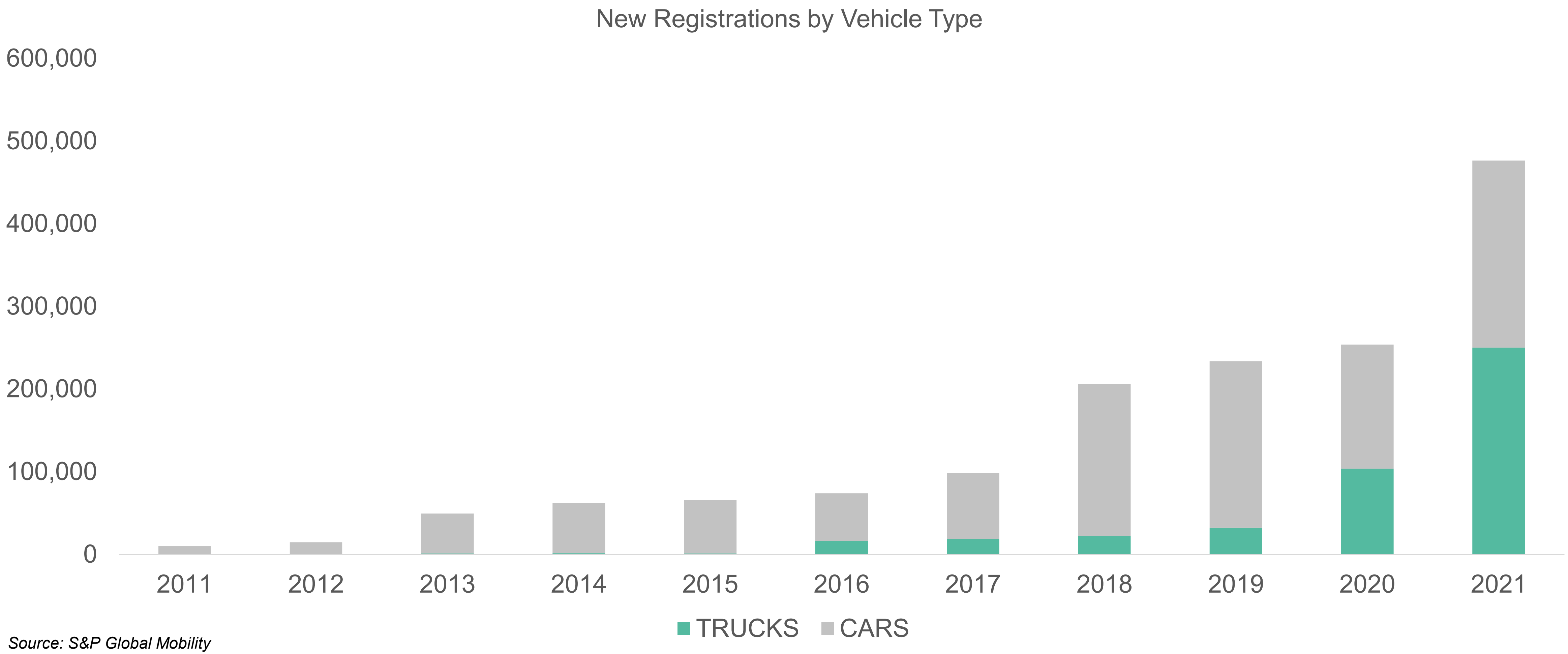
3.5T

Total US miles traveled for Passenger Cars and Light Trucks

In 2022, sustained prices over $4 will lead to a reduction of less than 1%; sustained pricing at $5 will likely lead to closer to 2% reduction as elective driving is further constrained.

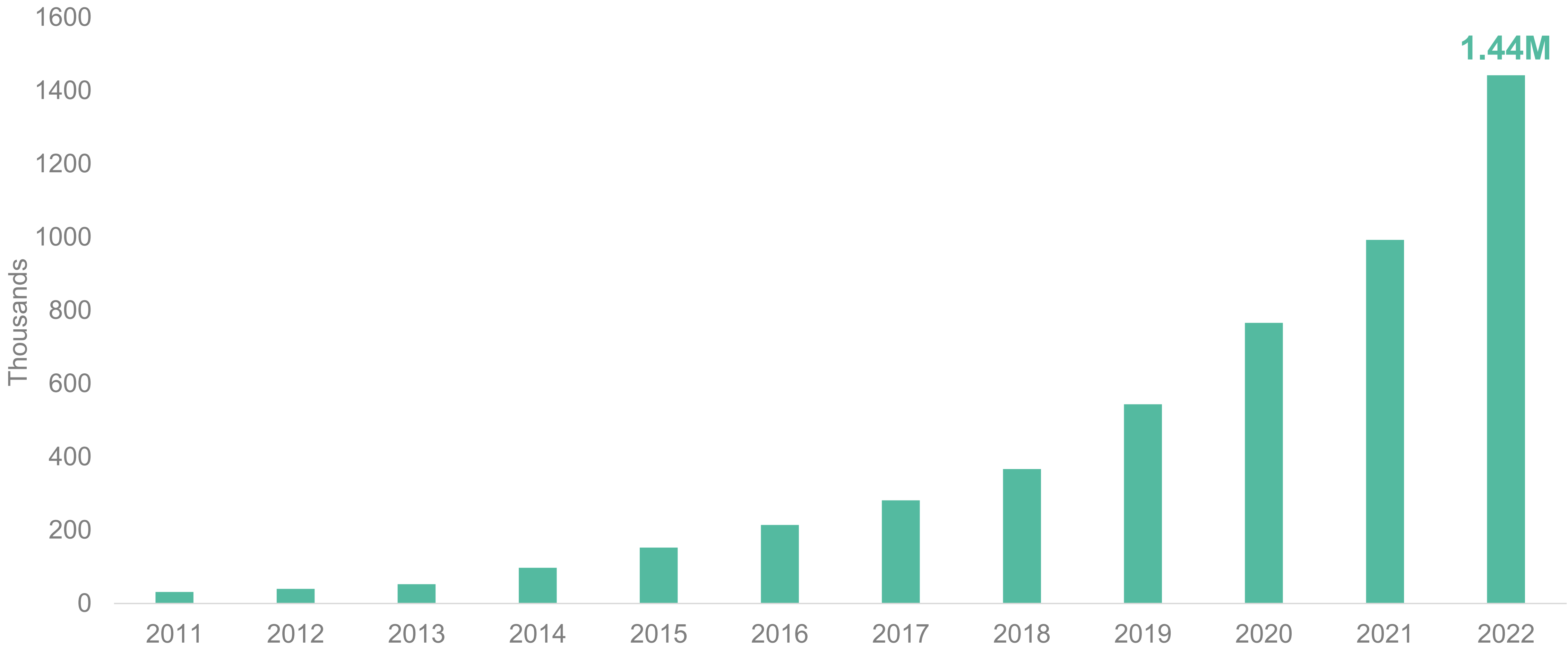
S&P Global Mobility 2022 VMT

Truck body style EV's boosting registrations



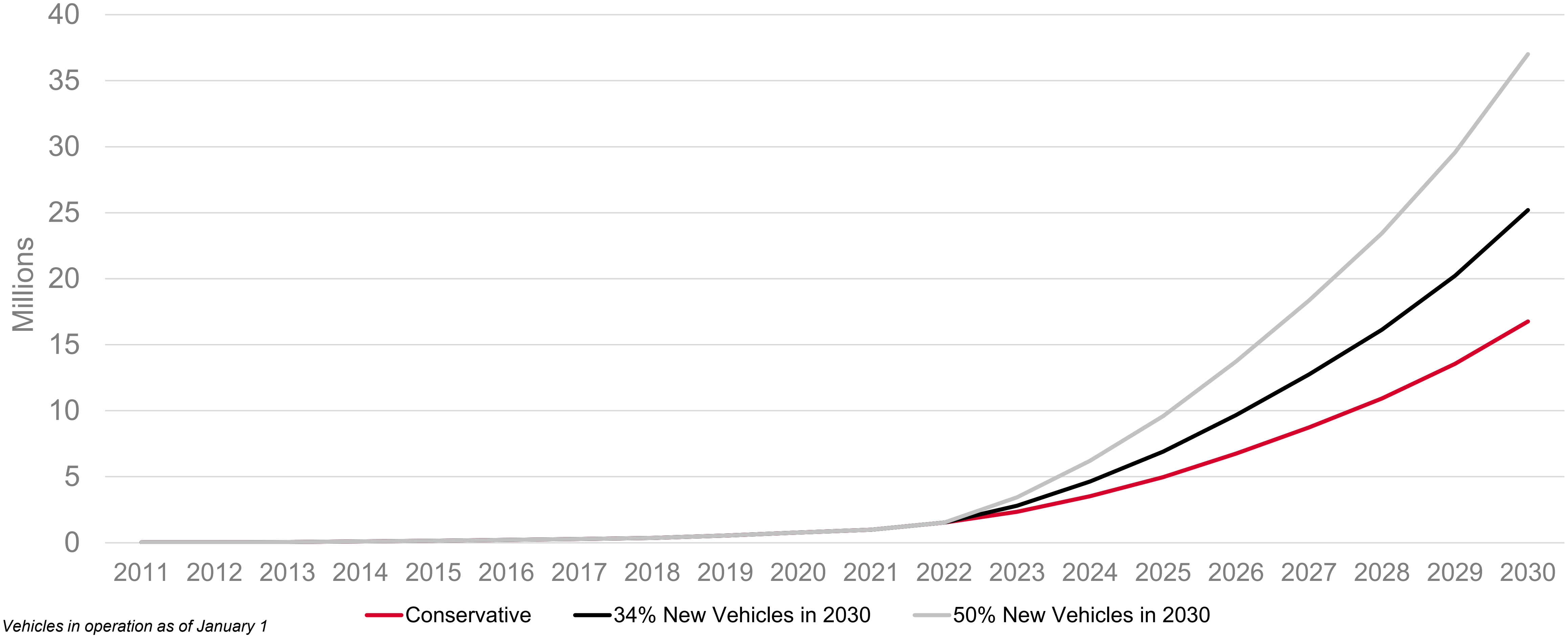
Source: S&P Global Mobility

Volume of Electric Vehicles in Operation is growing too



Vehicles in operation as of January 1
Source: S&P Global Mobility

EV volume in VIO outlook



Vehicles in operation as of January 1
Source: S&P Global Mobility

ZEV/LEV States Map

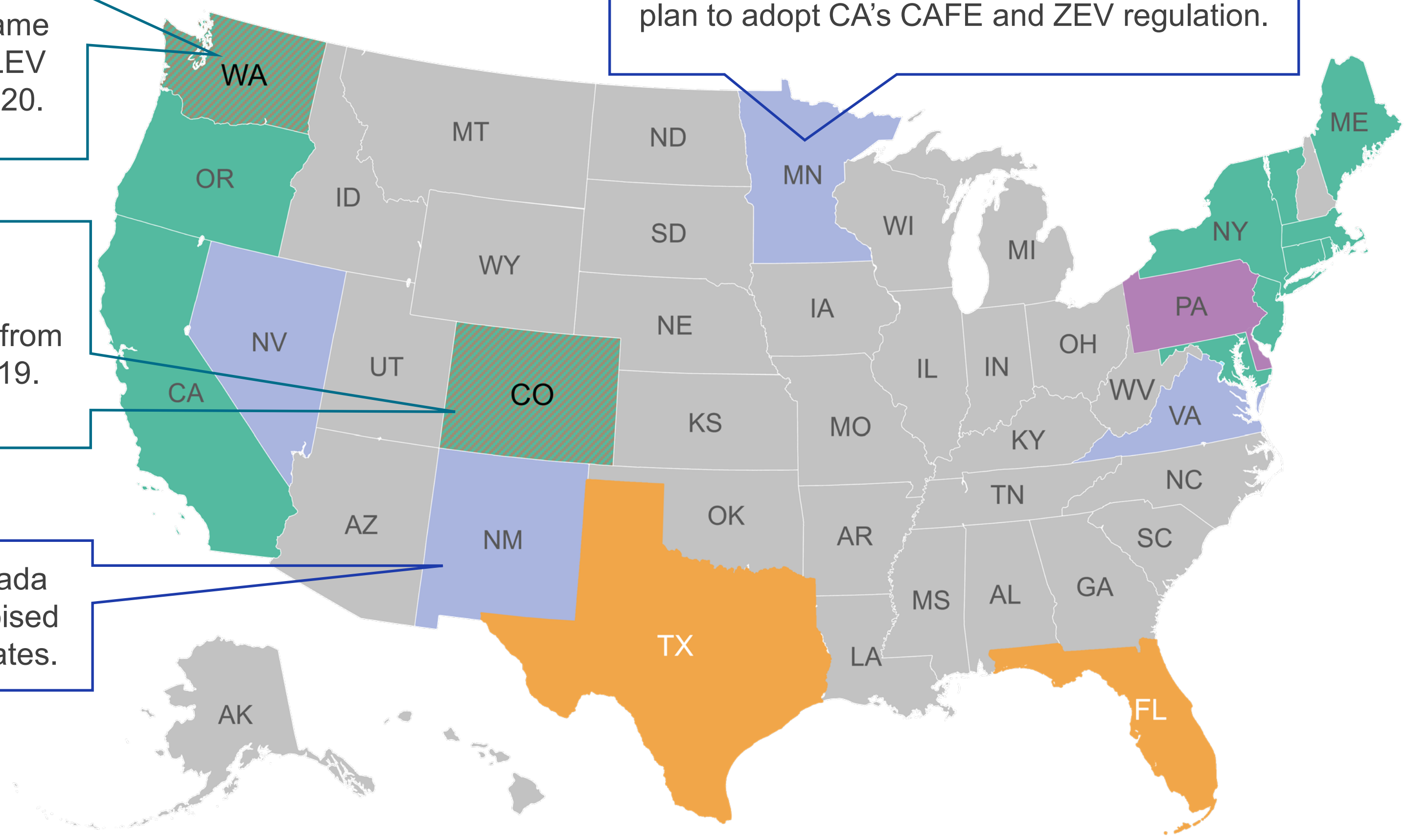
Two Previous LEV states, Colorado and Washington Recently Became ZEV; More Expected to Follow…

Washington became ZEV state from LEV states in April 2020.

Colorado became ZEV state from LEV in August 2019.

New Mexico, Nevada and Virginia are poised to become ZEV states.

In September 2019, Minnesota announced plan to adopt CA's CAFE and ZEV regulation.



ZEV states:

- 32% of total 2021 US registrations
- 58% of total 2021 US EV registrations

- Non-ZEV
- Planning
- LEV
- New ZEV
- ZEV

Florida and Texas are not ZEV Section 177 states. However, behind CA, they rank 2nd and 3rd nationally for BEV sales.

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Sources: CARB, S&P Global Mobility research

EV volume is growing, but face headwinds to continue pace

“The world needs more oil and gas now to deal with an energy shortage while pushing to transition to renewable supplies.” – Elon Musk, ONS Energy Conference, Norway
(Tesla (TSLA) Elon Musk Says World Needs More Oil and Gas as Bridge to Renewables – Bloomberg)

“The shift to relying on electricity for transport requires more battery materials including iron and lithium…That industry needs to expand massively so enough cells can be made to replace the energy provided by fossil fuels.” – Elon Musk, ONS Energy Conference, Norway
(Tesla (TSLA) Elon Musk Says World Needs More Oil and Gas as Bridge to Renewables – Bloomberg)

"staggering amount of work and investment that is needed to scale this industry quickly"; and that "90% to 95% of the battery capacity supply chain the industry will need over the next 10 years has not been built yet“ – RJ Scaringe, CERA Week 2022, Houston
(https://ihsmarkit.com/research-analysis/fuel-thought-pace-change-energy-mobility-climate-innovation.html)

“How did the F-150 Lightning fare in this head-to-head challenge? Let’s just say it didn’t match up well against the gas-powered Sierra. Towing the travel trailer significantly ate into the EV’s range, limiting how far the truck could drive before requiring a recharge” – RV.com (See How Towing a Travel Trailer Impacts the Range of an Electric F-150 Lightning - RV.com)

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Thank You!

For more information on S&P Global Mobility, please visit:
https://www.spglobal.com/mobility/en/

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