CENTER FOR AUTOMOTIVE RESEARCH

The Great Divide:

What Consumers Are Buying vs. The Investments Automakers & Suppliers Are Making in Future Technologies, Products & Business Models

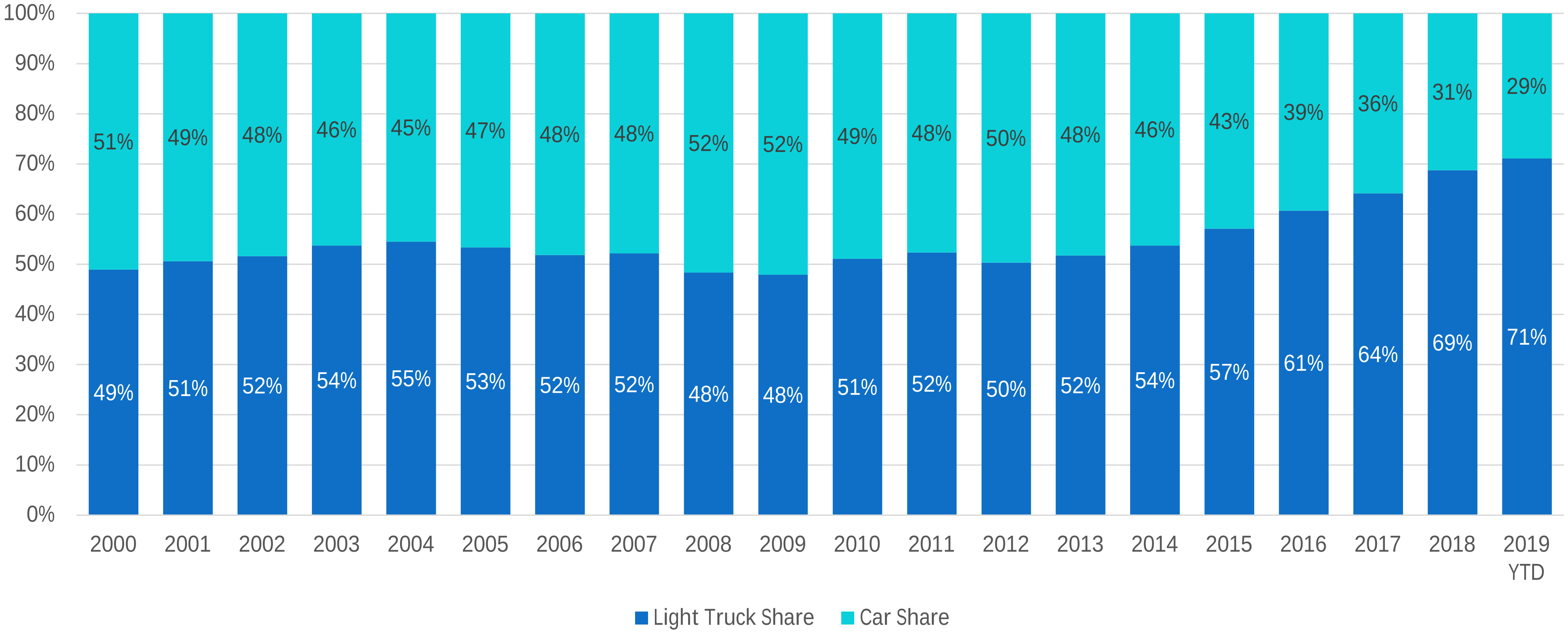
Kristin Dziczek, Vice President

Center for Automotive Research | Ann Arbor, MI

18 September 2019

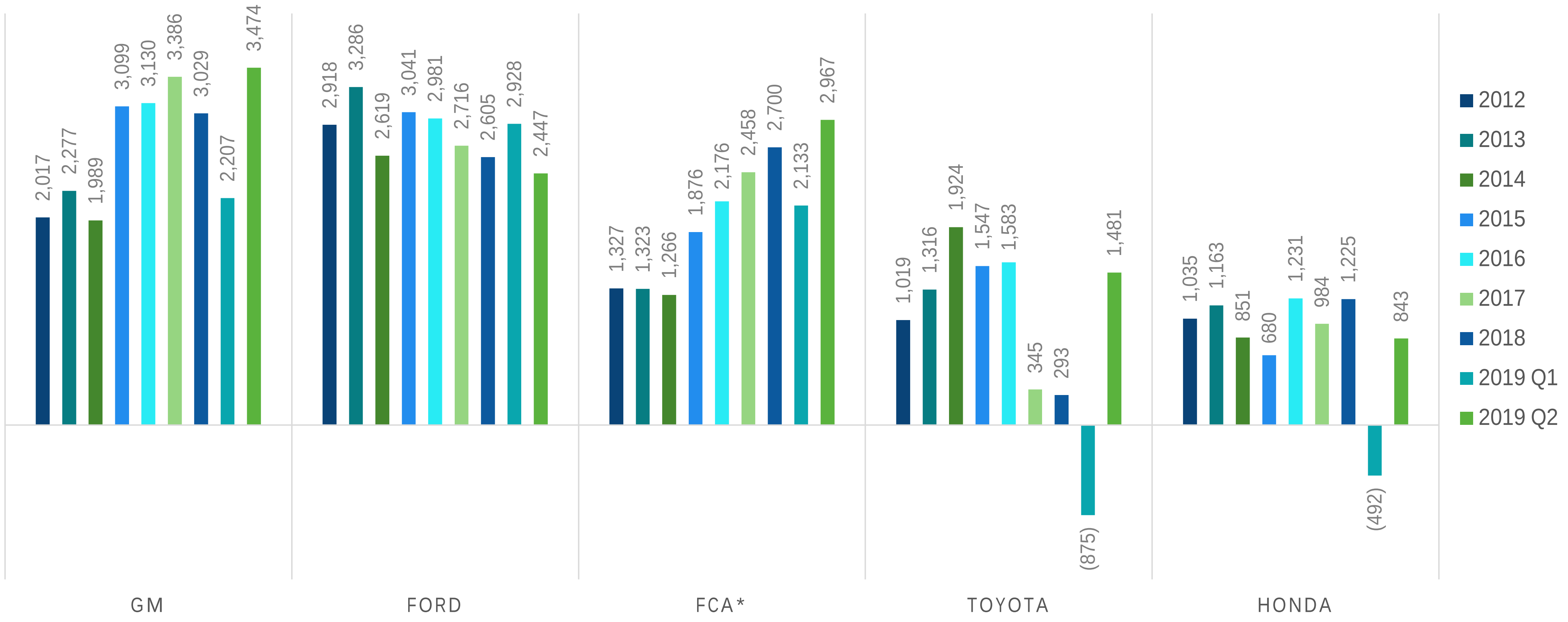
- Current Market
- Powertrain and Propulsion
- Innovative Mobility Services and Connected and Automated Vehicles
- Convergence of Electrified Powertrains and Connected and Automated Vehicles

U.S. Car-Truck Market Share Split, 2000 – 2019 YTD



Source: CAR Research based on IHS Markit and Wards Auto

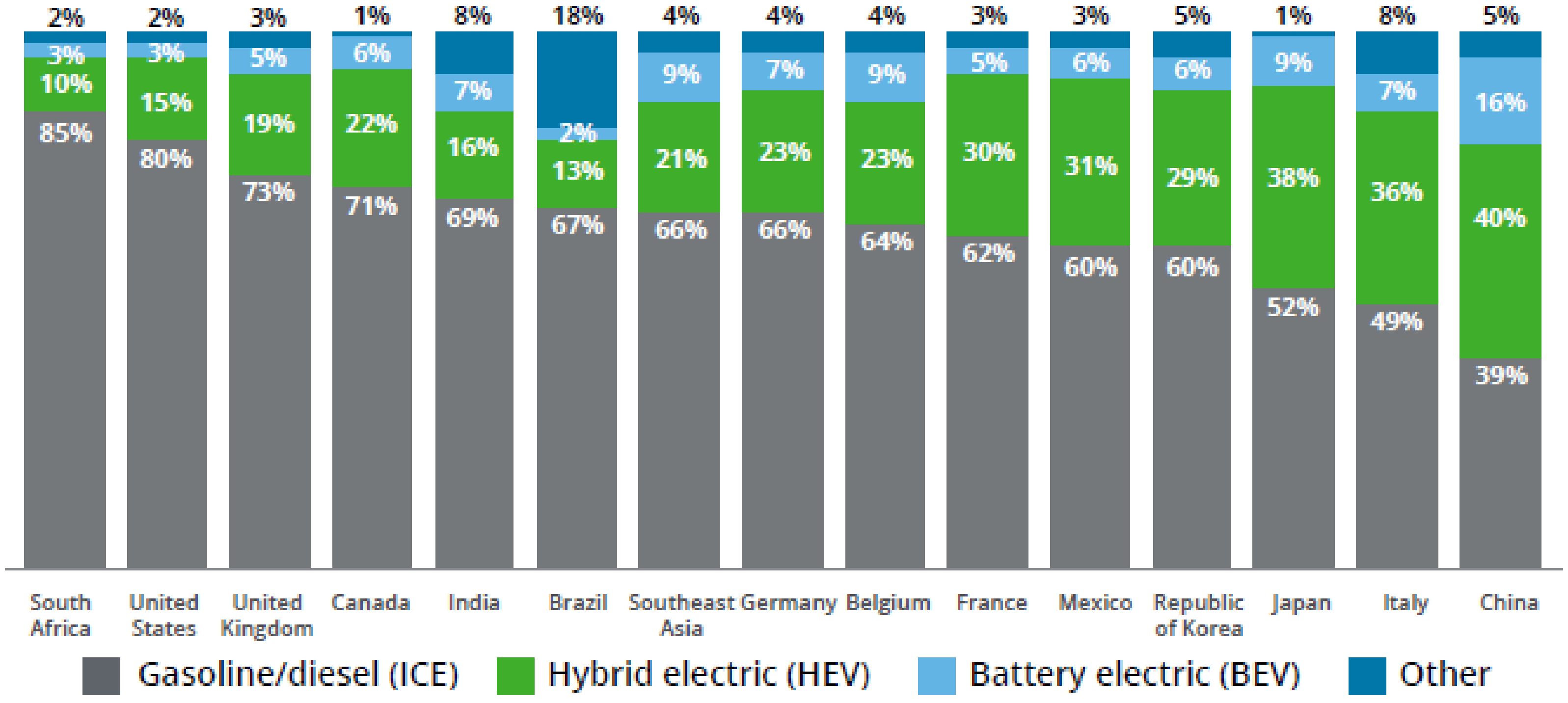
Per Vehicle Operating Profits, North America 2012 – Q2 2019



Source: CAR Research based on companies' financial reports.

**FCA US data up to 2014*

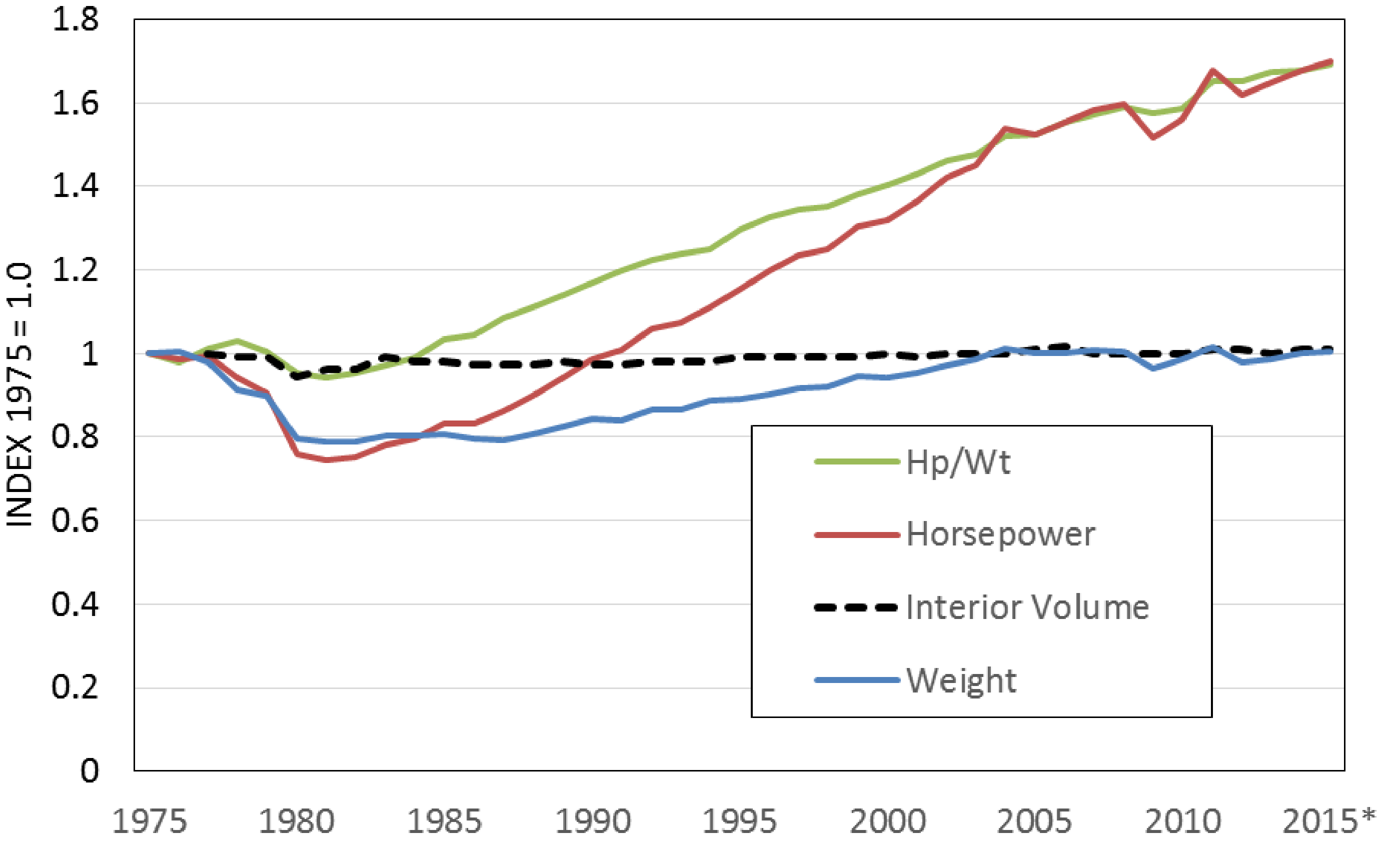
Consumer Preference for Type of Next Vehicle, 2018



Note: 'Other' category includes ethanol, compressed natural gas, and hydrogen fuel cell.

Source: 2018 Deloitte global automotive consumer study

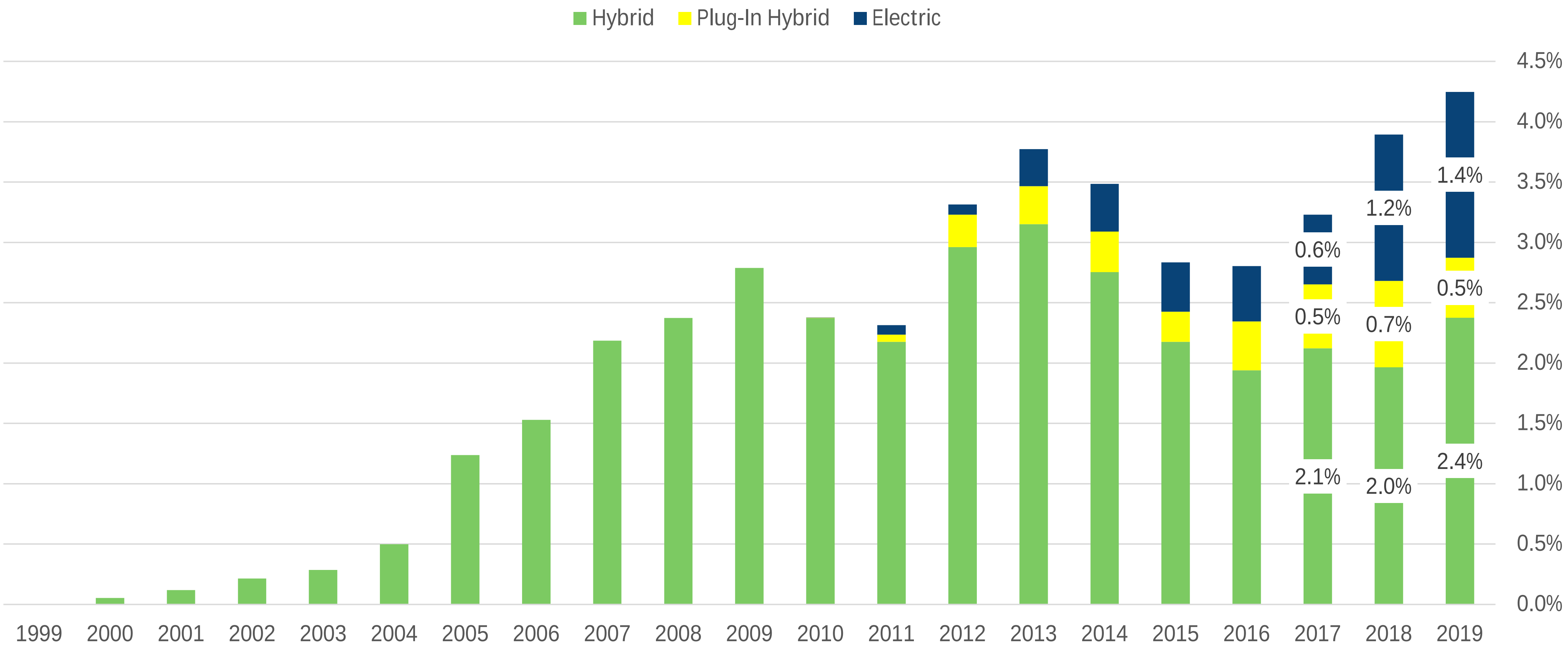
Selected Attributes of U.S. Passenger Cars, 1975-2015



Source: U.S. Environmental Protection Agency

U.S. Electrified Light Vehicle Sales by Propulsion Technologies

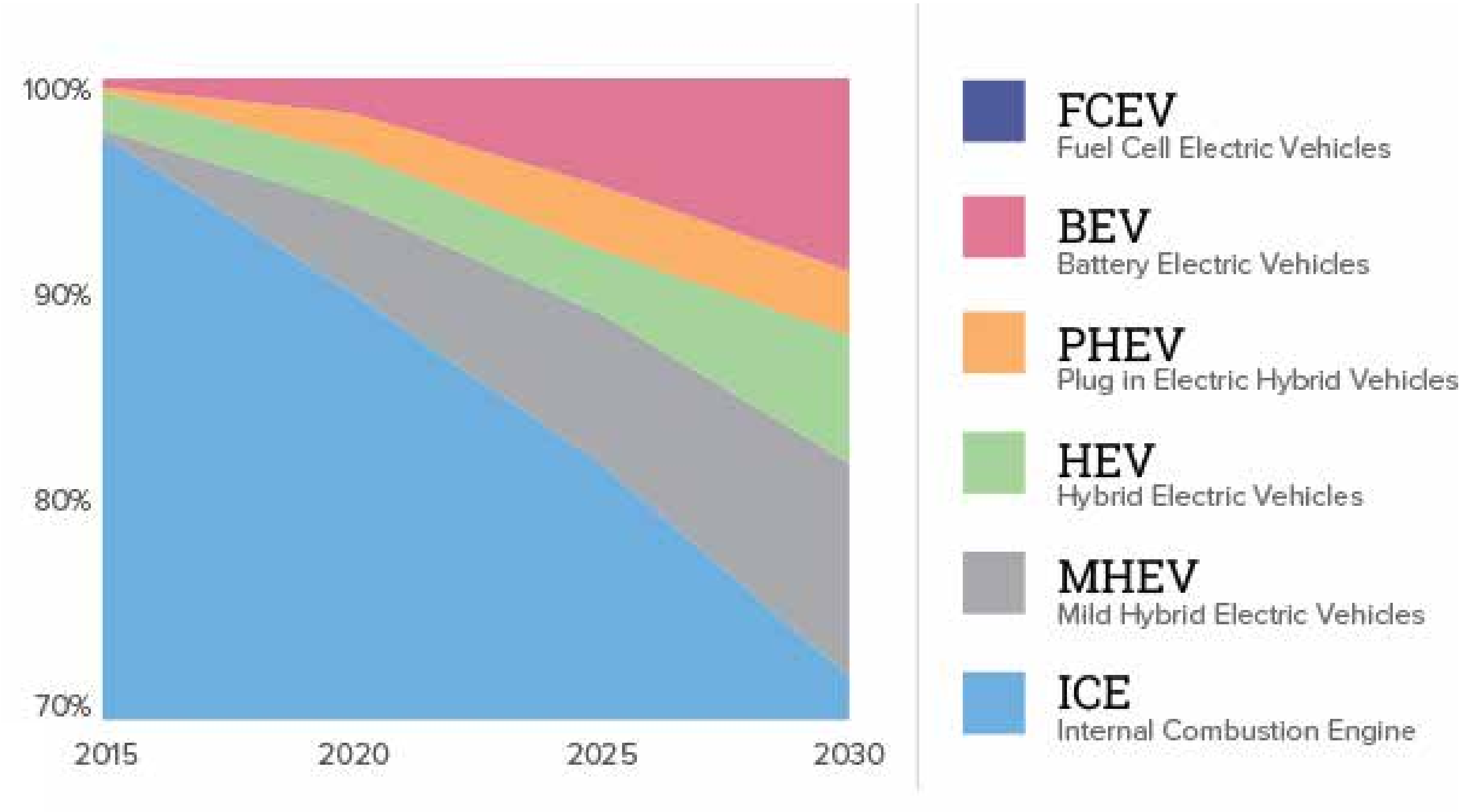
1999 – 2019 YTD Through August



Note: Electrified vehicles consist of BEV, HEV and PHEV

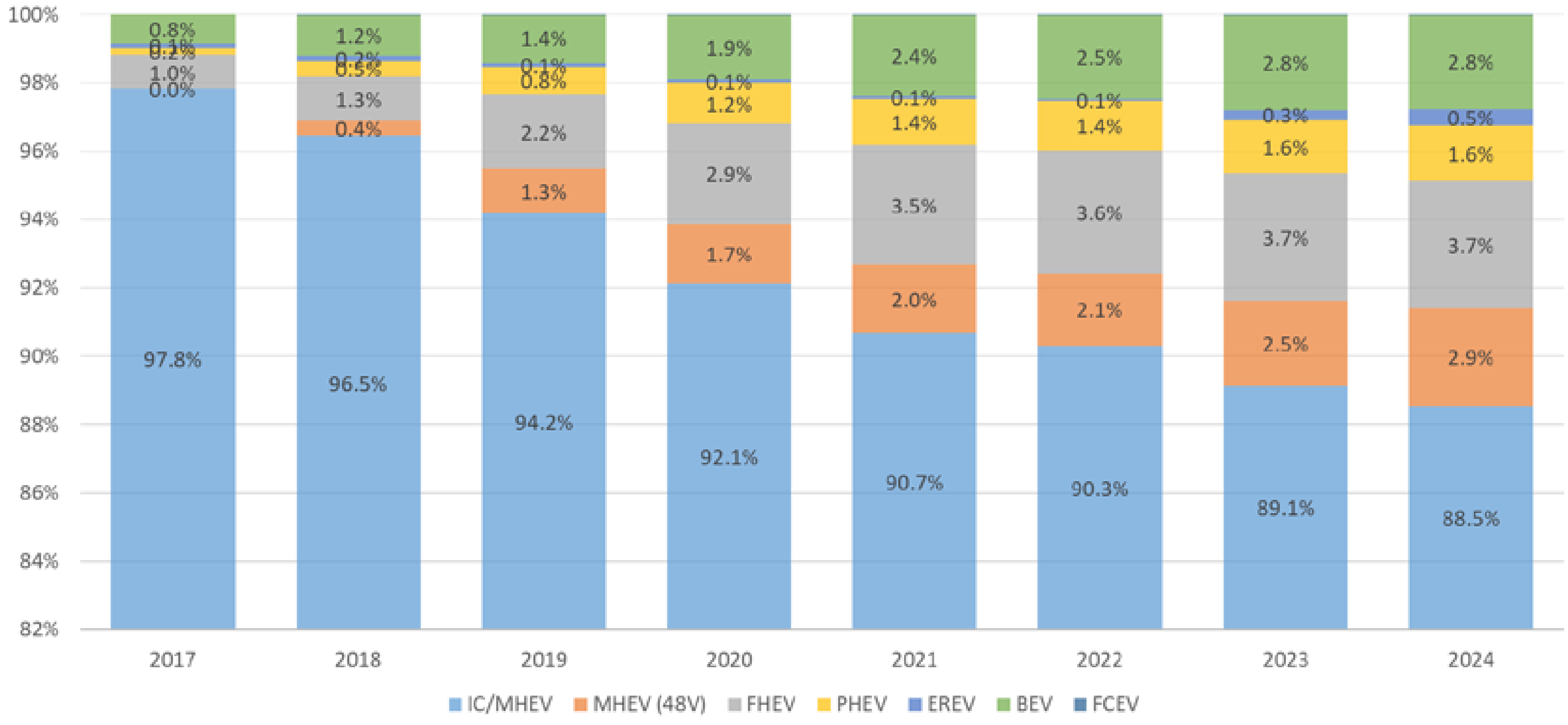
Source: Ward's Automotive Reports (from 2010 and on), HybridCars.com and CAR Research

Global Powertrain Market Share, 2015-2030



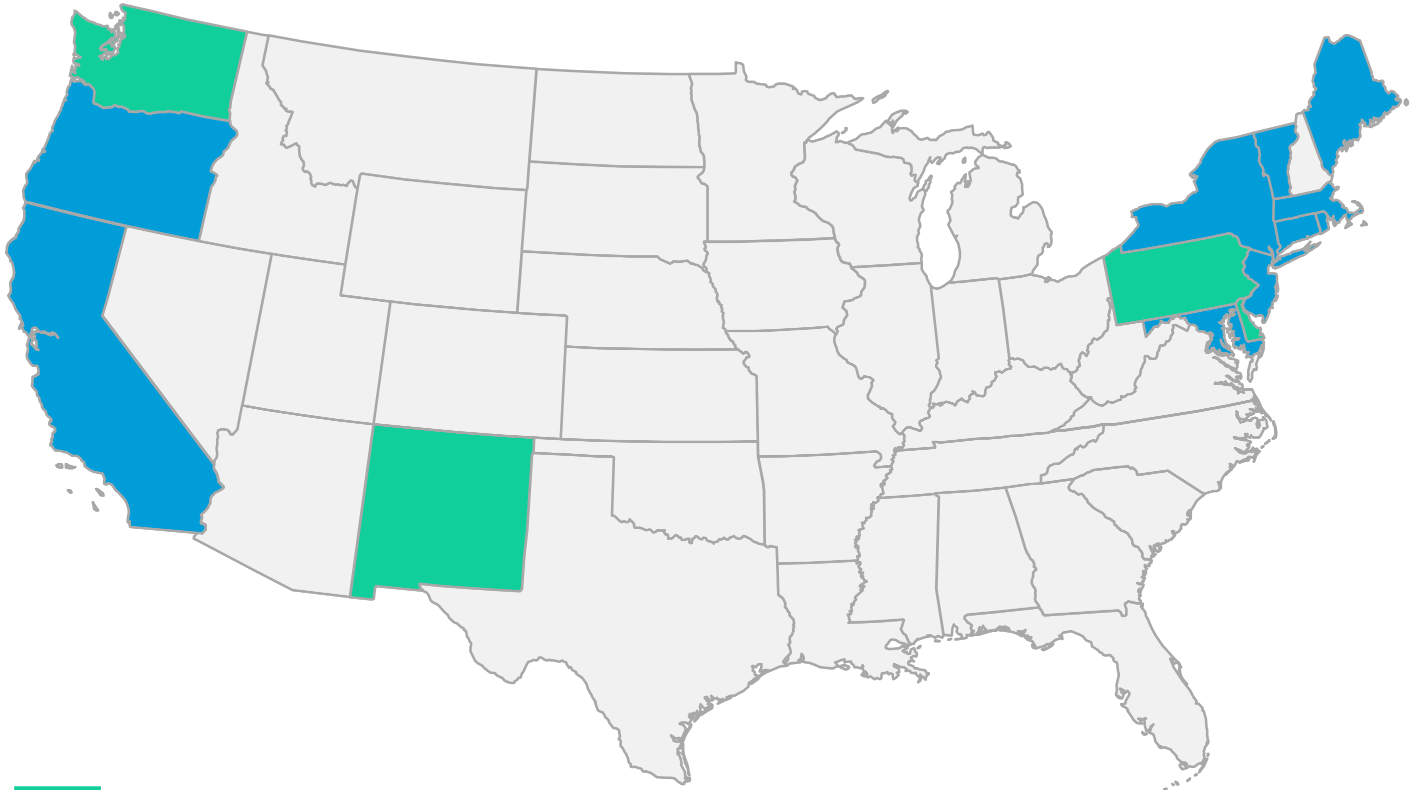
Source: CAR Research; USEPA/NHTSA Technical Assessment Report; Global EV Outlook 2016, International Energy Agency; Joining Forces to Tackle Road Transport CO2 Challenge, European Automobile Manufacturers Association; various others

North American Powertrain Production Share,
2017-2024



Source: LMC Automotive

States that Have Adopted California's Emissions Regulations

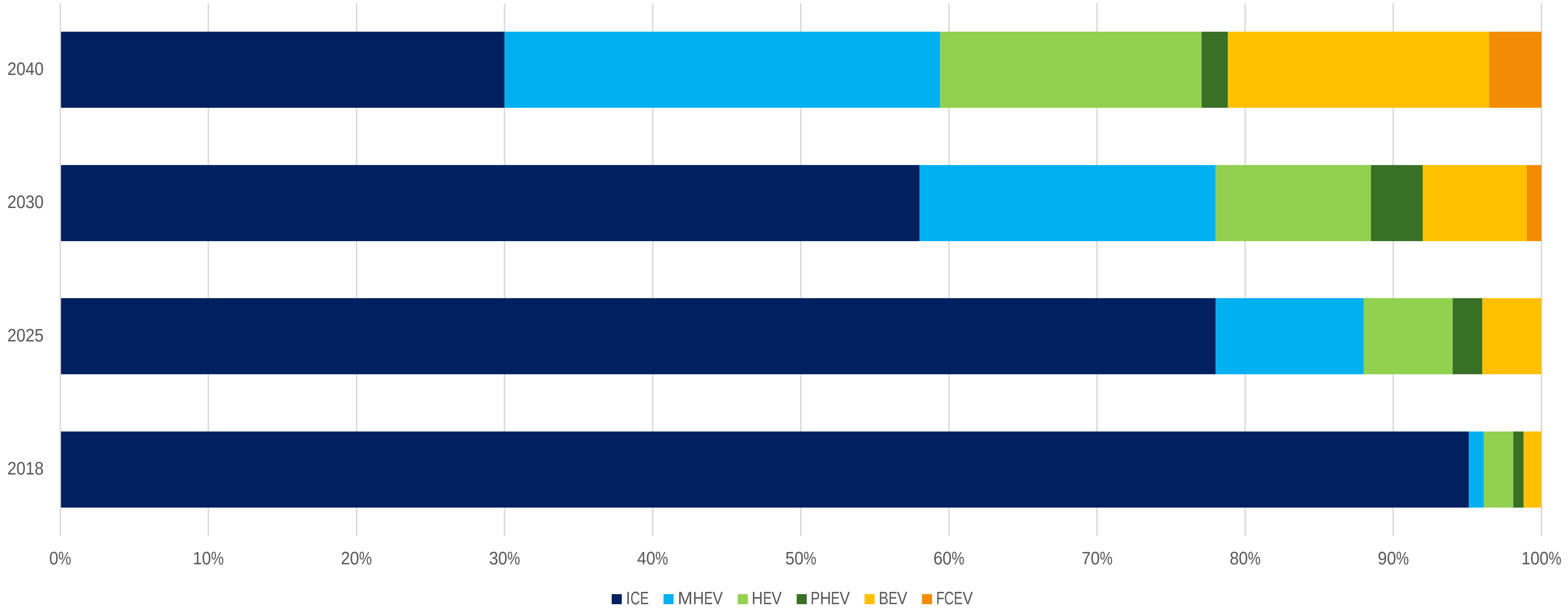


‘Section 117’ States (states that follow California's fuel emission standards)

ZEV States (states that follow California's fuel emission standards and ZEV mandate)

Source: Center for Automotive Research

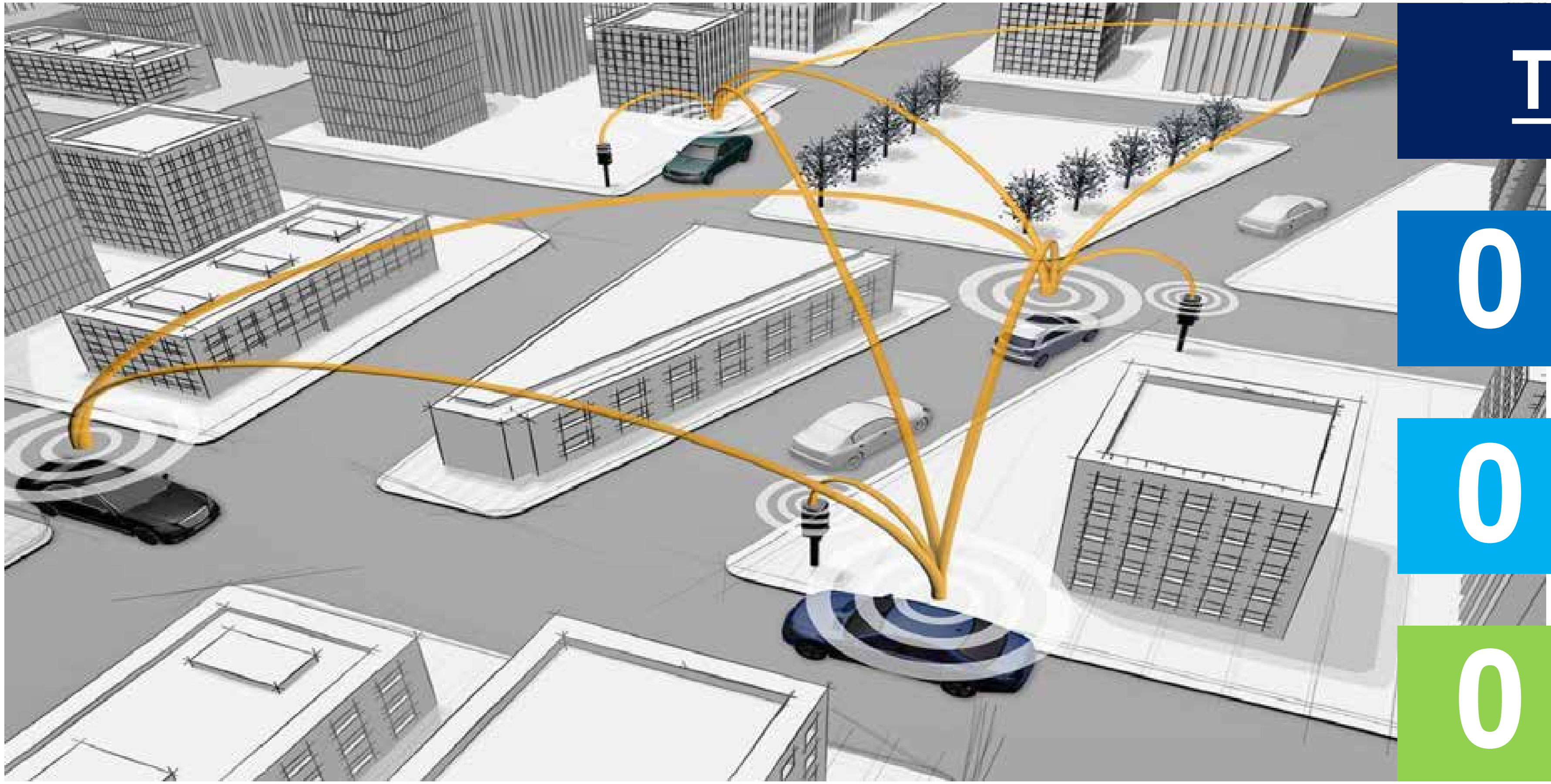
Market Penetration of Light Duty Propulsion Systems: N.A. Estimate 2018-2040



Mobility:

The movement of people and goods from place to place, job to job, or one social level to another (across bridges – physical or assumed).

Smart Mobility:
The movement of people and goods with…



TRIPLE ZERO

0 Accidents & Fatalities

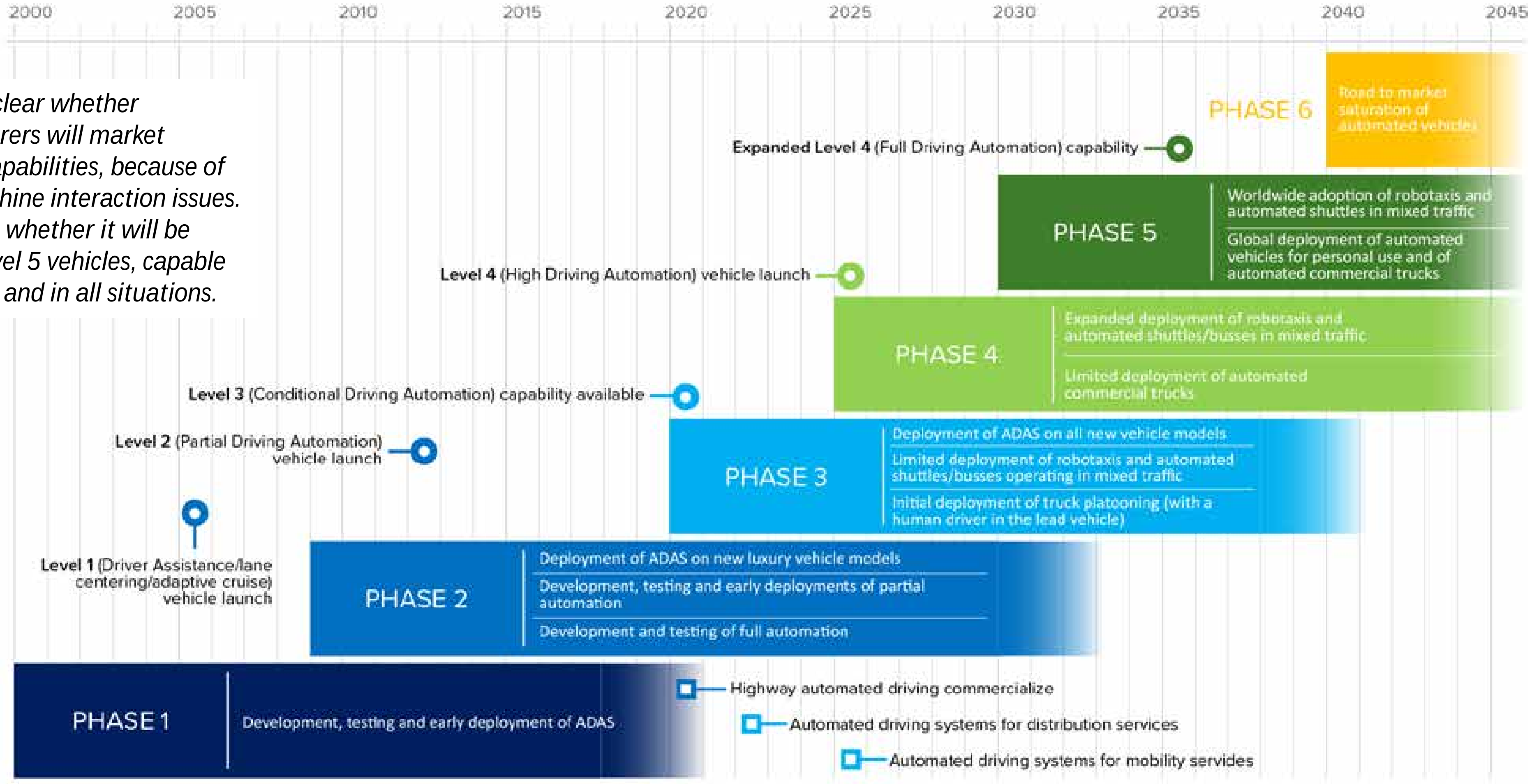
0 Carbon Footprint

0 Stress

Advanced Driver-Assistance Systems (ADAS) and Vehicle Automation Technologies

2000 to beyond 2040

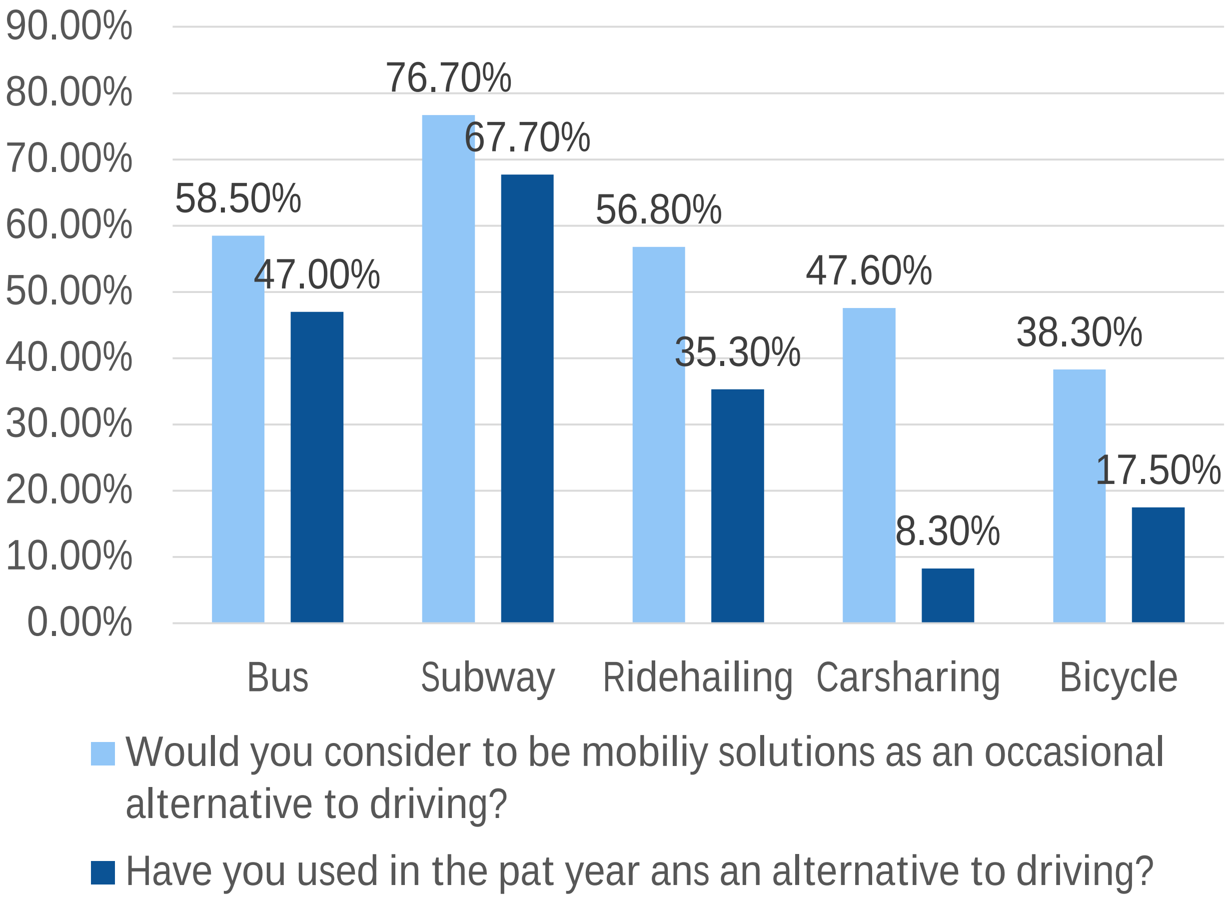
Note: It is currently unclear whether automotive manufacturers will market vehicles with Level 3 capabilities, because of significant human-machine interaction issues. It is too soon to predict whether it will be possible to produce Level 5 vehicles, capable of operating anywhere and in all situations.



Source: CAR Research, Citi GPS, BCG, Oliver Wyman

Target Users of Innovative Mobility Services

- Early adopters: urban dwellers with higher income and education.
- Millennials will account for much of the expansion of innovative mobility services.
- Aging Baby Boomers will seek transportation alternatives to driving.



Alternatives to Driving

Source: Abraham, 2016

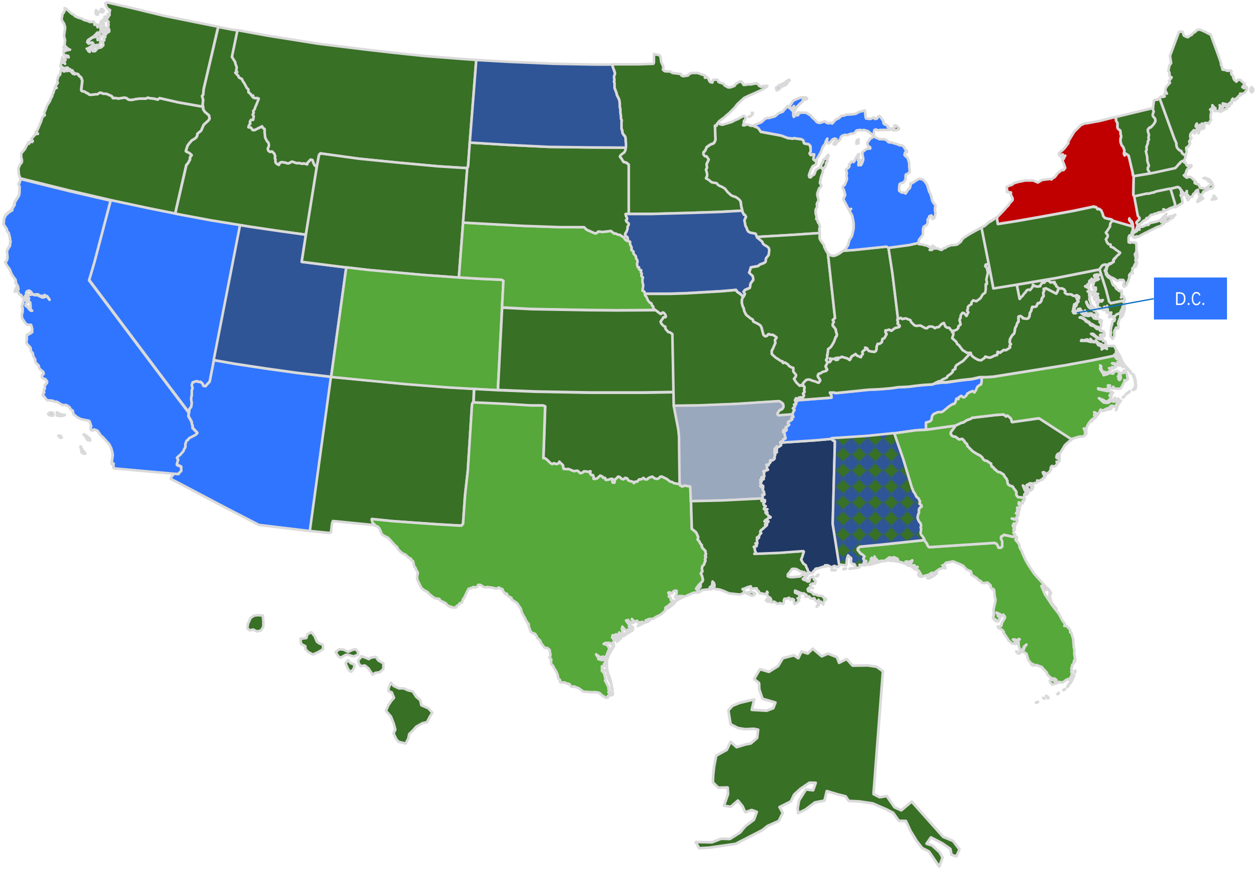
Consumer Attitudes Related to Automated Vehicles

Level of Automation	Age 16-24	25-34	35-44	45-54	55-64	65-74	75+
No Automation	12.4%	8.0%	9.7%	6.1%	5.0%	3.8%	3.1%
Emergency Only	18.3%	11.3%	15.7%	16.0%	14.7%	12.2%	16.7%
Help Driver	26.7%	25.4%	21.1%	41.2%	44.4%	56.0%	52.2%
Partial Automation	16.3%	15.3%	19.0%	13.2%	17.0%	13.9%	15.4%
Full Automation	26.2%	40.0%	34.4%	23.4%	18.9%	14.2%	12.7%

Age Differences in Willingness to Use Automation in Vehicles – Maximum Level of Automation Respondents Would Be Comfortable With
Source: Abraham, 2016

State Regulation of Automated Vehicle *Deployment*

- Not directly addressed
- Explicitly allowed subject to standing law
- State approval/reporting process
- Commercial vehicles explicitly permitted, light vehicles not addressed
- Operation requires "at least one hand … on the steering mechanism at all times."



Source: Eric Paul Dennis, Center for Automotive Research. Last update July 18, 2019. Does not address any pre-consumer vehicle *testing* requirements. Does not include states where only platooning is addressed.

Summary

Thank you