The Electric/Autonomous Car Question

Trade School

December 3rd, 2020

Pete Mento

Mento LLC

The Re-Mix …

- How did this finally happen?
- What will this technology mean for the world?
- And what about logistics?
- What does this mean for the broader global economy?

The First Car

In 1807, *François Isaac de Rivaz* designed the first car powered by an internal combustion engine fueled by hydrogen. In 1886, the first petrol or gasoline-powered automobile, was invented by *Karl Benz*. This is also considered to be the first "production" vehicle, as *Benz* made several other identical copies.

François Isaac de Rivaz's Hydrogen Powered Car

Karl Benz's Gas Powered Car (background)

DISPENSE WITH A HORSE

Price $1,000. *No Agents.*

and save the expense, care and anxiety of keeping it. To run a motor carriage costs about ½ cent a mile.

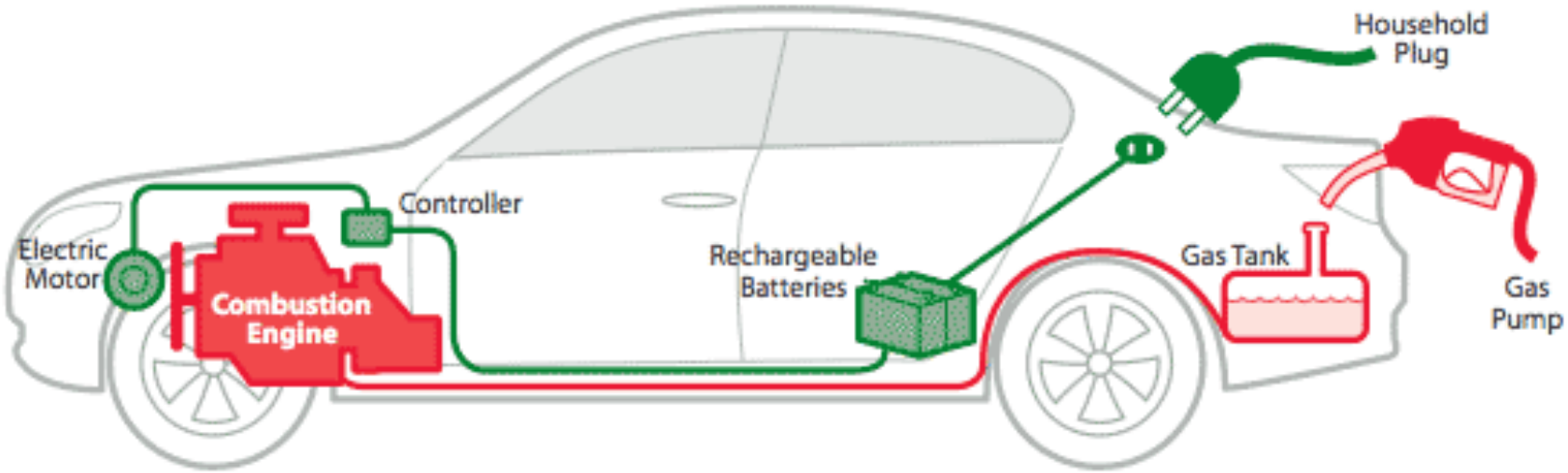
THE WINTON MOTOR CARRIAGE

is the best vehicle of its kind that is made. It is handsomely, strongly and yet lightly constructed and elegantly finished. Easily managed. Speed from 3 to 20 miles an hour. The hydrocarbon motor is simple and powerful. No odor, no vibration. Suspension Wire Wheels. Pneumatic Tires. Ball Bearings. ☞ *Send for Catalogue.*

THE WINTON MOTOR CARRIAGE CO., Cleveland, Ohio.

Electric vs. Gasoline

Electric	Gasoline
No Tailpipe Emissions	Greenhouse Gases/Pollution
Utility Company	OPEC
100+/- Mile Range	300+ Mile Range
Hours to Recharge	Minutes to Refuel
2 cents per mile	12 cents+ per mile



MOBILITY FUTUREVISION

ARTWORK BY SMART

55 MINUTES THINKING ABOUT THE PROBLEM
5 MINUTES THINKING ABOUT SOLUTIONS

WE NEED TO EDUCATE CUSTOMERS
THIS WILL BE THE SAFEST WAY TO DRIVE
BUT WON'T WE MISS THE THRILL OF DRIVING ?
IS SHARED MOBILITY THE FUTURE?
WE DON'T HAVE ALL THE ANSWERS YET

YES, IT'S MESSY, BUT WE ARE NOT IN THE MIDDLE
WE WILL MAKE MANY MISTAKES
THE MESSY MIDDLE

CONTROL
SPACE
TIME
AUTONOMOUS
CONNECTED
ELECTRIC
SHARED
THERE IS NO LIMIT TO THE POSSIBILITIES

NEW BUSINESS MODELS
THE ROAD TO AUTONOMY
WE MUST ELIMINATE THE FEARIN OUR CUSTOMERS. THERE MAY BE ACCIDENTS, BUT IT IS A SAFER WAY TO TRAVEL

PEOPLE ARE MORE CONCERNED WITH THE CONNECTIVITY OF THEIR CAR THAN THEY ARE ABOUT THE MILEAGE

WE SEE IT MORE AS A LIFT RATHER THAN A CAR WITHOUT A DRIVER

CUSTOMER CENTRICITY
WILL OUR CUSTOMERS ACCEPT CHANGE?

SAFETY
AUTONOMY IS THE NEW SEAT BELT

INFRASTRUCTURE

COST
COST OF RIDE VS COST OF OWNERSHIP

REGULATIONS
CREATE AN ICE VEHICLE BAN TO DRIVE OLDER CARS OUT OF THE CITYCENTRE
WOULD YOU DRIVE A DRIVERLESS CAR? YES NO

ENVIRONMENT
CONSUMER INSIGHT IS KEY: ELECTRIC CARS ARE BETTER FOR THE ENVIRONMENT AND THEY IMPROVE LOCAL AIR QUALITY

IMPROVEMENTS
WE NEED MORE CROSS-INDUSTRY COLLABORATION
A LACK OF UNDERSTANDING OF PHYSICAL INFRASTRUCTURE
A LACK OF UNDERSTANDING OF THE REQUIREMENTS FOR NEXT GENERATION FUELLING
WE NEED A CLEARER DIRECTION AT A MACRO LEVEL
A LACK OF CLEAR STANDARD OF TECH SPECIFICATION OF AUTONOMY
A LACK OF POLICY, COMPLIANCE AND GOVERNANCE

COMMERCIAL FLEETS
DRIVERS MINDSET ISSUE
SUPPLY CHAIN
INFRASTRUCTURE
HOSPITALITY
INSURANCE
PROFITABILITY
TRAINING

CHARGING
I WANT TO GET MY NAILS DONE, SHOP, GO TO GYM WHILST I CHARGE, NOT JUST SIT AND WAIT
I SHARE!
I OWN MINE. I LOVE DRIVING, IT GIVES ME THE SENSE OF INDEPENDENCY
AND WHAT WILL YOU DO WHEN YOU HAVE KIDS?
ARE CHARGING POINTS REALLY THE FUTURE?

EDUCATION & EXPERIENCE
WE SHOULD ALLOW CUSTOMERS TO TEST DRIVE ELECTRIC VEHICLES FOR A WEEK TO CHANGE THEIR PERCEPTION OF THE COST AND EASE OF CHARGING

SHARED MOBILITY
- SAVES MONEY
- SAVES ENERGY
- SAVES SAPCE
- EASILY ACCESSIBLE VIA PHONE APP
- SAVES THE ENVIROMENT

RENT FOR 2 HOURS £ £ £
PICK UP HERE

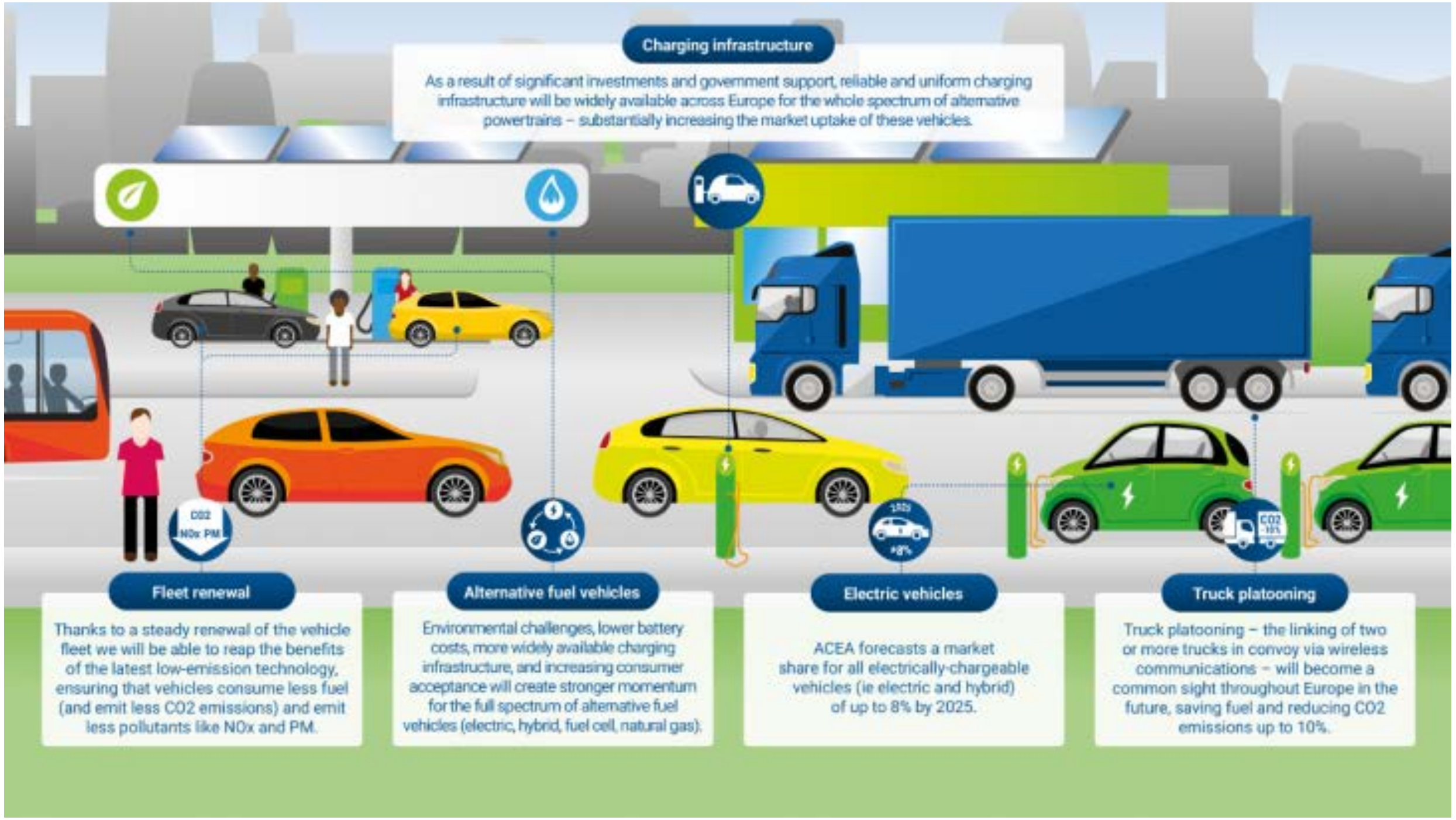
SOMEONE STILL NEEDS TO SERVICE IT!

HOW TO MANAGE ALL CUSTOMER SEGMENTS?

PRIVATE CUSTOMER
WE NEED TO BUILD MORE CHARGING POINTS AND IMPROVE THE TIME IT TAKES TO CHARGE AN ELECTRIC VEHICLE

CHALLENGES AND OPPORTUNITIES EXTEND BEYOND AUTOMOTIVE INDUSTRY

EDF ENERGY · bluelab · Shell · CISCO · IDEALondon · UCL · NovAzure



Charging infrastructure

As a result of significant investments and government support, reliable and uniform charging infrastructure will be widely available across Europe for the whole spectrum of alternative powertrains – substantially increasing the market uptake of these vehicles.

Fleet renewal

Thanks to a steady renewal of the vehicle fleet we will be able to reap the benefits of the latest low-emission technology, ensuring that vehicles consume less fuel (and emit less CO2 emissions) and emit less pollutants like NOx and PM.

Alternative fuel vehicles

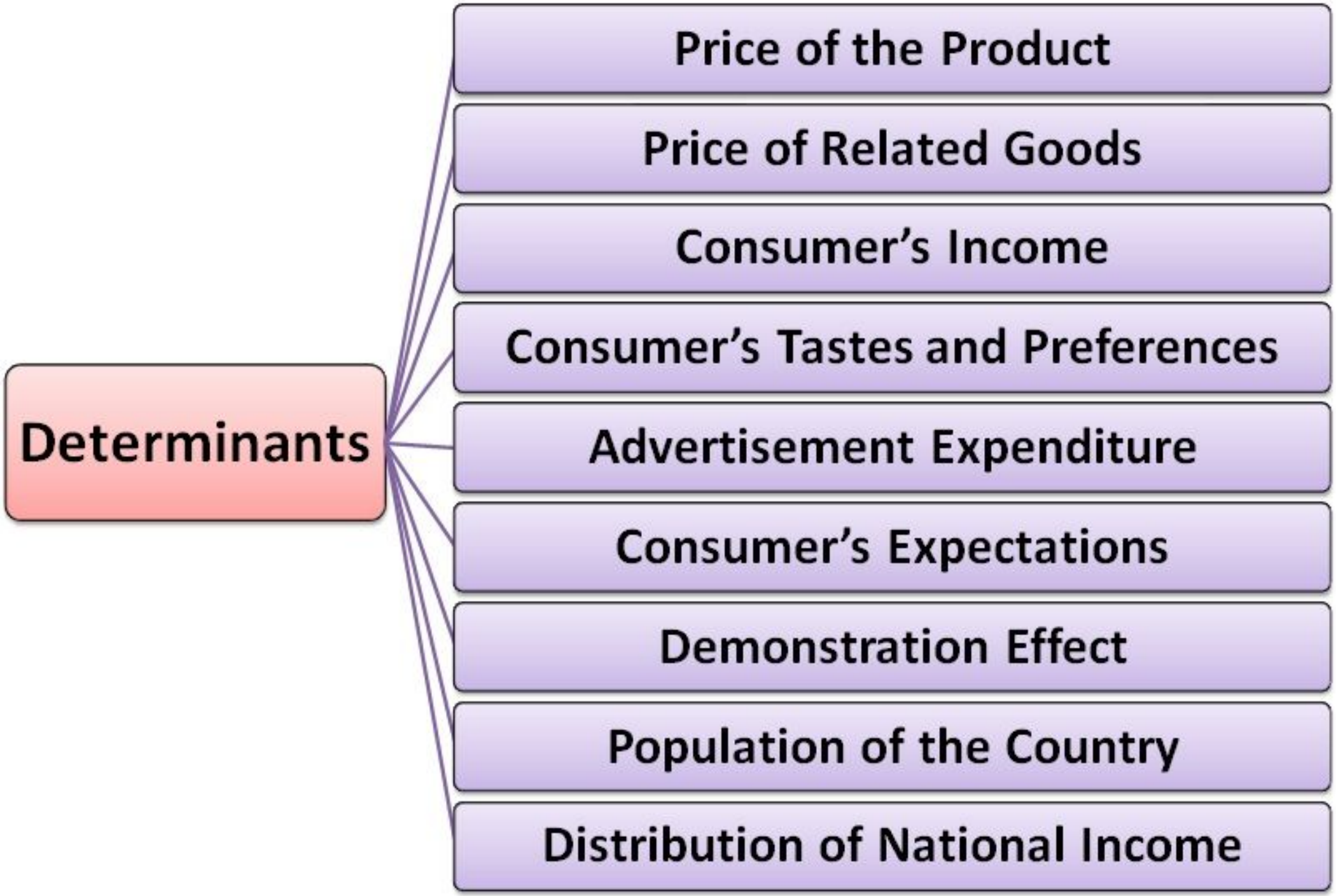
Environmental challenges, lower battery costs, more widely available charging infrastructure, and increasing consumer acceptance will create stronger momentum for the full spectrum of alternative fuel vehicles (electric, hybrid, fuel cell, natural gas).

Electric vehicles

ACEA forecasts a market share for all electrically-chargeable vehicles (ie electric and hybrid) of up to 8% by 2025.

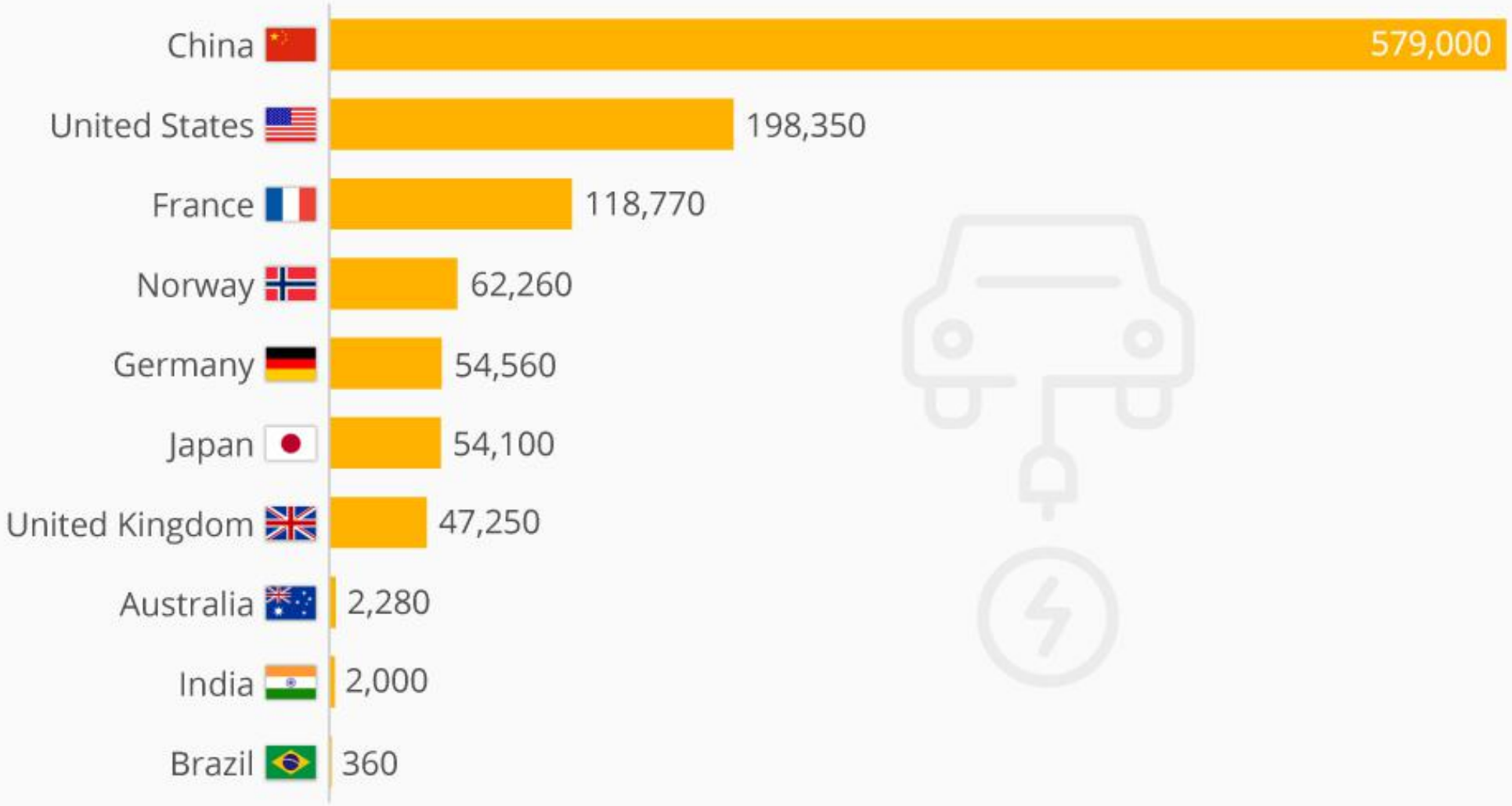
Truck platooning

Truck platooning – the linking of two or more trucks in convoy via wireless communications – will become a common sight throughout Europe in the future, saving fuel and reducing CO2 emissions up to 10%.


Determinants
Price of the Product
Price of Related Goods
Consumer's Income
Consumer's Tastes and Preferences
Advertisement Expenditure
Consumer's Expectations
Demonstration Effect
Population of the Country
Distribution of National Income

Electric Car Sales Are Surging In China

Electric vehicle sales (BEV and PHEV) by county in 2017*



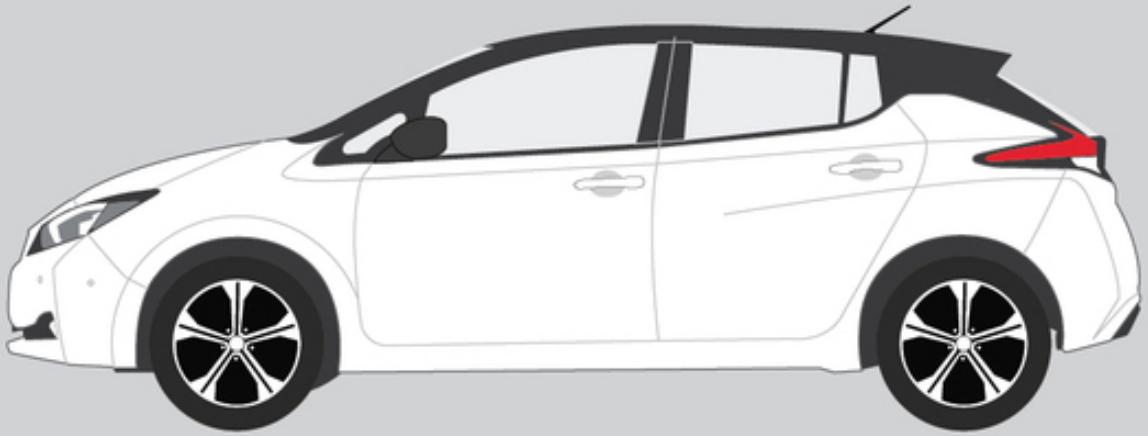
* Selected countries. BEV – Battery electric. PHEV – plug-in hybrid.

Source: International Energy Agency

ONE IN THREE PEOPLE IN SOUTH EAST ASIA ARE OPEN TO ELECTRIC VEHICLE AS NEXT CAR

NISSAN FUTURES

of respondents are open to purchasing an EV as their next car, with respondents in the Philippines, Thailand, and Indonesia the most eager

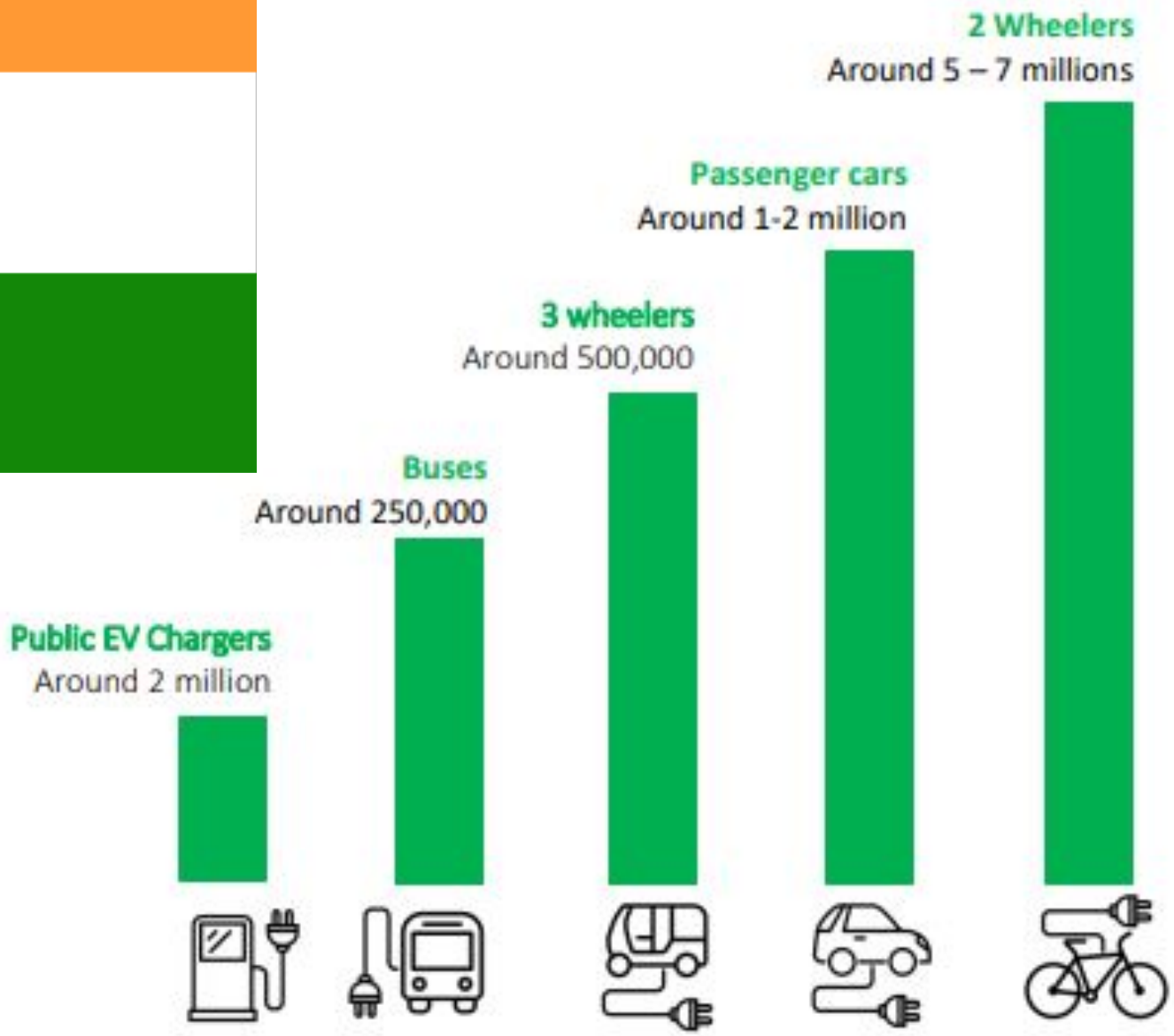


Top 3 barriers to overcome for EV purchase in selected South East Asian countries

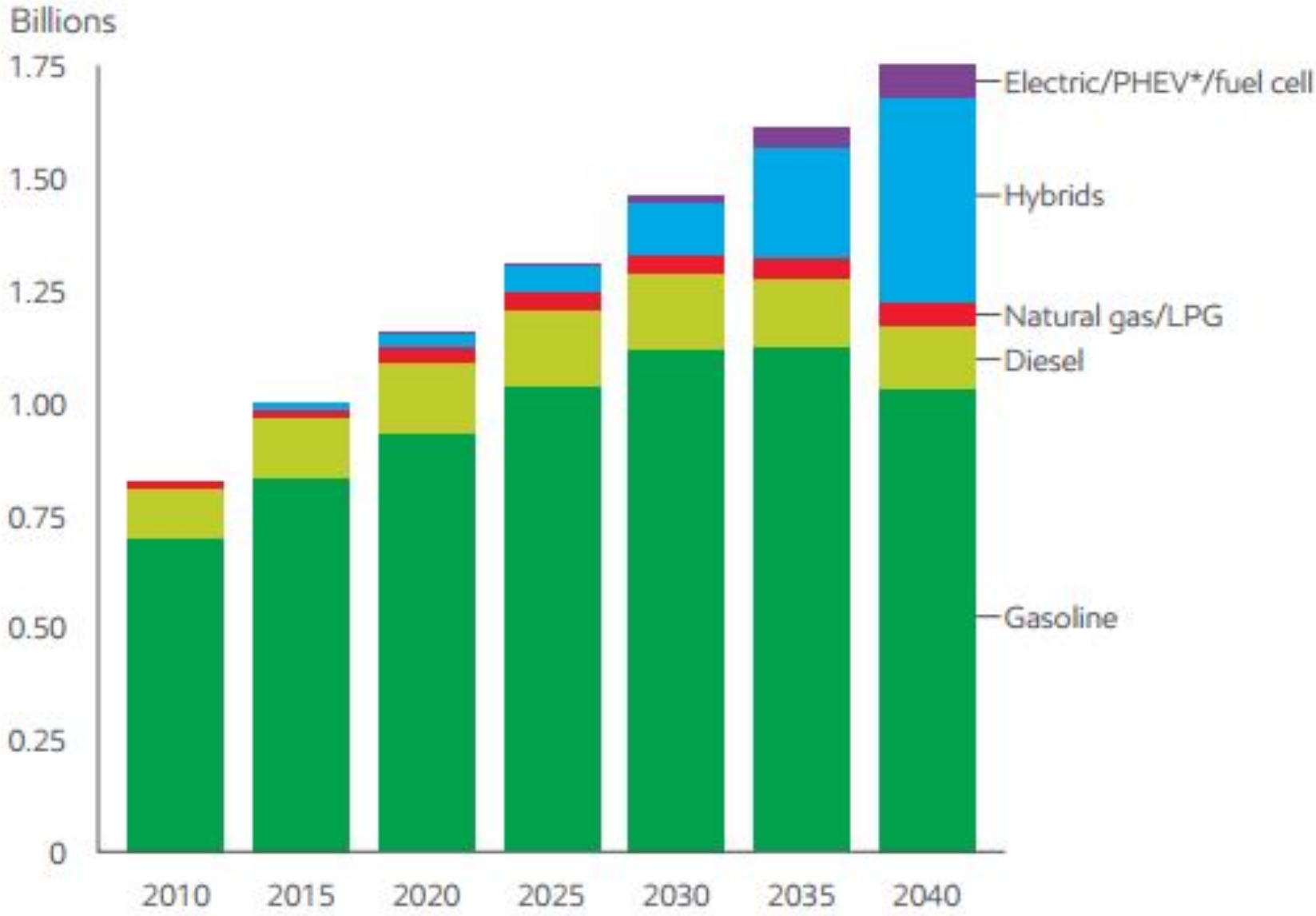
NISSAN INTELLIGENT MOBILITY

Nissan-commissioned study "Future of Electric Vehicles in South East Asia", conducted by Frost & Sullivan in Jan 2018

FROST & SULLIVAN

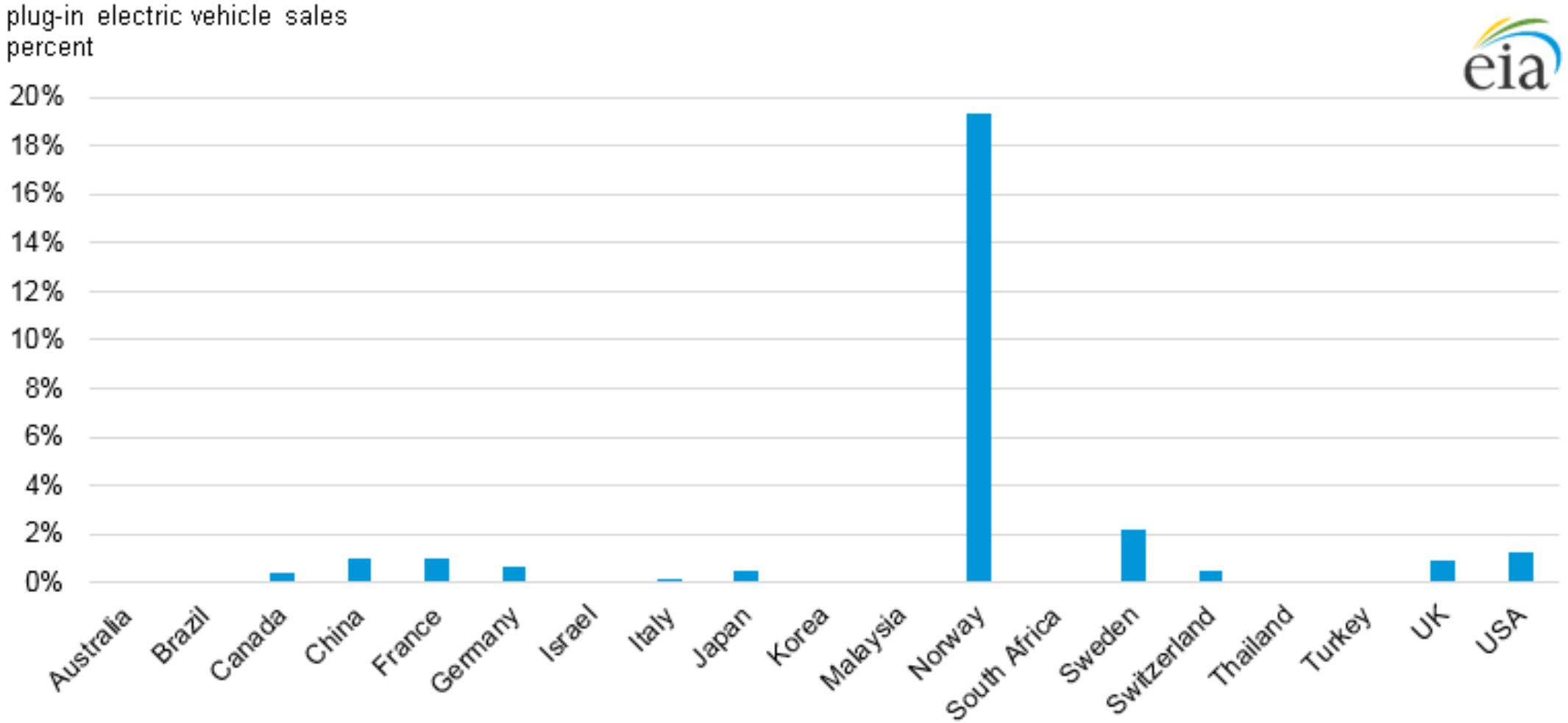

2 Wheelers
Around 5 – 7 millions
Passenger cars
Around 1-2 million
3 wheelers
Around 500,000
Buses
Around 250,000
Public EV Chargers
Around 2 million

Light-duty vehicle fleet by type



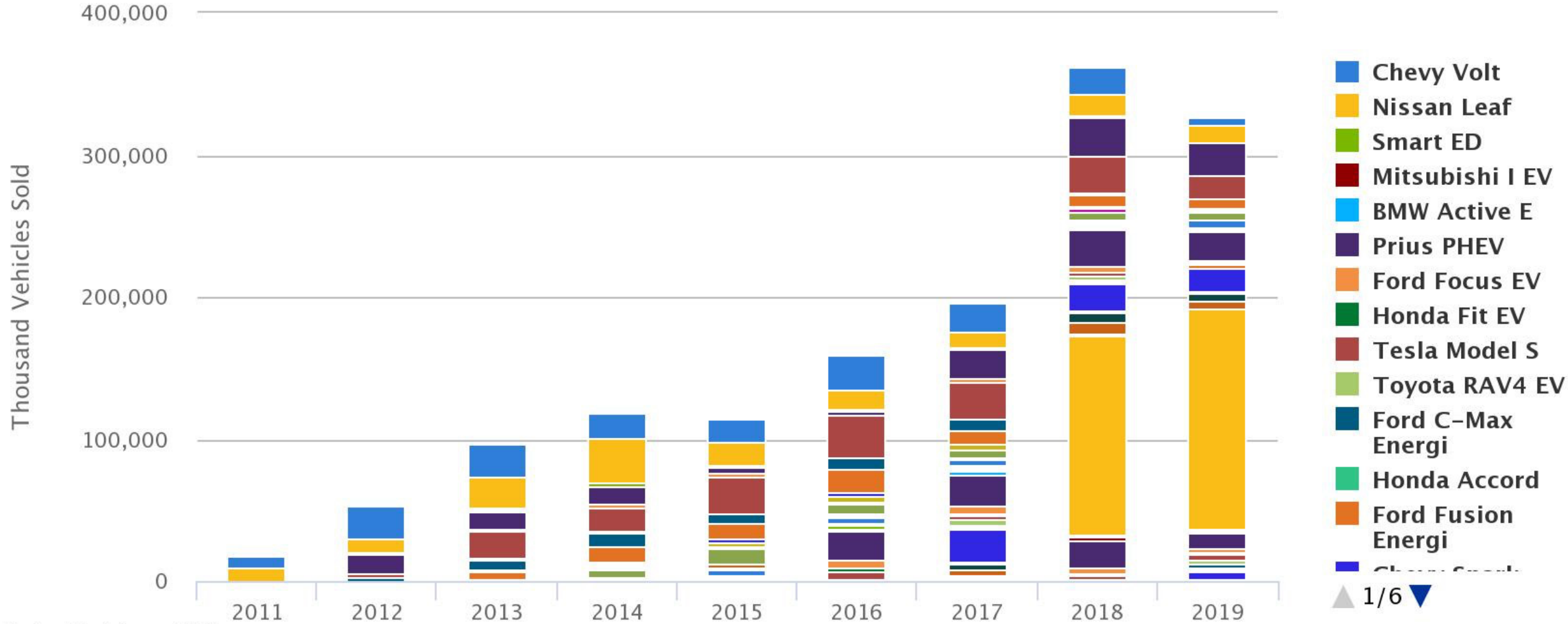
*Plug-in hybrid electric vehicles

Figure IF1-1. Plug-in electric vehicle sales as a percent of total vehicles sales in 2015 for select countries



Source: International data from the International Energy Agency, U.S. data from AEO2017 Reference case

U.S. Plug-in Electric Vehicle Sales by Model



Last updated: January 2020

Charting a New Journey

Drive started with the **Niti Aayog policy on EVs**, defining a 15-year roadmap to attain complete electrification

Ola, Uber, and Zoom began tapping into the **EV portfolio** of Mahindra

BS Protocol for Charging was formed to build the framework for future **charging stations**

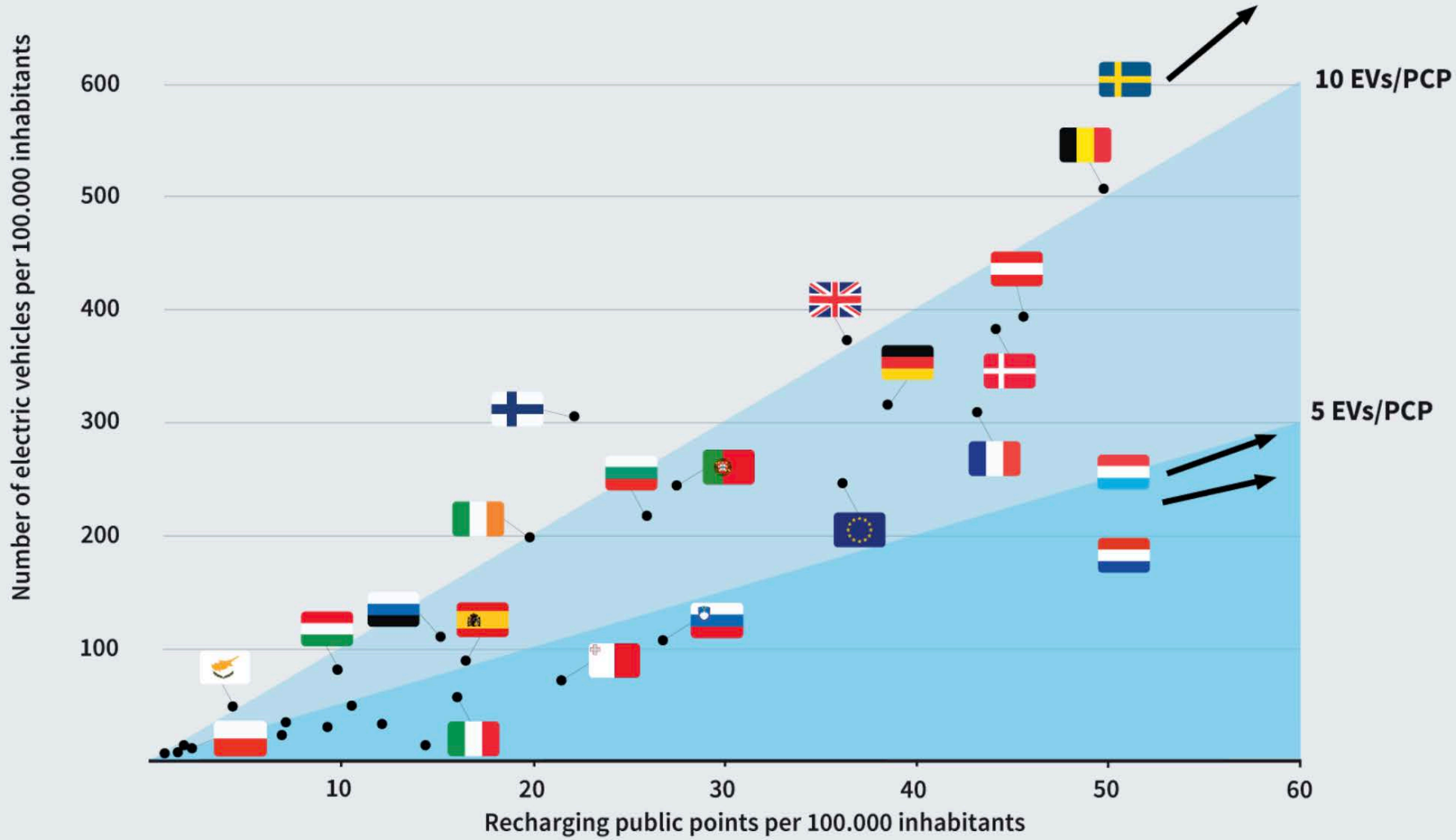
M&M-Ford, Renault-Nissan, Honda Motor, Mercedes Benz, BMW, Volvo and JLR have EVs planned for India

Penetration of EVs globally is less than 1%

India has issues related to charging infrastructure, range anxiety and actual vehicle cost

Siam has proposed incentives, including tax reduction on electric vehicles to 5% from 12%

Current number of public chargers and EVs across Europe



PCP : public charging points

Off the charts: Sweden: 79 PCP/100,000 inhabitants and 1043 EVs/100,000 inhab.
Netherlands: 296 PCP/100,000inhab and 996 EVs/100,000 inhab.
Luxembourg: 153 PCP/100,000 inhabitants and 755 EVs/100,000 inhab.

Source: T&E analysis of Plugsurfing, OpenChargemap and EAFO

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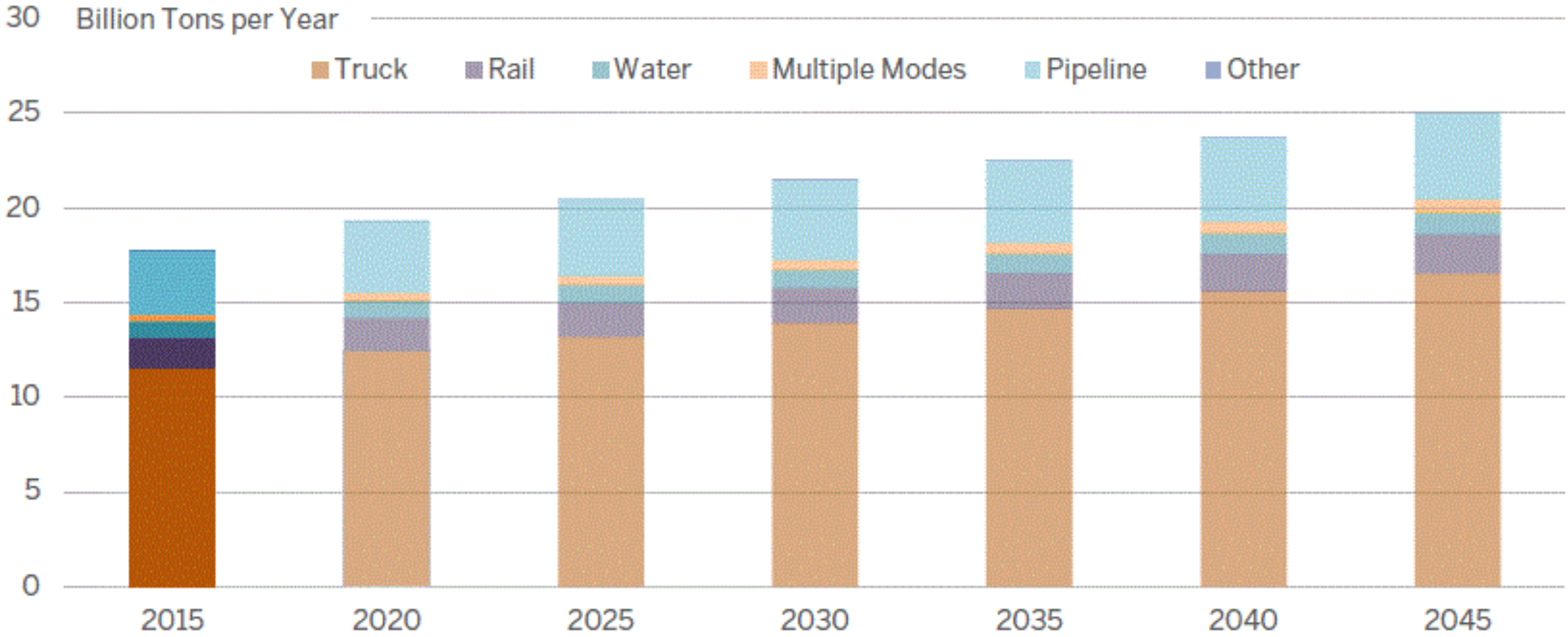
transportenvironment.org

FIGURE 1 · U.S. Freight Forecast, 2015 - 2045

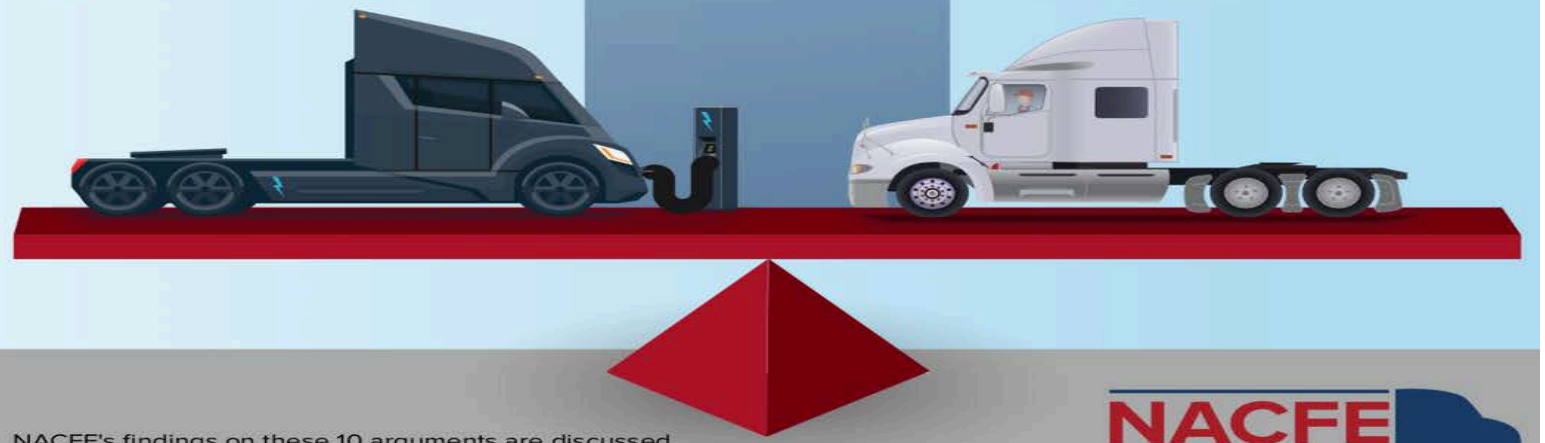


Note: Chart excludes 'Air' data series.

Source: Federal Highway Administration

10 ARGUMENTS
FOR AND AGAINST ELECTRIC VEHICLES

Argument **FOR** Electric Trucks	VS.	Argument **AGAINST** Electric Trucks
1 Commercial battery electric vehicle (CBEV) weight is not an issue	**WEIGHT**	1 Vehicle tare weight is too high to support my freight needs
2 CBEV technology is proven and here now	**TECHNOLOGY**	2 Technology is not ready
3 Maintenance will be less costly		3 Maintenance may not be less costly
4 CBEVs will last beyond 10 years		4 Vehicle life is too short
5 CBEVs will be competitively priced	**COST**	5 Vehicle purchase price is too high for a positive ROI
6 CBEVs will be less expensive to operate		6 Vehicle operating costs are too great for positive ROI
7 CBEVs will command a premium at resale		7 Vehicle residual value is questionable
8 Trust the market to provide CBEV charging solutions	**CHARGING**	8 Charging infrastructure is not ready
9 Trust the market to provide CBEV charging solutions		9 Charging Infrastructure is not fast enough
10 The grid and market will evolve with CBEVs		10 The electric grid cannot support growth in electric vehicles



NACFE's findings on these 10 arguments are discussed in detail in its Electric Truck Guidance Report

NACFE
NORTH AMERICAN COUNCIL FOR FREIGHT EFFICIENCY

436.5 million

metric tons of CO_2 emissions in 2017

212 million

metric tons of CO_2 emissions are from full-truckload freight

Full-Truckload

Less-than-Truckload

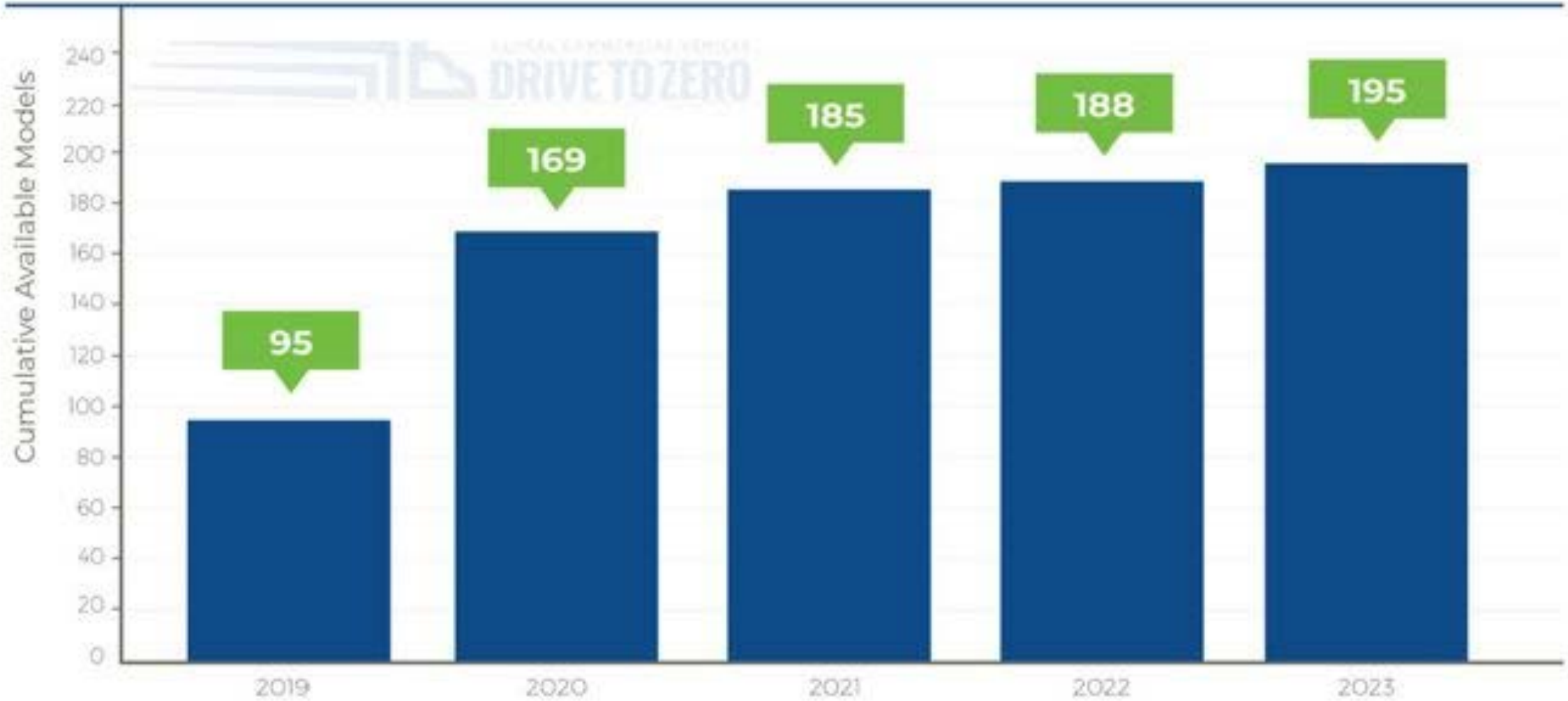
Other

CONVOY

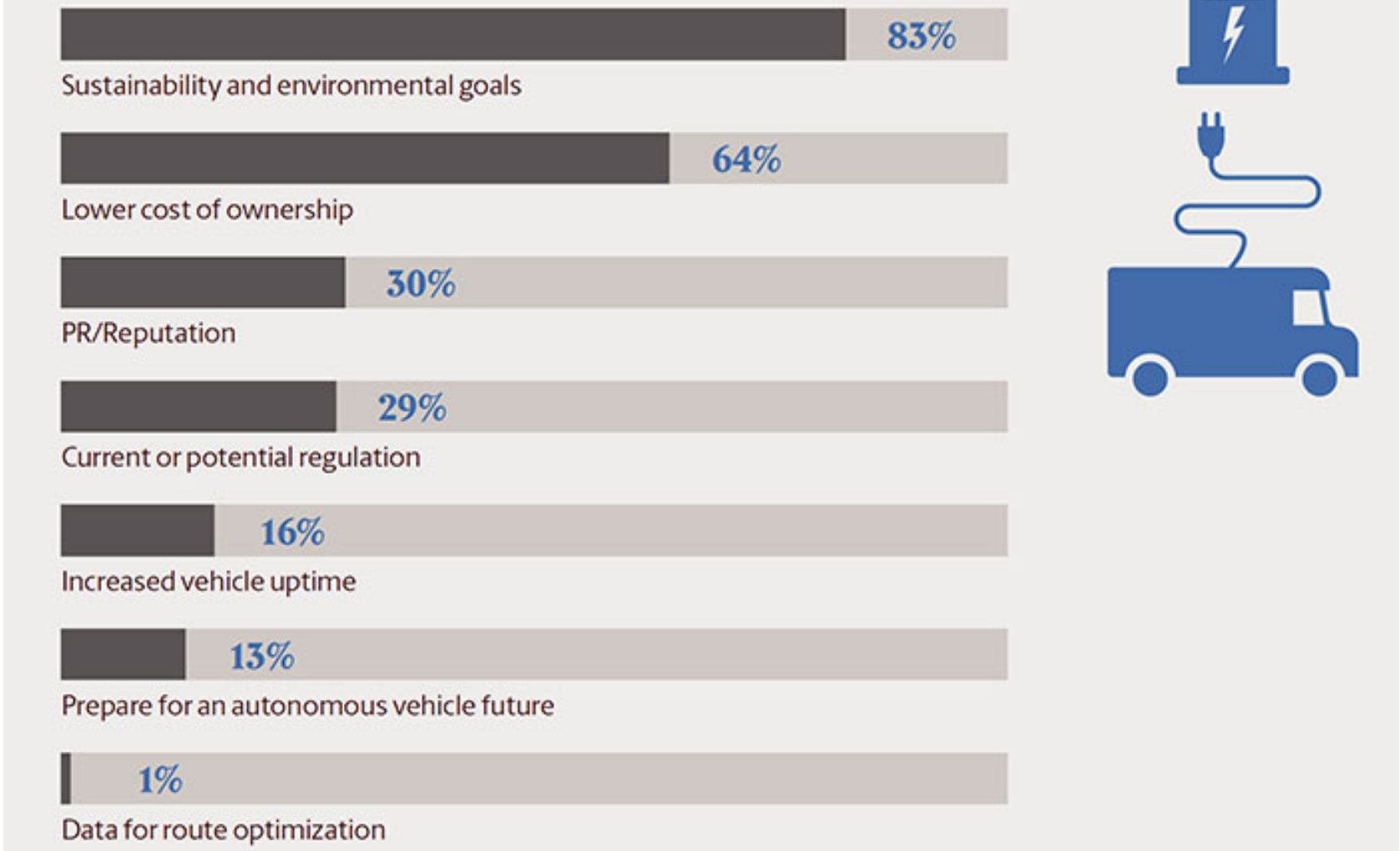
Source: Convoy analysis of data from the U.S. Environmental Protection Agency and U.S. Census Bureau's 2002 Vehicle Inventory and Use Survey.

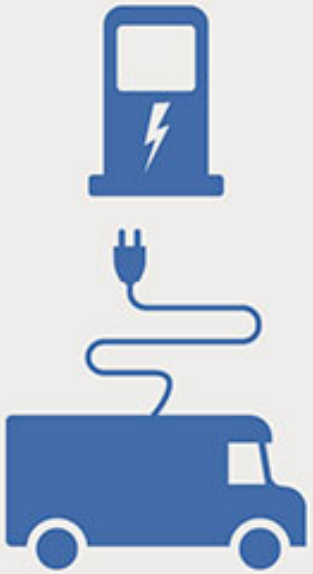
Model availability to double by 2023

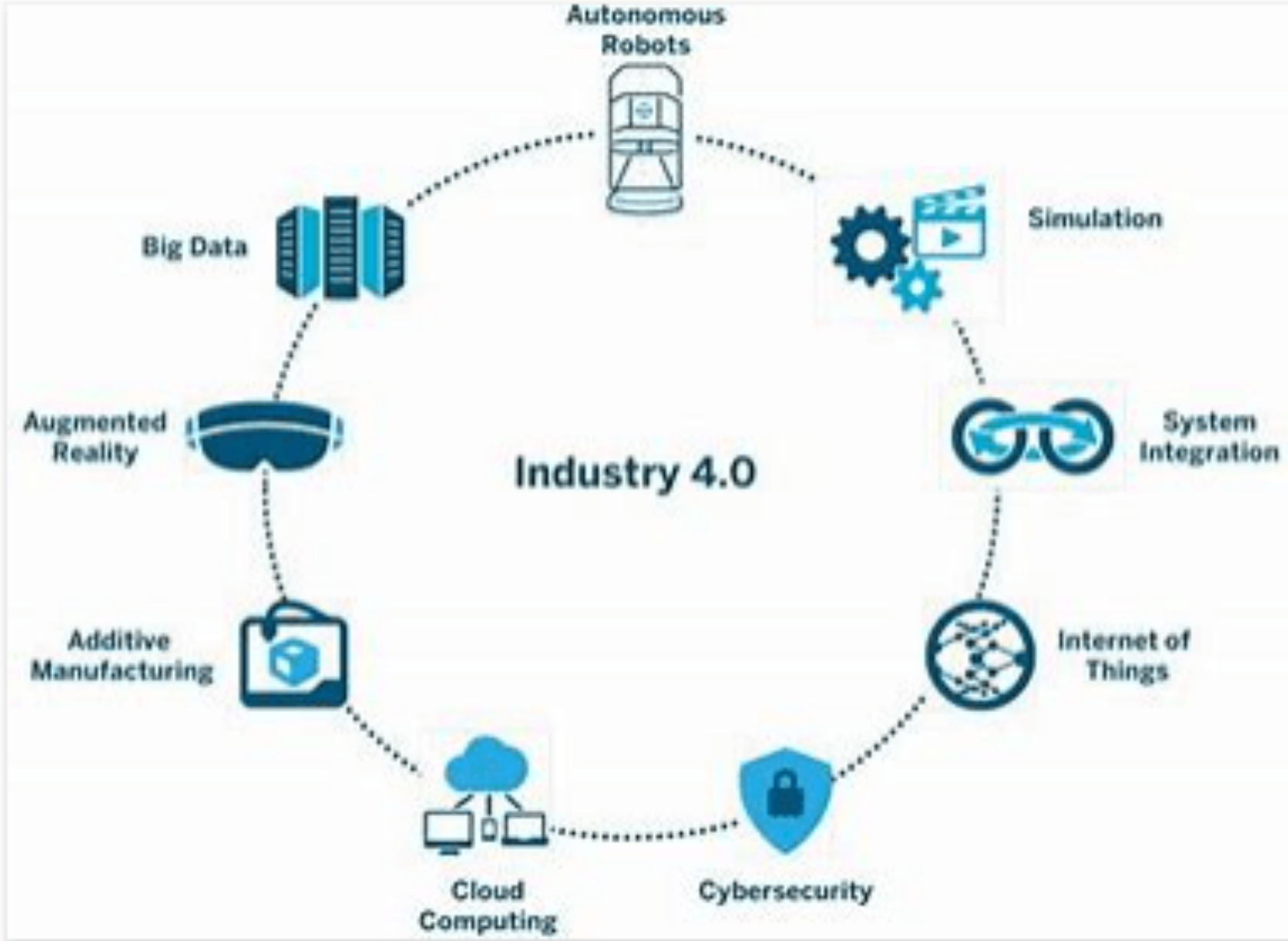
Total cumulative vehicle models, U.S. & Canada



MOTIVATORS FOR FLEET ELECTRIFICATION



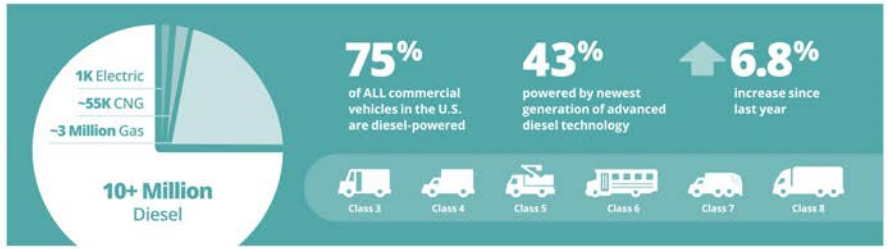


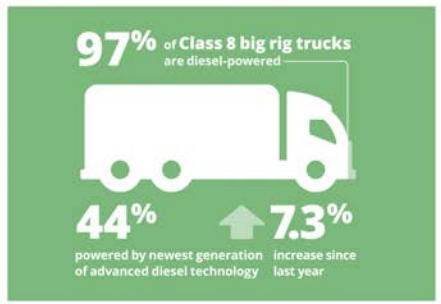

Autonomous Robots
Simulation
System Integration
Internet of Things
Cybersecurity
Cloud Computing
Additive Manufacturing
Augmented Reality
Big Data
Industry 4.0

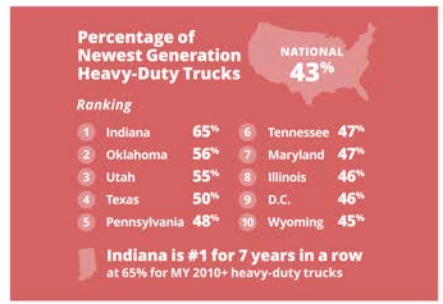
DIESEL DELIVERS

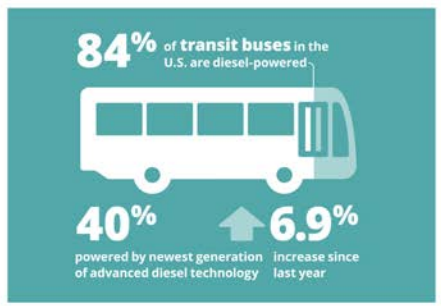
the Goods and the People

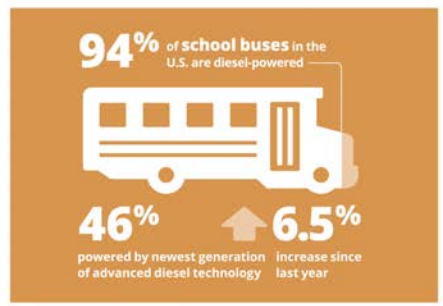
DIESEL TECHNOLOGY FORUM

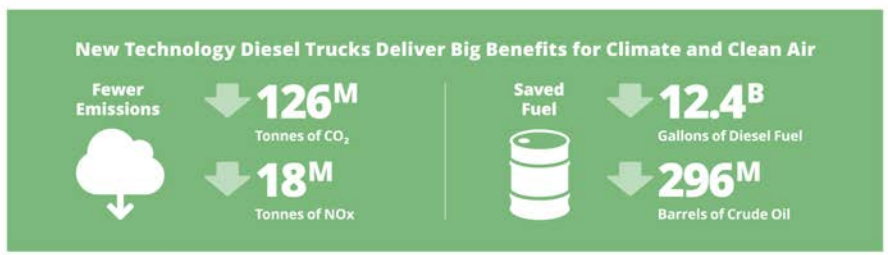








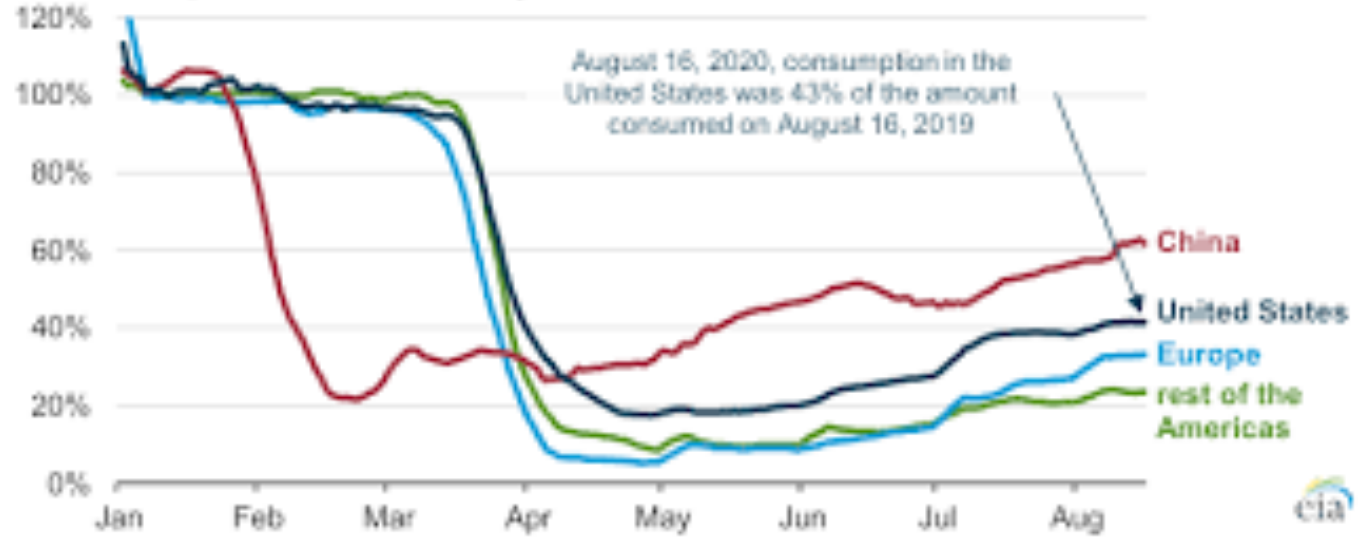




Source – July 2019 U.S. Vehicles in Operation Data (Class 3-8 vehicles, Model Year 2010 and newer) provided by IHS Markit

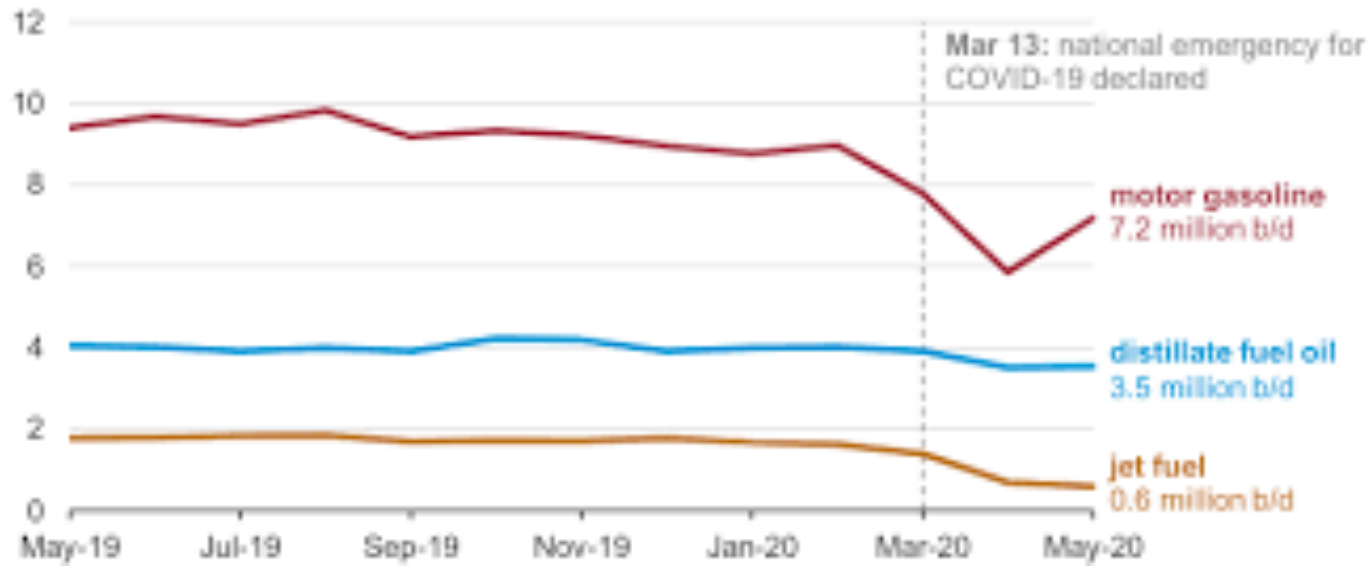
Ratio of 2020 jet fuel consumption by commercial passenger jets to 2019 consumption, seven-day moving average (January 1, 2020–August 16, 2020)

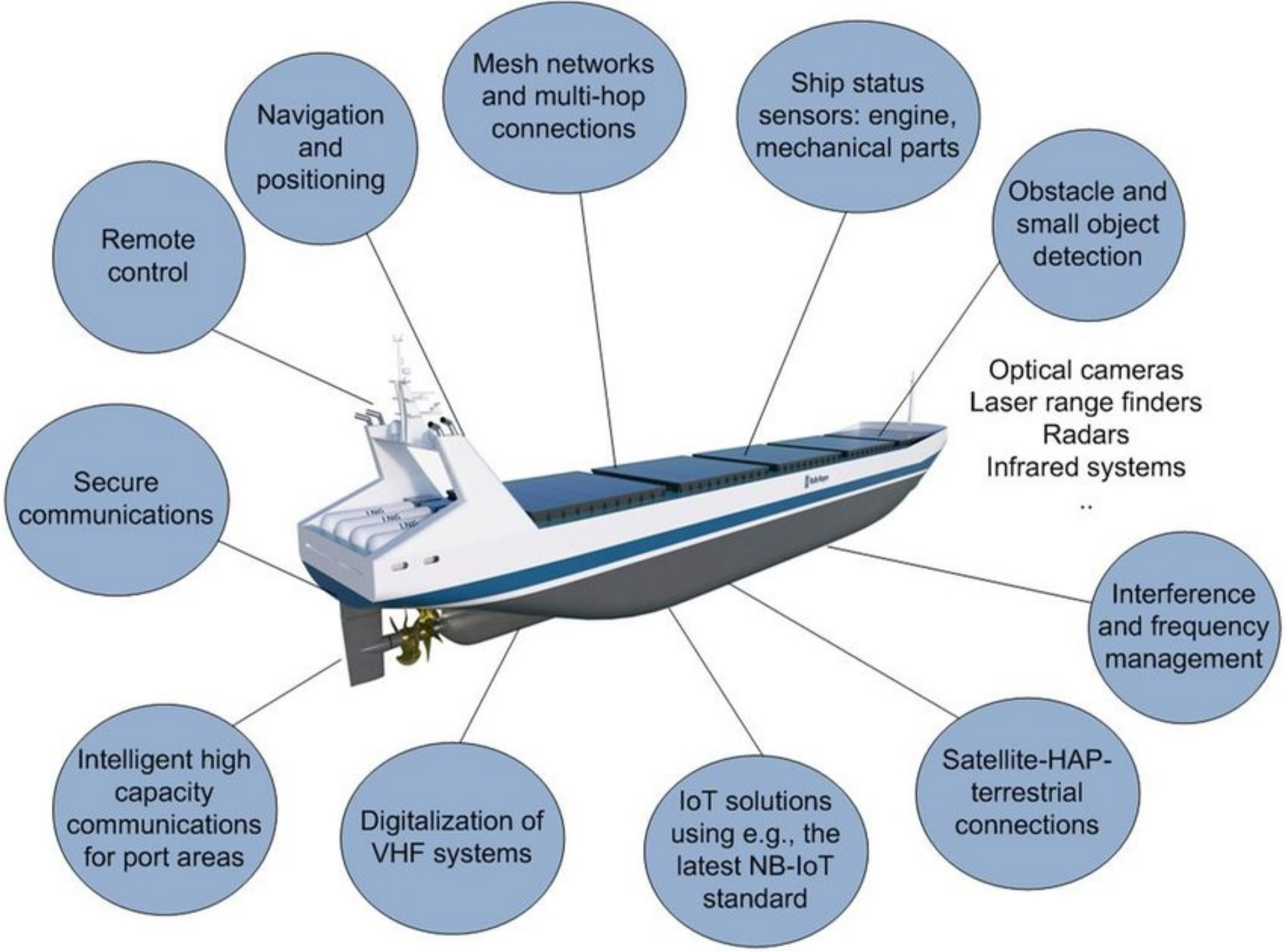
2020 consumption relative to same day in 2019



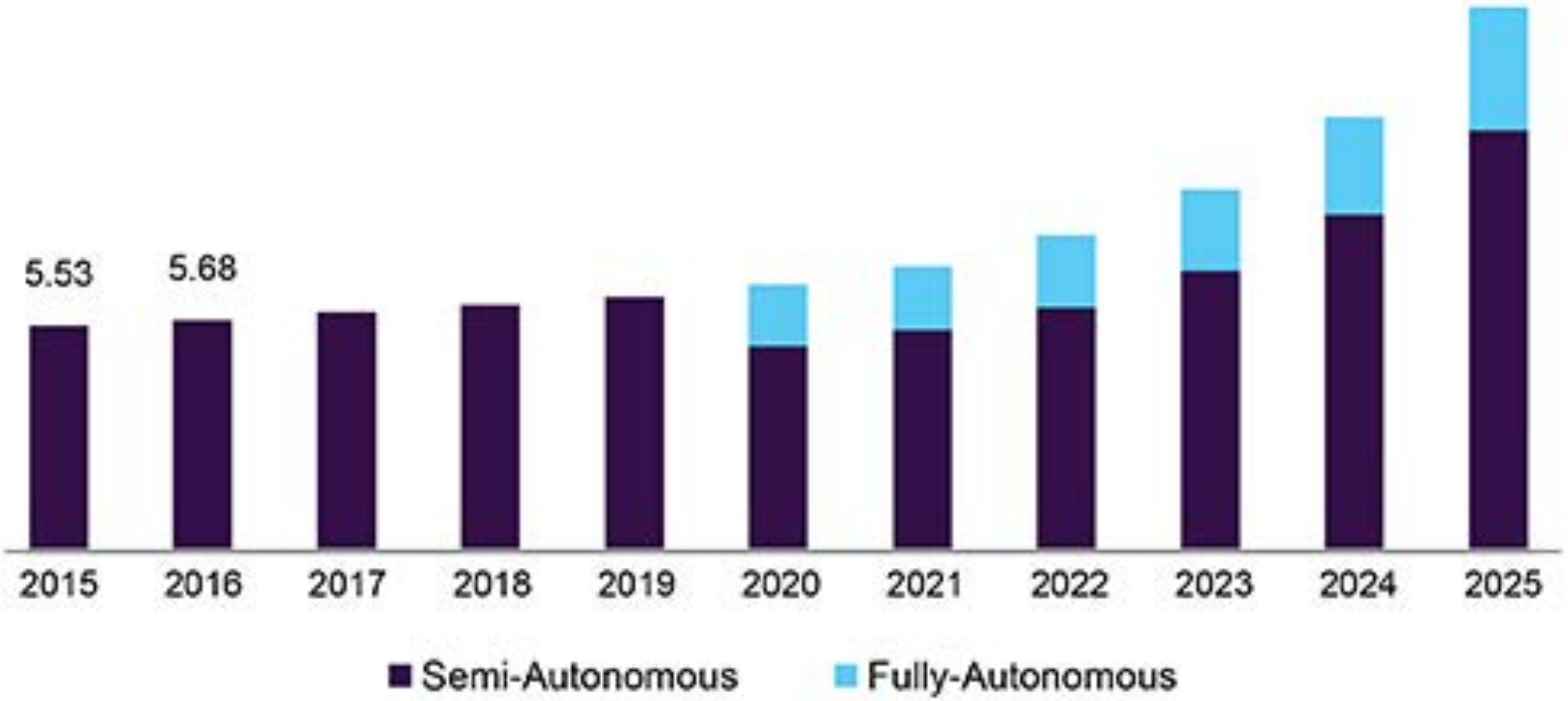
U.S. product supplied of gasoline, distillate, and jet fuel (May 2019–May 2020)

million barrels per day (b/d)



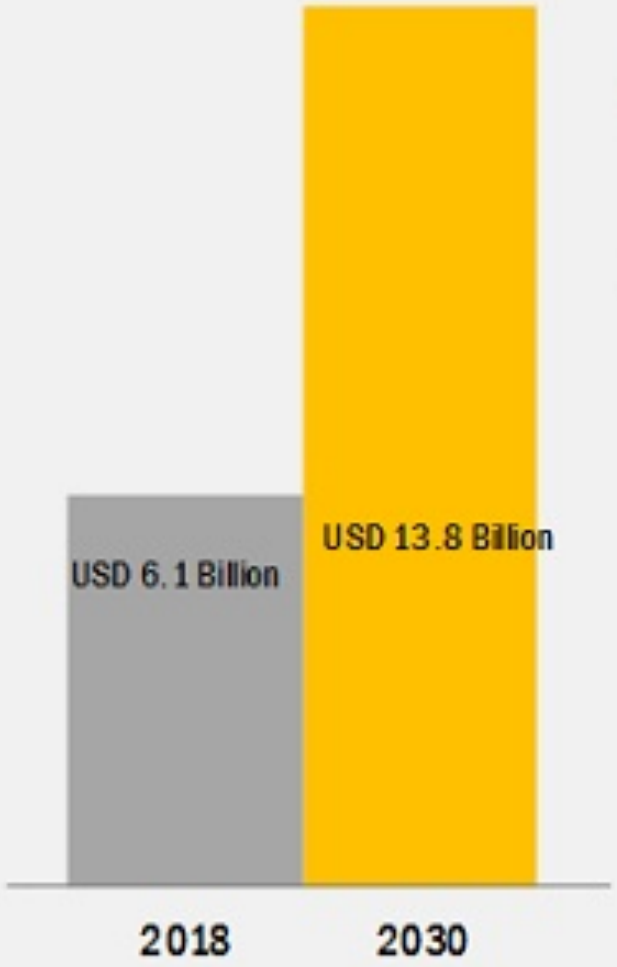

Mesh networks and multi-hop connections
Navigation and positioning
Ship status sensors: engine, mechanical parts
Remote control
Obstacle and small object detection
Optical cameras
Laser range finders
Radars
Infrared systems
..
Secure communications
Interference and frequency management
Intelligent high capacity communications for port areas
Digitalization of VHF systems
IoT solutions using e.g., the latest NB-IoT standard
Satellite-HAP-terrestrial connections

Global autonomous ships market size, by autonomy level, 2015 - 2025 (USD Billion)



Source: www.grandviewresearch.com

Market overview:



CAGR

7.00%

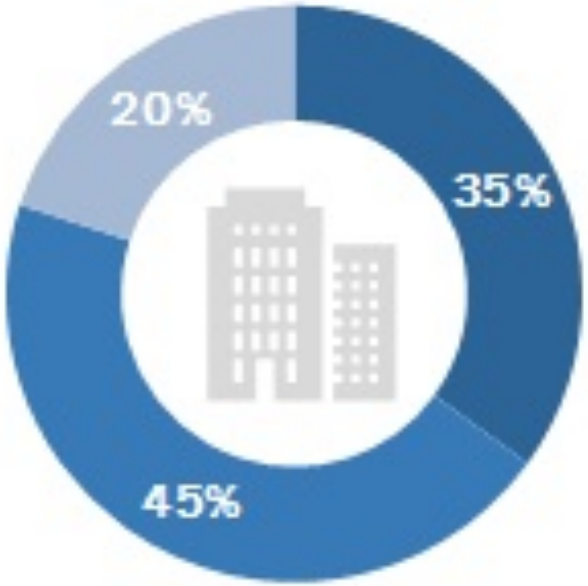
- The autonomous ships market is projected to grow from USD 6.1 billion in 2018 to USD 13.8 billion by 2030, at a CAGR of 7.00% from 2018 to 2030.
- Increasing global sea trade, improving marine navigational safety, and growing maritime tourism are major factors expected to drive the market for autonomous ships.
- The European autonomous ships market is expected to witness the highest rate during the forecast period, owing to the increasing investments various companies such as Rolls-Royce, Kongsberg, and Wartsila to develop fully autonomous ships in Scandinavian countries suchas Norway.

e-estimated, p-projected

REMOTE-CONTROLLED / AUTONOMOUS SHIPPING

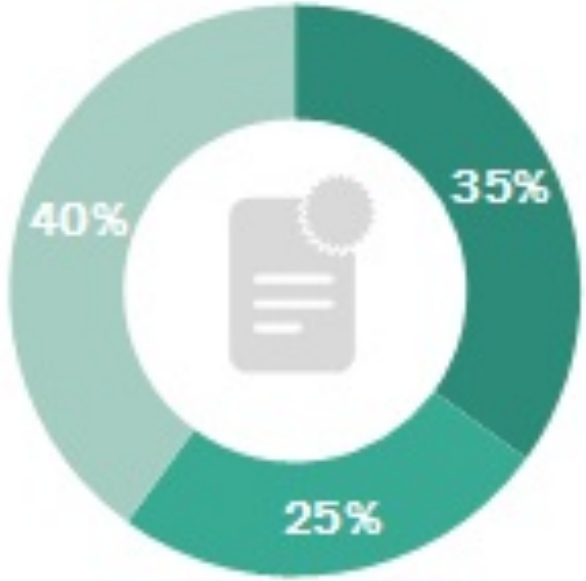
THREAT, RISK, HAZARD AND VULNERABILITY SOURCES

By Company



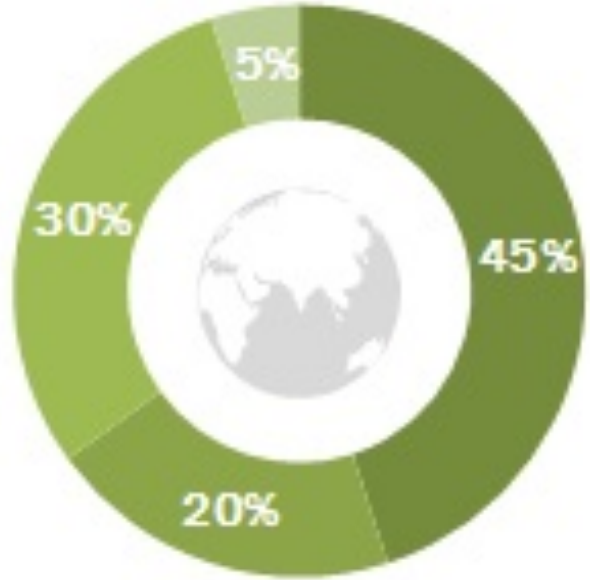
Tier 1 Tier 2 Tier 3

By Designation



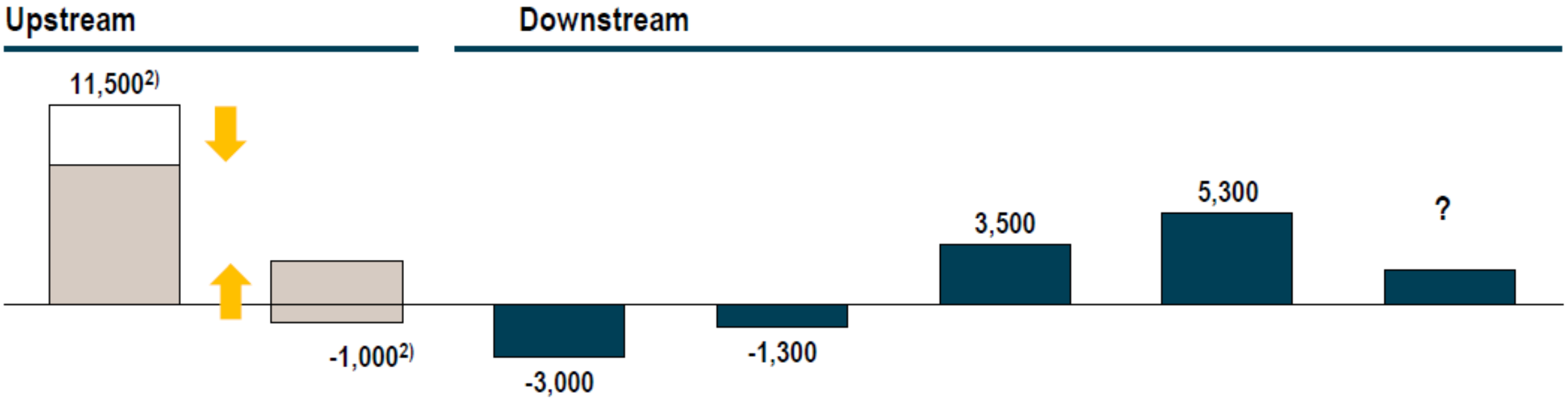
C-Level Executives Directors Others

By Region



North America Europe Asia Pacific RoW

Changes in lifecycle revenue pools per vehicle EV vs. ICE [EUR], 2015[1)]



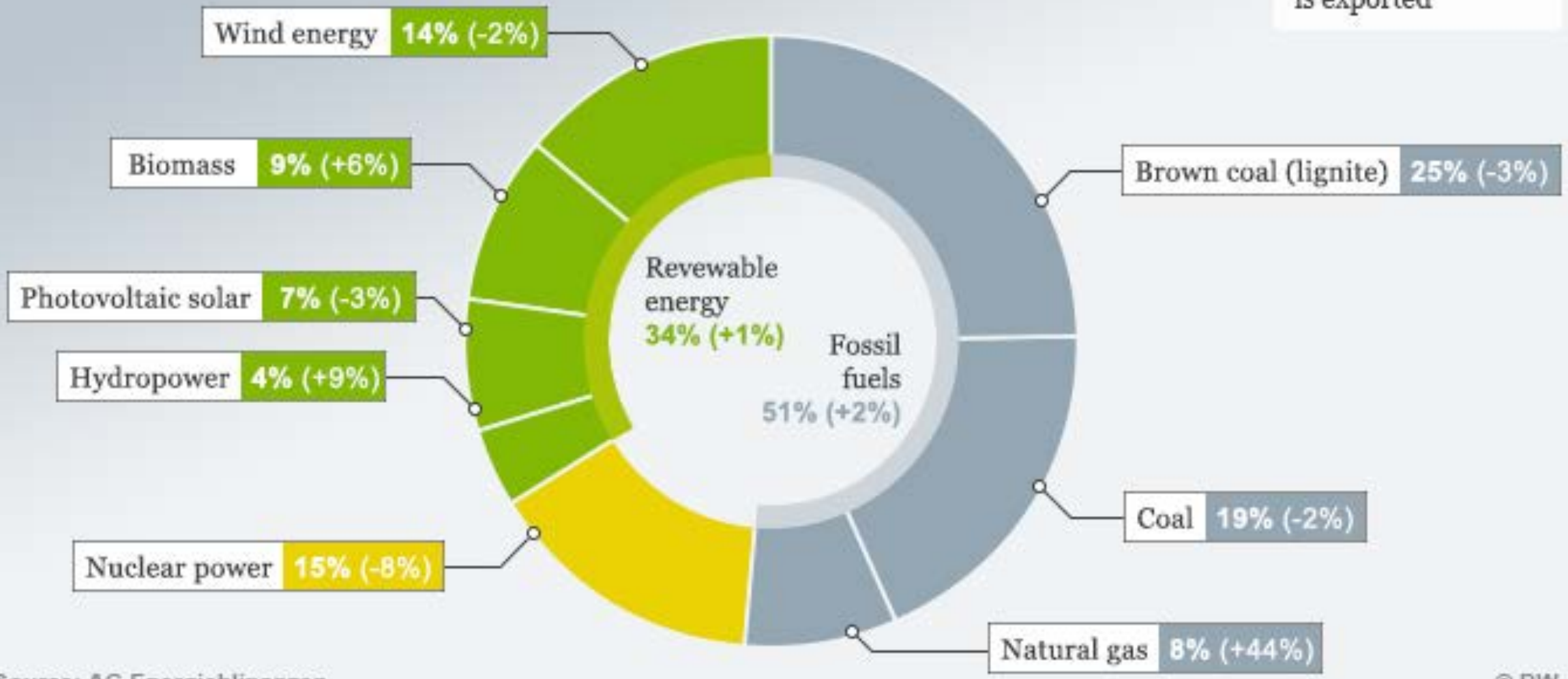
- **OEMs eager to produce components**
- **Car sharing models etc. to leverage lower operating costs**
- **Mobility services / new leasing models to switch to TCO comparision**
- **High efficient recycling needed**

1) Assumption: Â-class vehicle produced in 2015, life time 15 years, 12.500 km p.a., one battery change, all figures at 2015 costs (2nd battery: at 20220 cost level)
2) Assumption: all new powertrain components manufactured by suppliers 3) Telematik, fast Charging, ...

Germany's energy mix in 2016

Proportion by sector for electricity production
(difference from 2015)

9% of the electricity is exported



Source: AG Energieblinanzen

Effects of Subsidizing the Purchase of Electric Vehicles

	Gasoline Consumption	Greenhouse Gas Emissions
Excluding the Effect of CAFE Standards	Reduces consumption by those who purchase electric vehicles	Reduces emissions produced by those who purchase electric vehicles
	Costs the government $3 to $7 per gallon saved when people buy an electric vehicle that is similar in size and performance to a conventional vehicle with average fuel economy	Costs the government from $230 to $4,400 per metric ton of carbon dioxide equivalent emissions reduced when people buy electric vehicles that are comparable to conventional vehicles with average fuel economy; that cost also depends on the emissions released in generating the electricity used to recharge vehicles' batteries
Including the Effect of CAFE Standards		
Short-term effects	Has little or no impact on total consumption	Has little or no impact on total emissions
	Government's cost per gallon is much greater than above	Government's cost per metric ton is much greater than above
Long-term effects	The tax credits can affect gasoline consumption and emissions if future revisions to the CAFE standards are influenced by current sales of electric vehicles and expectations about future sales.	

TAPA
Transported Asset Protection Association

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