



# เอกสารประกอบการงานเสวนา MORNING TALK ครั้งที่ 1

## ถอดรหัส...ความท้าทายของอุตสาหกรรมยานยนต์สมัยใหม่ สู่เป้าหมายเศรษฐกิจยั่งยืน

วันพุธที่ 15 มีนาคม 2566 เวลา 09.00-12.30 น.

โรงแรมพูลแมน กรุงเทพ จี สยาม  
และถ่ายทอดผ่าน ZOOM

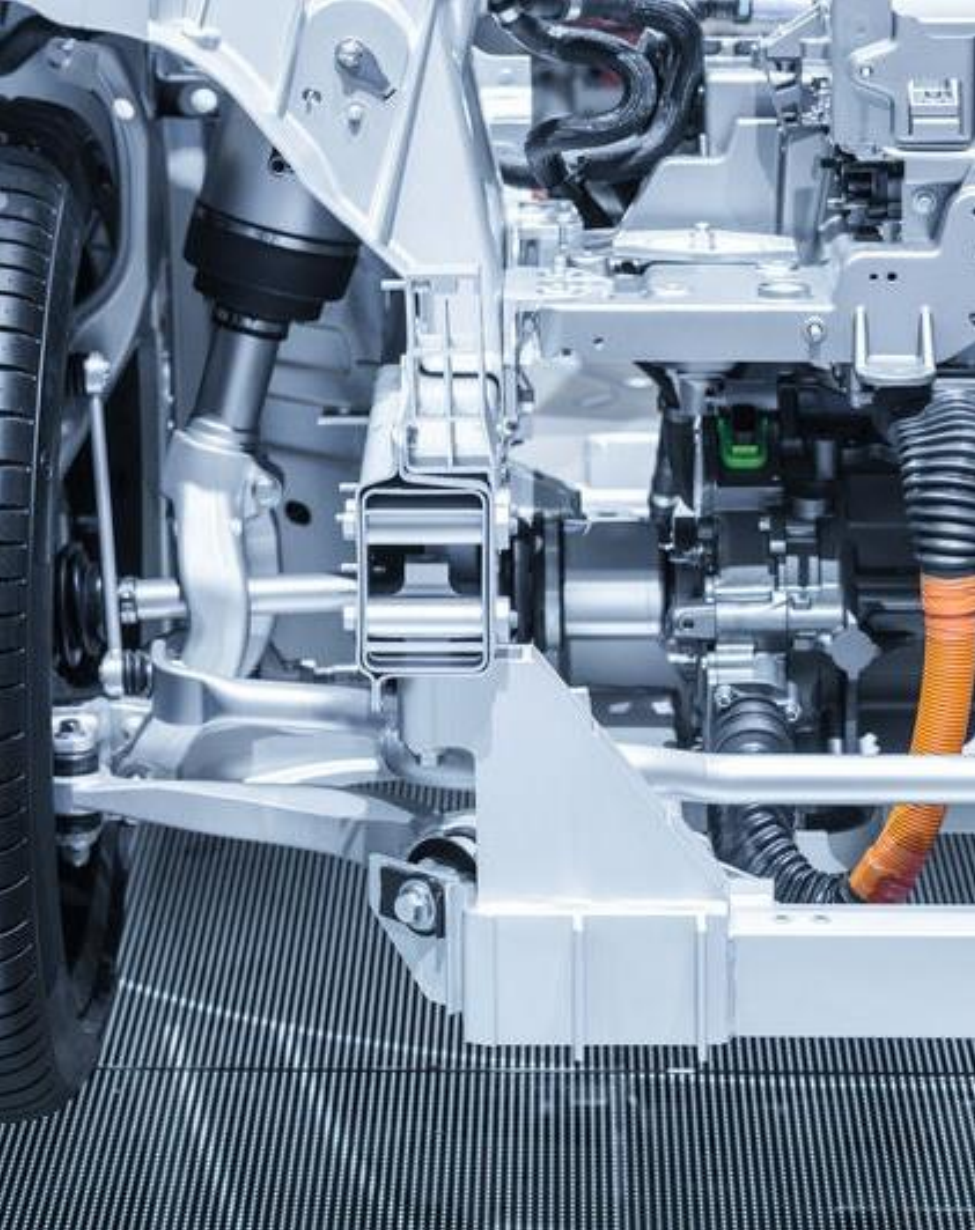




# Gearing up for the transition of Thai automotive industry to next-generation automotive

Presented By Dr. Kriengsak Wongpromrat  
President, Thailand Automotive Institute

Mar 15, 2023



# Topics

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1. Vehicle Development Philosophy: 5S
2. Situation of Thai Automotive Industry
3. Next-Generation Automotive are Disrupting Automotive Supply Chains



# Vehicle Development Philosophy

## - 5S -

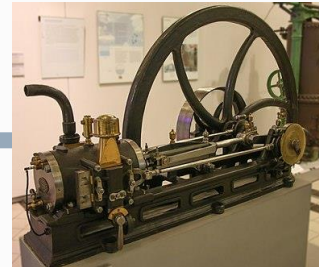
# The Evolution of Automotive Technology



**3000 - 2500 B.C.**  
Carriage



**1771** The first steam engine powered vehicles by Nicolas-Joseph Cugnot



**1860** The first commercially internal combustion engine by Étienne Lenoir



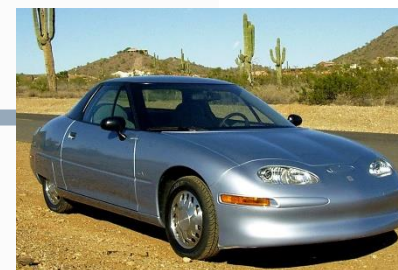
**1885** Benz Patent Motorwagen  
The first practical modern automobile was produced in series production.



**2008** Tesla Roaster (BEV)  
Newcomer in automobile industry



**1997** Toyota Prius  
The first mass-produced gasoline-electric hybrid car



**1996** General Motors EV1  
The first mass-produced electric car

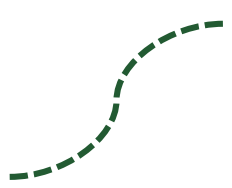


**1908** Ford Model T  
The first mass production of automobile.

**SAVE TIME**



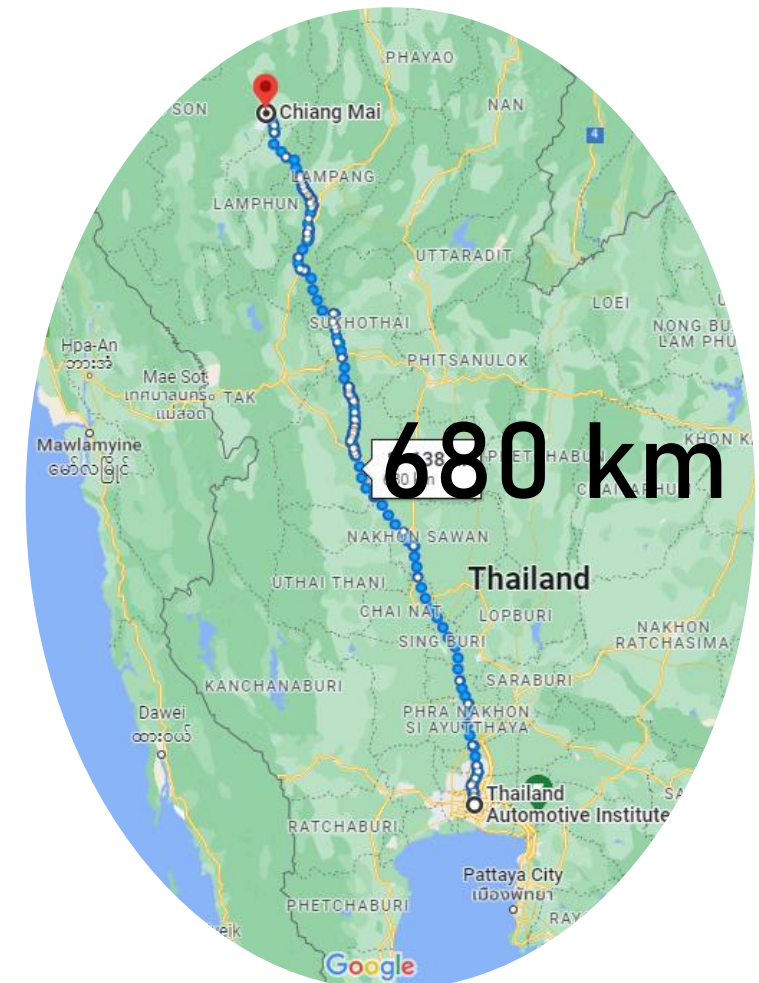
# How long does it take from Bangkok to Chiang Mai?

  **1** hours

  **9** hours

  **17** hours

  **6** Days



**SAVE LIFE**

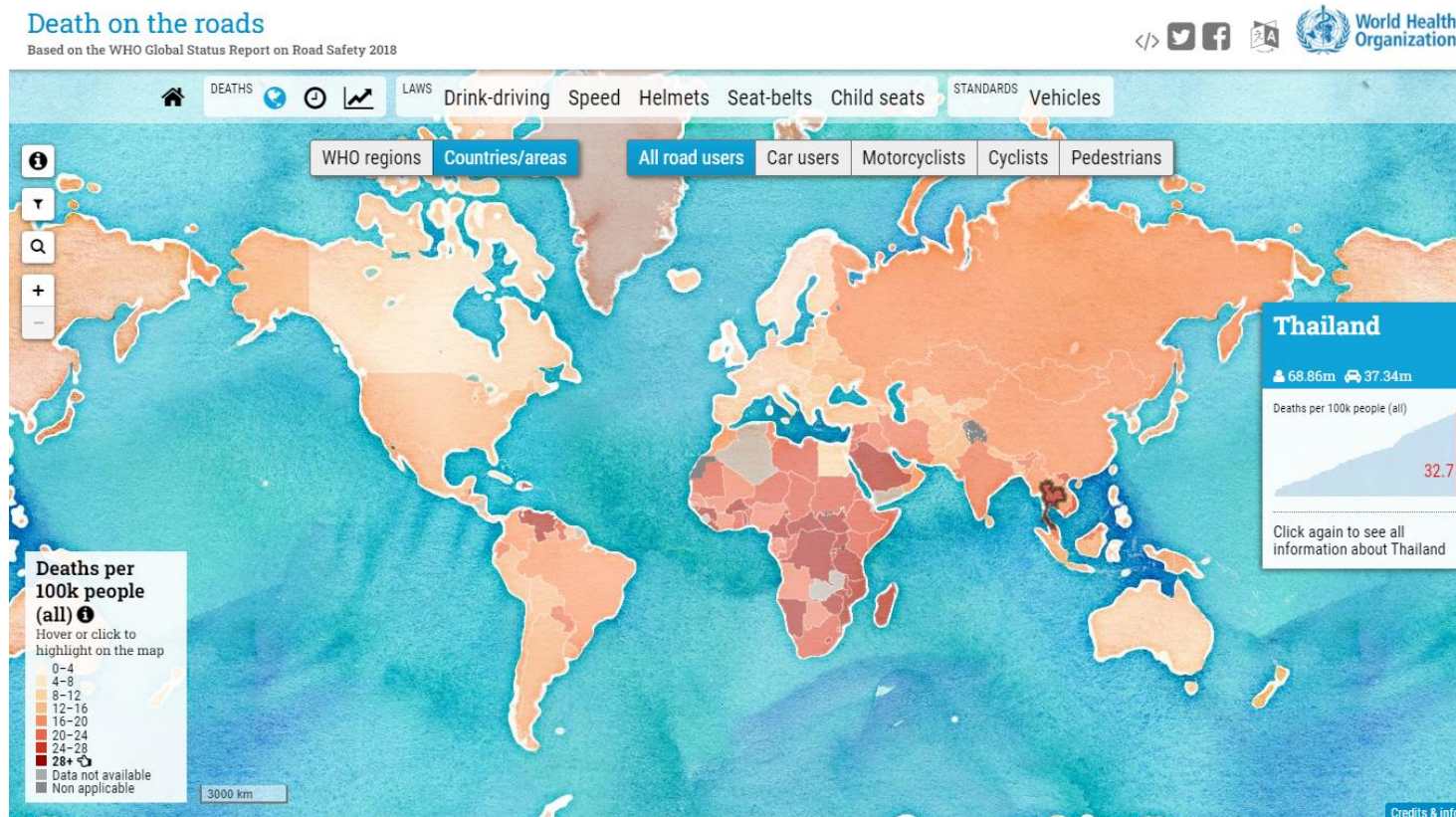




# Road Safety

50 million injuries and 1.3 million fatalities due to traffic accidents occur every year worldwide.

In 2021, Thailand will have the highest rate of road accident fatalities in Asia with 21,745 fatalities, or 32.7 per 100,000 people.



# Safety Belt

## V-type three-point safety belt

Since the 1960s, Bohlin's belt has saved many hundreds of thousands of lives and prevented or reduced the severity of injuries among many millions. This makes the three-point safety belt the single most important safety device in the car's 120-year history. And that's not just Volvo's claim.

As confirmation of its effectiveness, Bohlin's invention has been identified by German patent registrars as one of the eight patents to have the greatest significance for humanity during the hundred years from 1885 to 1985. Bohlin shares this honour with patent-holders such as Benz, Edison and Diesel.



# Safety system in vehicle

## Passive Safety System



Seatbelts



Airbags



Deformation  
Zones

## First Wave of Active Safety Systems

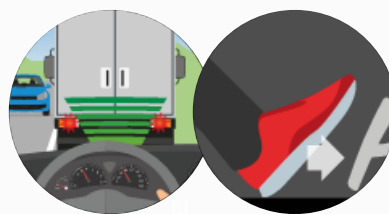


Anti-lock braking  
Systems (ABS)

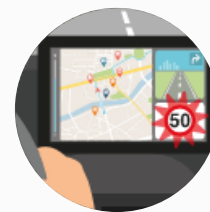


Electronic Stability  
control (ESC)

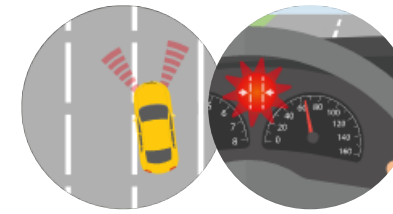
## Second Wave of Active Safety



Autonomous emergency  
braking (AEB)



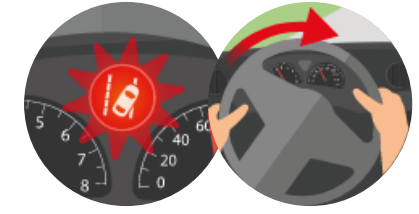
Speed limit  
information (SLI)



Lane departure  
warning (LDW)



Drowsiness  
and attention  
detection systems



Lane keeping  
assistance (LKA)



Tire pressure  
Monitoring  
systems (TPMS)

# ระบบ ADAS ช่วยเพิ่มความปลอดภัยในการใช้ยานยนต์

ADAS (Advanced Driver Assistance Systems) หรือ ระบบช่วยเหลือผู้ขับขี่ขั้นสูง

## Forward collision warning

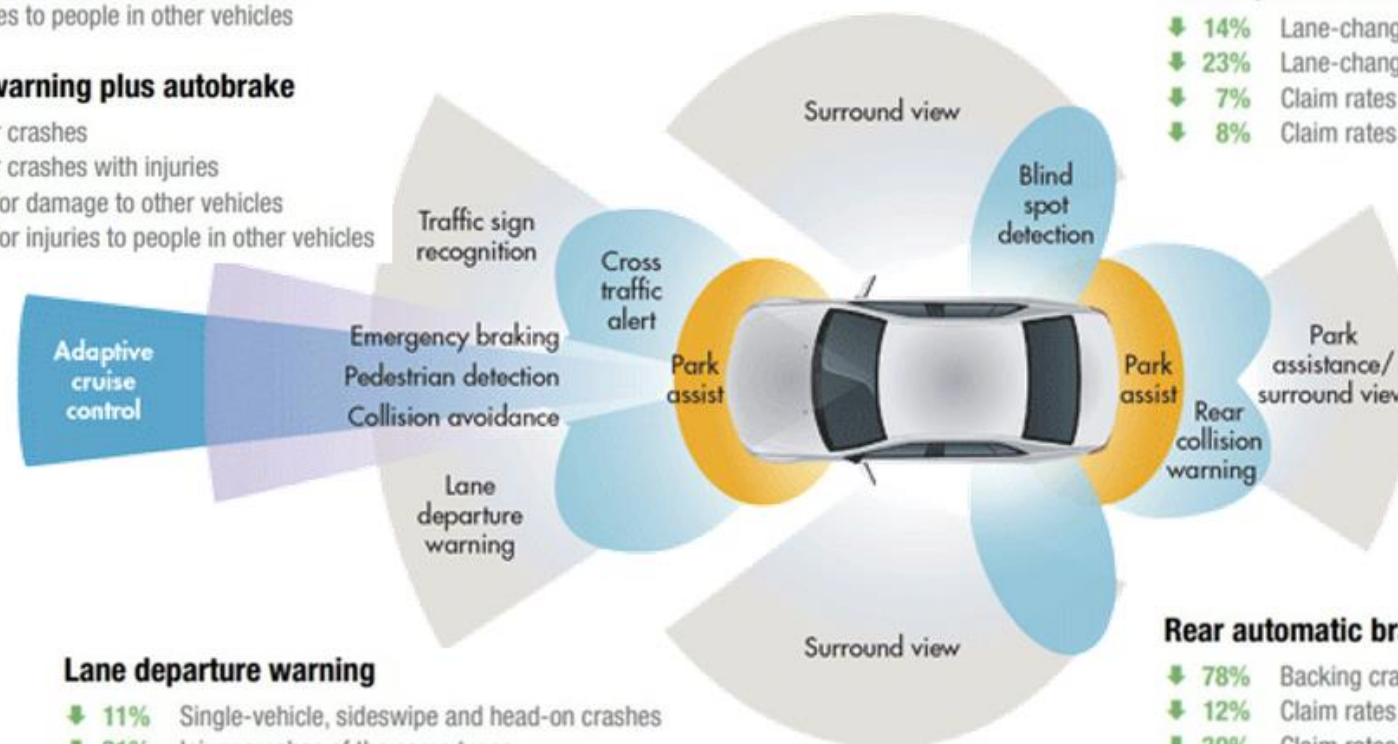
- ↓ 27% Front-to-rear crashes
- ↓ 20% Front-to-rear crashes with injuries
- ↓ 9% Claim rates for damage to other vehicles
- ↓ 16% Claim rates for injuries to people in other vehicles

## Forward collision warning plus autobrake

- ↓ 50% Front-to-rear crashes
- ↓ 56% Front-to-rear crashes with injuries
- ↓ 13% Claim rates for damage to other vehicles
- ↓ 23% Claim rates for injuries to people in other vehicles

## Blind spot detection

- ↓ 14% Lane-change crashes
- ↓ 23% Lane-change crashes with injuries
- ↓ 7% Claim rates for damage to other vehicles
- ↓ 8% Claim rates for injuries to people in other vehicles



## Rearview cameras

- ↓ 17% Backing crashes

## Rear cross-traffic alert

- ↓ 22% Backing crashes

## Lane departure warning

- ↓ 11% Single-vehicle, sideswipe and head-on crashes
- ↓ 21% Injury crashes of the same types

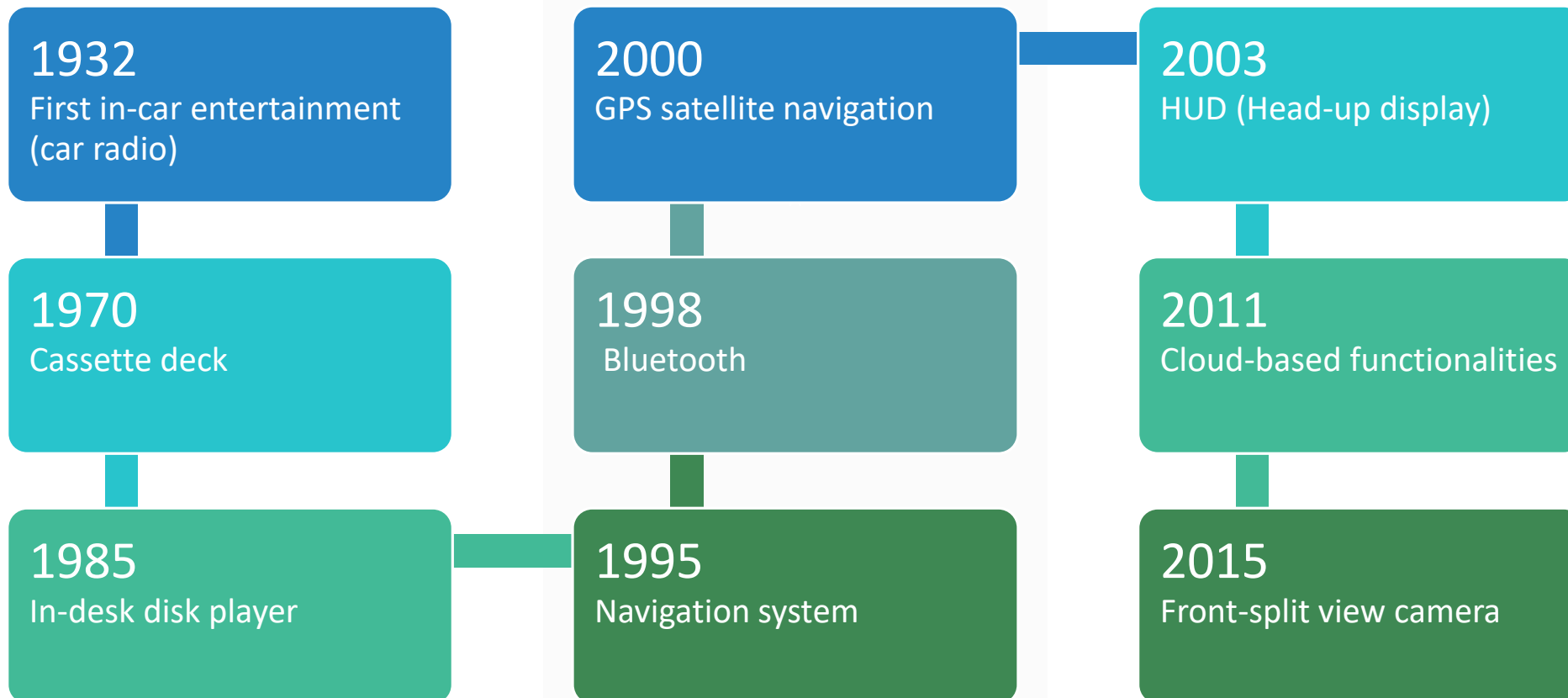
## Rear automatic braking

- ↓ 78% Backing crashes (when combined with rearview camera and parking sensors)
- ↓ 12% Claim rates for damage to the insured vehicle
- ↓ 30% Claim rates for damage to other vehicles

SERVE LIFE

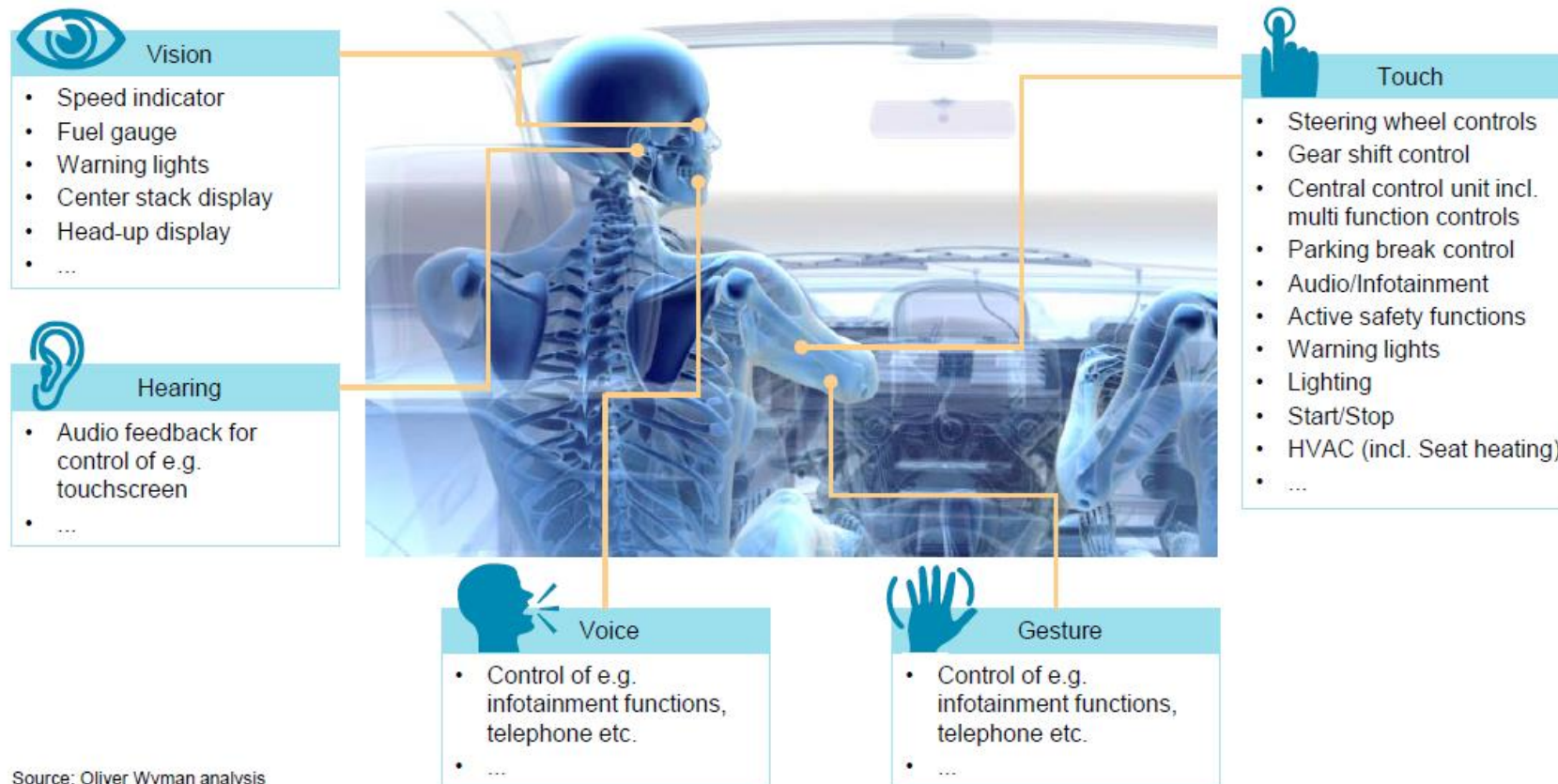


# Innovation Milestones in Infotainment Module



# Human Machine Interface (HMI) in Vehicles

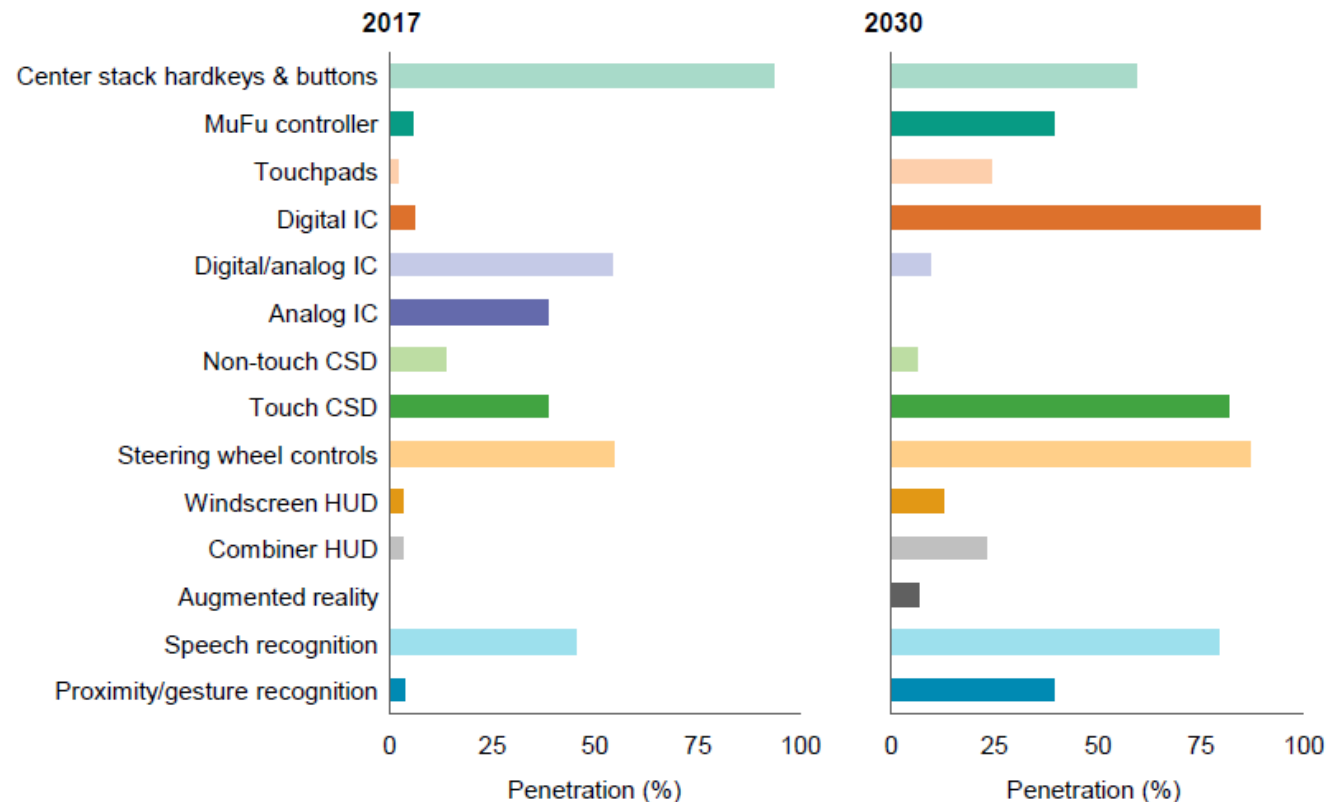
## Selected HMI systems in passenger vehicles



Source: Oliver Wyman analysis

# Increase Demand for Comfort and Connectedness

**Penetration rate of HMI technologies**  
In % of total vehicles, 2017–2030



Note: MuFu = Multi-Function, CSD = Center stack display, IC = Instrument cluster, HUD = Head-up display  
Source: Oliver Wyman HMI Point of view

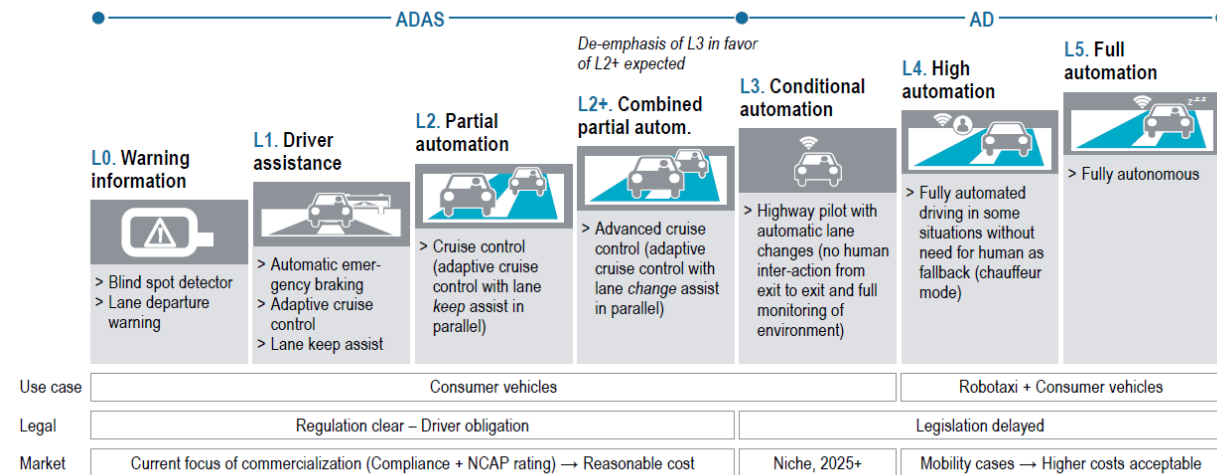
## Comments

- The future cockpit will deliver an increasingly **intuitive, innovative and personalized user experiences**
- This next-generation HMI is expected to prevail until 2030, smartly combining **voice control, touchscreens and conventional controls** depending on **application and passengers**
- Development will be fueled by ongoing **vehicle automation**, and – predominantly – the achievement of **critical mass** together with **increasing functions/components integration**



# Global AV Forecast by 2030

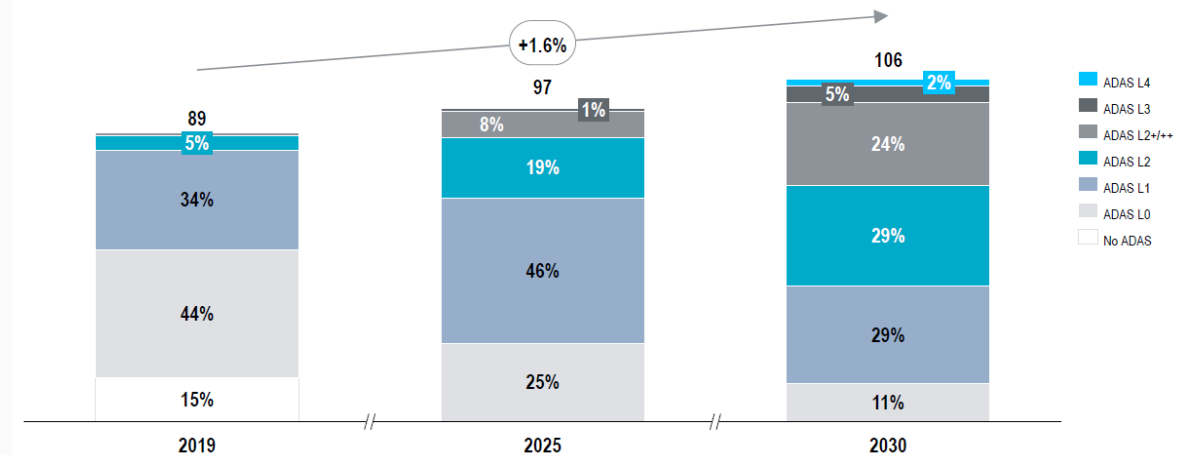
## Definition of levels of autonomy



Source: SAE Int., J3016; fka; Roland Berger

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Market penetration rates per level of autonomy, light-duty vehicles [m of vehicles, %]



# Definition of Autonomous Vehicle

An autonomous vehicle is technology that is capable of self-driving through connectivity and data communication. It works through the collaboration of communication technology, sensor detection, and navigation.



Advanced  
Driver  
Assistance  
Systems

Autonomous  
Driving

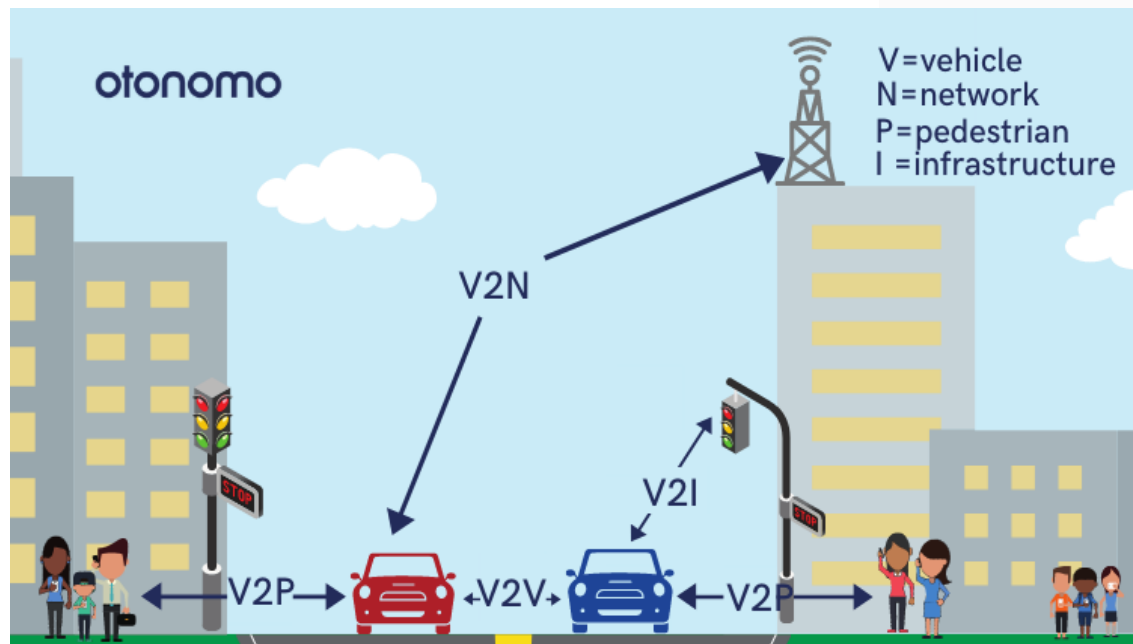
For on-road vehicles		Steering and acceleration/ deceleration	Monitoring of driving environment	Fallback when automation fails	Automated system is in control
Human driver monitors the road	<b>0</b> NO AUTOMATION				N/A
	<b>1</b> DRIVER ASSISTANCE				SOME DRIVING MODES
	<b>2</b> PARTIAL AUTOMATION				SOME DRIVING MODES
Automated driving system monitors the road	<b>3</b> CONDITIONAL AUTOMATION				SOME DRIVING MODES
	<b>4</b> HIGH AUTOMATION				SOME DRIVING MODES
	<b>5</b> FULL AUTOMATION				

- Automatic cruise control
  - Advance emergency braking
  - Lane keeping
  - Parking assist
- Traffic assist (Automatic cruise control with steering control)
  - Advanced Emergency breaking & steering
  - Auto parking
- Highway pilot
  - Traffic-jam pilot
  - Remote parking
- City pilot / Highway urban pilot
  - Valet parking
- Auto pilot; Robo-Taxi

# Connected Vehicle

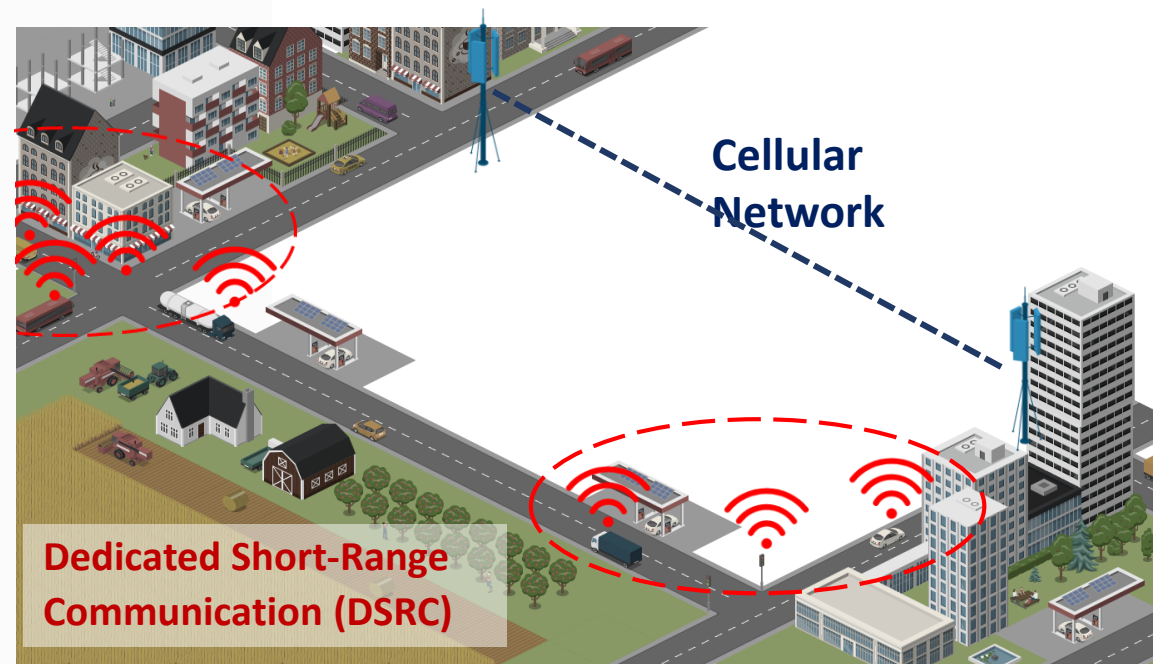
A connected vehicle is technology that can connect and communicate with anything.

## Type of Vehicle Communication

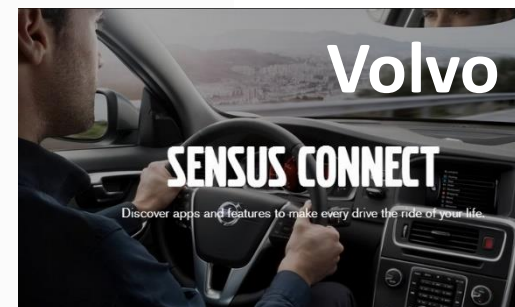


<https://otonomo.io/blog/v2x-connected-vehicles/>

## Type of Vehicle Communication Network



# CAV Function launched in Thai market

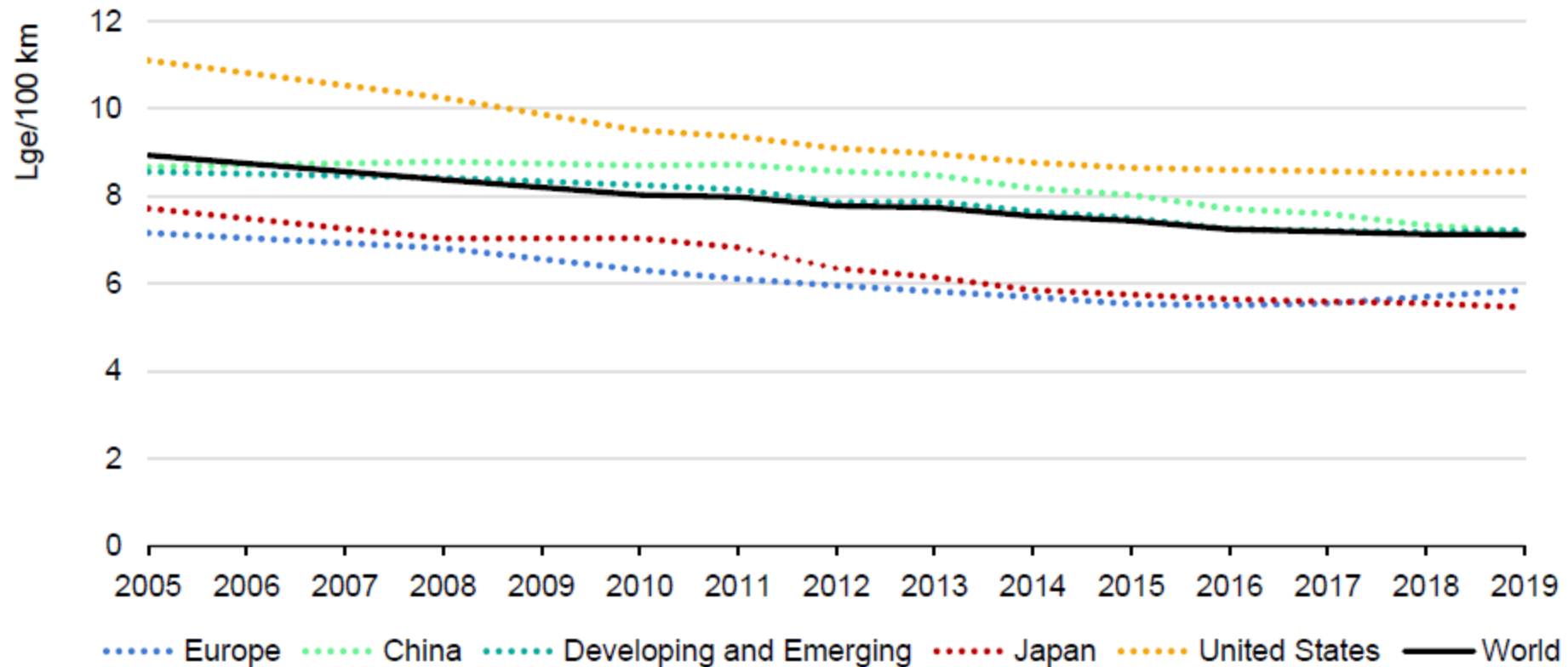


# SAVE COST



# Improvement in average fuel consumption

Average fuel consumption of new light-duty vehicle sales, 2005-2019



IEA. All rights reserved.

# Fuel Economy Label

**Fuel Economy**  
**26** MPG  
 Small SUVs range from 16 to 32 MPG. The best vehicle rates 99 MPG.  
 22 city 32 highway  
 3.8 gallons per 100 miles

**You save \$1,850**  
 in fuel costs over 5 years compared to the average new vehicle.

**Annual fuel COST \$2,150**

**Fuel Economy & Greenhouse Gas Rating** (tailpipe only) **7**  
 This vehicle emits 347 grams CO<sub>2</sub> per mile. The best emits 0 grams per mile (tailpipe only). Producing and distributing fuel also create emissions. Learn more at [fuel economy.gov](http://fuel economy.gov)

**Smog Rating** (tailpipe only) **6**  
 Best

Actual results will vary for many reasons, including driving conditions and how you drive and maintain your vehicle. The average new vehicle gets 22 MPG and costs \$32,660 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at \$2.70 per gallon. MPG is miles per gallon equivalent. Vehicle emissions are a significant cause of climate change and smog.

[fuel economy.gov](http://fuel economy.gov)  
 Calculate personalized estimates and compare vehicles

**Vehicle Information**  
 CO<sub>2</sub> emission figure (g/km)  
**A** 104 g/km

< 120	A
120+ to 140	B
140+ to 155	C
155+ to 170	D
170+ to 190	E
190+ to 225	F
225+	G

**Fuel Use (estimated) for 18,000 kilometres**  
 A fuel use figure is indicated to the consumer as a guide for comparison purposes. This figure is calculated by using the combined drive cycle (urban and extra urban fuel consumption cycles).  
**774 litres**

**Motor Tax for 12 months**  
 Motor Tax varies according to the CO<sub>2</sub> emissions of the vehicle.  
**€100**

**Vehicle Registration Tax (VRT) Rate**  
 Percentage rate of VRT payable of the value of the vehicle is dependant on the CO<sub>2</sub> emissions.  
**14%**

**Environmental Information**  
 A guide on fuel economy and CO<sub>2</sub> emissions which contains data for all new passenger car models is available at any point of sale free of charge or directly from the Society of the Irish Motor Industry, 5 Upper Pembroke Street, Dublin 2. Tel: 01-6761690, web address: [www.simi.ie](http://www.simi.ie). In addition to the fuel efficiency of a car, driving behaviour as well as other non-technical factors play a role in determining a car's fuel consumption and CO<sub>2</sub> emissions. CO<sub>2</sub> is the main greenhouse gas responsible for global warming.

**Make:**

**Model/Version:**

**Carbon dioxide emissions (g/km): 104 g/km** This figure may be obtained from the vehicle's Certificate of Conformity.  
 Important note: Some specifications of this make/model may have lower CO<sub>2</sub> emissions than this. Check with your dealer.

Fuel Consumption:	Litres/100km	Fuel Type:
Drive cycle		
Urban	5.0	Petrol
Extra-urban	4.2	Engine Capacity (cc): 1497
Combined	4.3	Transmission: Automatic

**에너지소비효율등급**  
 1  
 월간소비전력량 31.4 kWh/월  
 모델명: A-B713C  
 용량: 714 L  
 냉각용량: 493 L  
 냉방용량: 221 L  
 에너지이용합리화법에 의한 표시

**2020年度 燃費基準+50%達成車**

**ECO sticker**  
 CO<sub>2</sub> 120 g/km  
 5.2 L/100 km (= 19.2 km/L) (combined)  
 อัตราการใช้น้ำมันเฉลี่ย \*  
 สถานะในเมือง \* 3.5 L/100 km  
 สถานะนอกเมือง \* 6.2 L/100 km

มาตรฐานสิ่งแวดล้อม: มอก. ✓ EURO 4 ✓ EURO 5 ✓ EURO 6

มาตรฐานความปลอดภัย: ABS+ESC ✓ UN R13 ✓ UN R13H

มาตรฐานการปกป้องผู้โดยสาร: UN R94 ✓ UN R95

มาตรฐานระบบส่งกำลังด้วยไฟฟ้า: UN R100 ✓

**ข้อมูลพื้นฐาน**  
 ยี่ห้อ: HAVAL  
 รุ่น: H6 HEV ULTRA  
 ประเภท: รถยนต์ปลั๊กอินไฮบริด  
 หมายเลขตัวถัง (VIN): MHAAT1560XXXXX  
 รหัสเครื่องยนต์: P01  
 รหัสเครื่องยนต์: G6W48150  
 เครื่องยนต์: 1.5T (HEV), ความจุระบบเชื้อเพลิง: 1499 ลิตร  
 ระบบเกียร์: 6 สปีดอัตโนมัติ ประเภท CVT  
 น้ำหนักรถ: 1690 - 1720 กิโลกรัม  
 ขนาดล้อ(หน้า/หลัง): 225/55R19  
 จำนวนที่นั่ง: 5  
 ประเภทเชื้อเพลิง: เอ็นอีซี (HEV)  
 หมายเหตุพิเศษ: ไซท์ แกรง วอลล์ มอเตอร์ แลนด์เครน (ประเทศไทย) จำกัด

**ผู้ผลิต / ผู้นำเข้า**  
 ชื่อ: บริษัท แกรง วอลล์ มอเตอร์ แลนด์เครน (ประเทศไทย) จำกัด  
 ที่อยู่: 111/1 หมู่ที่ 4 ดินแดงอุตสาหกรรมนิคมจังหวัดชลบุรี 21140

**อุปกรณ์ที่ติดตั้งจากโรงงาน**  
 1. ฟิล์มกันแดดหน้าต่างสีเงิน  
 2. ระบบไฟส่องสว่างภายนอก LED (DRL)  
 3. ฟิล์มกันรอยกระจก  
 4. ฟิล์มกันรอยกระจก Panoramic (เดอ-ดีด) ระบบบังลม  
 5. กระจกสีฟ้า พร้อมฟิล์มกันรังสีอัลตราไวโอเล็ต  
 6. กระจกล้ออะลูมิเนียม 5 สปีด พร้อมระบบกันลื่น  
 7. พวงมาลัยอะลูมิเนียมแบบเบิ้ล ขนาด 12.3"  
 8. ระบบจ่ายไฟที่จอดรถไร้สาย  
 9. ระบบกันขโมยที่มีเซ็นเซอร์ตรวจจับการชนและการขโมย  
 10. ระบบความปลอดภัยเชิงป้องกันอุบัติเหตุ (ACC)  
 11. ระบบเบรกอัตโนมัติ: 3 ช่วง (IP)  
 12. ระบบช่วยเหลือผู้ขับขี่ (ADAS)  
 13. ฟิล์มเคลือบกระจกสีฟ้า 300 นาโนเมตร  
 14. ระบบช่วยการทรงตัว (ESP)  
 15. ระบบเตือนการชนด้านหน้าด้วยเรดาร์ (FCW)  
 16. ระบบช่วยการทรงตัวในขณะเลี้ยว (ESC)  
 17. ฟิล์มเคลือบกระจกสีฟ้าที่หน้าต่างด้านหลัง (SLG)  
 18. ระบบช่วยเลี้ยว (DOW)  
 19. ระบบเตือนการชนด้านหลัง (RCW)  
 20. เซ็นเซอร์ตรวจจับความดันลมยาง

**ราคาขายปลีกแนะนำ (ภาษีรวมแล้ว)**  
**1,349,000 บาท ( 8% )**

**MAKE MODEL VARIANT TRANSMISSION FUEL TYPE**

Fuel Consumption (L/100km)	CO <sub>2</sub> Emissions (g/km)
<b>12.4</b> Combined Test	<b>291</b> Combined Test
<b>16.7</b> Urban	Carbon dioxide (CO <sub>2</sub> ) is the main contributor to climate change
<b>9.8</b> Extra Urban	

Vehicle tested in accordance with ADR 81/02. Actual fuel consumption and CO<sub>2</sub> emissions depend on factors such as traffic conditions, vehicle condition and how you drive.

More information at [www.greenvehicleguide.gov.au](http://www.greenvehicleguide.gov.au)

# SAVE EARTH





# Climate Change

Climate change refers to long-term shifts in temperatures and weather patterns. These shifts may be natural, such as through variations in the solar cycle. But since the 1800s, human activities have been the main driver of climate change, primarily due to burning fossil fuels like coal, oil and gas.

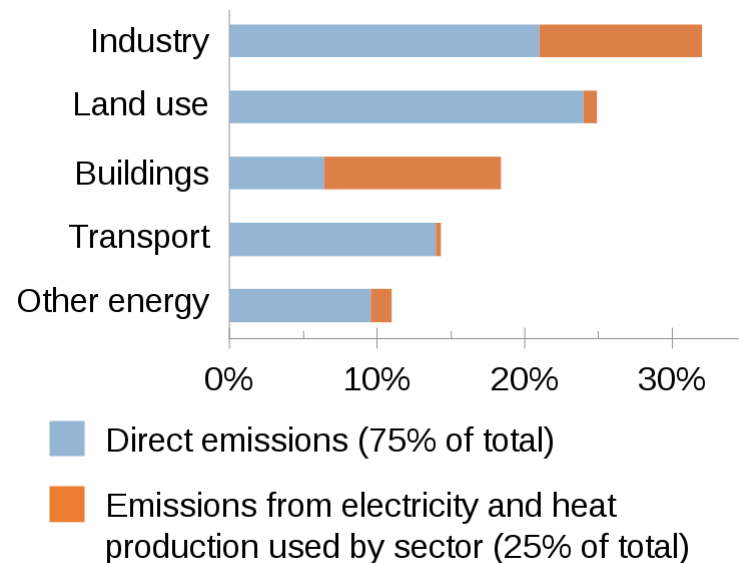
1958 .....> 2017 .....> NOW



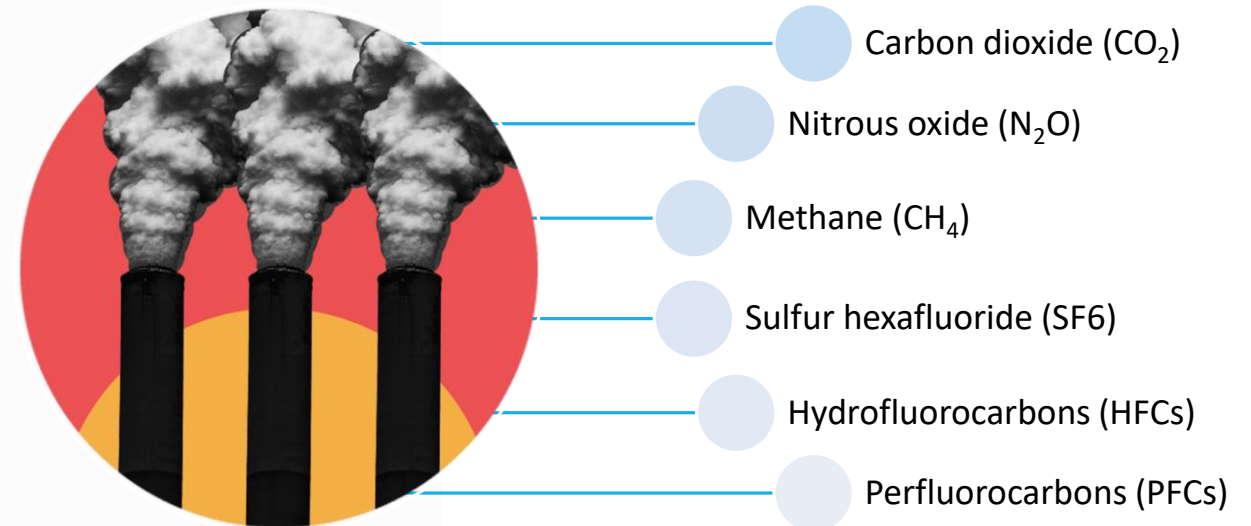
# Causes of Climate Change

Fossil fuels – coal, oil and gas – are by far the largest contributor to global climate change, accounting for over 75 per cent of global greenhouse gas emissions and nearly 90 per cent of all carbon dioxide emissions. As greenhouse gas emissions blanket the Earth, they trap the sun’s heat. This leads to global warming and climate change.

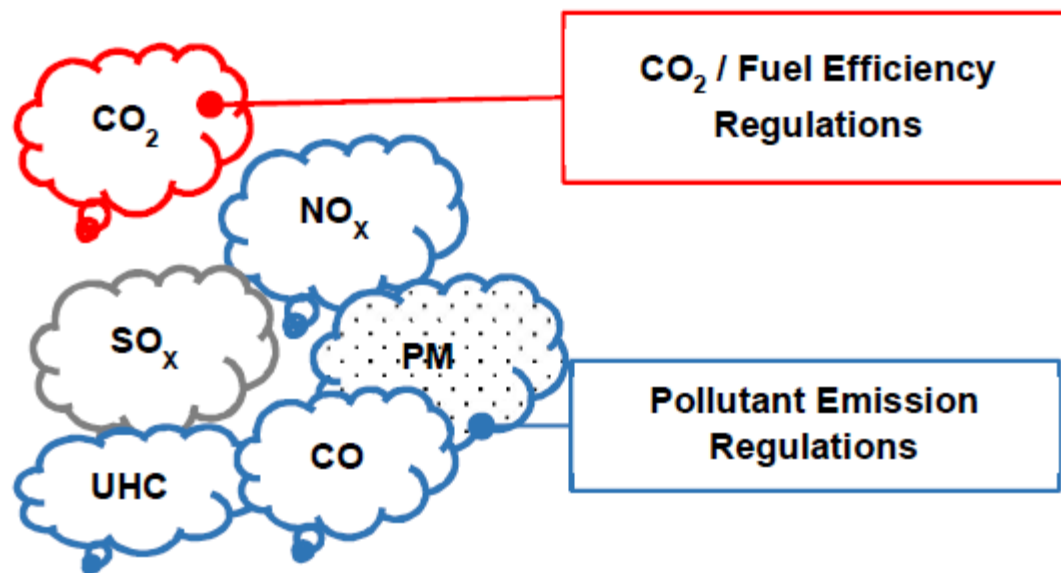
Greenhouse emissions by economic sector



Greenhouse emissions



# Pollutant from Combustion





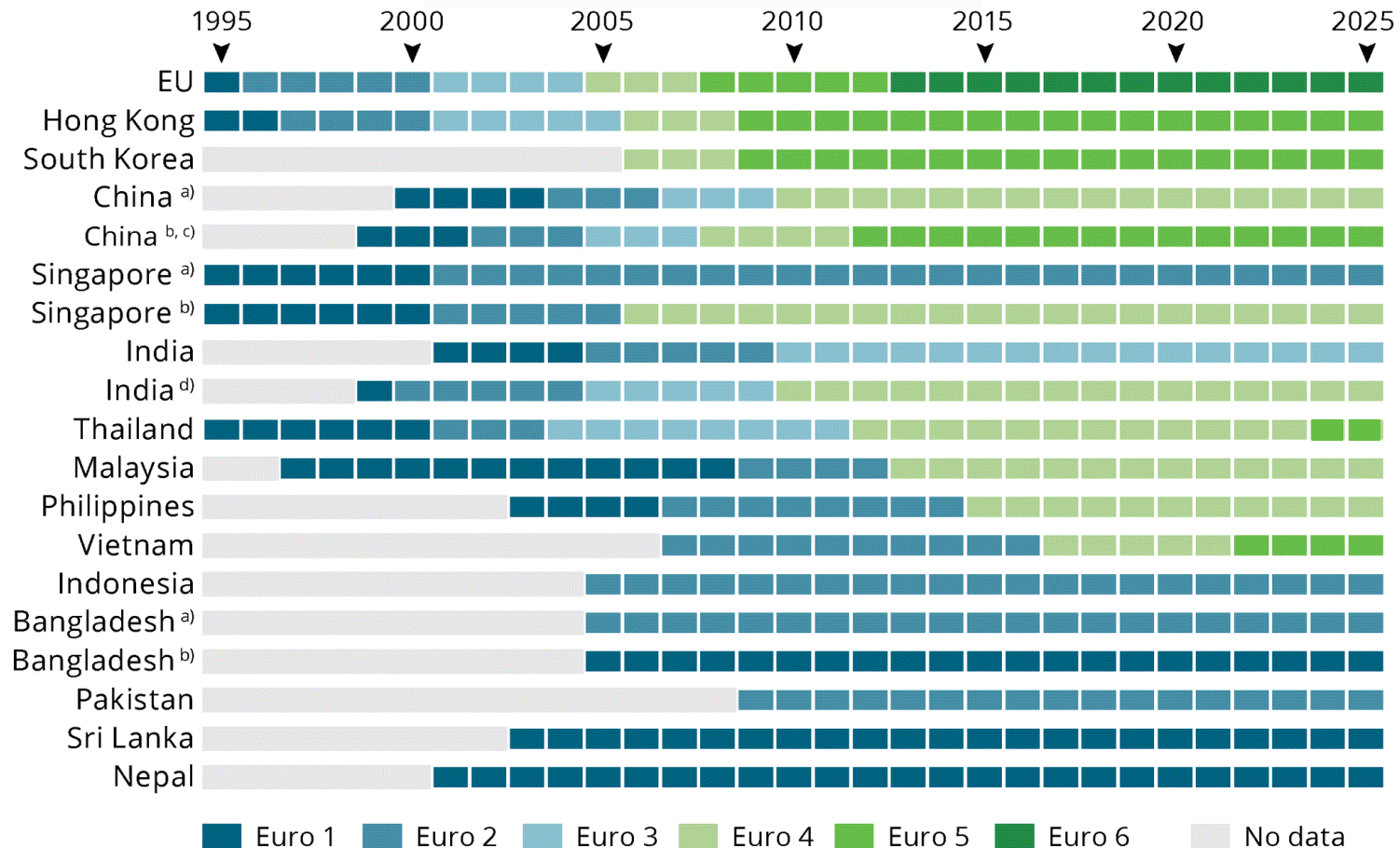
# Emission Control

# Vehicle Emission Control

Euro standard	Introduction dates		Petrol		Diesel		Petrol & Diesel
	New approvals	All new registrations	NOx (g/km)	Mass of particles (g/km)	NOx (g/km)	Mass of particles (g/km)	Number of ultra-fine particles per km
<b>Euro 1</b>	1 July 1992	31 December 1992	0.97 <sup>(1)</sup>	-	0.97 <sup>(1)</sup>	0.14	-
<b>Euro 2</b>	1 January 1996	1 January 1997	0.5 <sup>(1)</sup>	-	0.9 <sup>(1)</sup>	0.1	-
<b>Euro 3</b>	1 January 2000	1 January 2001	0.15	-	0.5	0.05	-
<b>Euro 4</b>	1 January 2005	1 January 2006	0.08	-	0.25	0.025	-
<b>Euro 5</b>	1 September 2009	1 January 2011	0.06	0.0045 <sup>(2)</sup>	0.18	0.0045	6 × 10 <sup>11</sup> (3)
<b>Euro 6</b>	1 September 2014	1 September 2015	0.06	0.0045 <sup>(2)</sup>	0.08	0.0045	6 × 10 <sup>11</sup> (4) (5)

<sup>(1)</sup> Expressed as HC+NOx.  
<sup>(2)</sup> Applicable to direct injection petrol engines.  
<sup>(3)</sup> Applicable to diesel engines only.  
<sup>(4)</sup> Limit of 6 × 10<sup>12</sup> in the case of direct injection petrol engines.  
<sup>(5)</sup> Common limit of 6 × 10<sup>11</sup> for direct injection petrol engines and diesel engines from September 2017/September 2018.

# Adoption of the Euro emissions standards





# Carbon Reduction

# Definition of Electric Vehicle

An electric vehicle (EV) is a mode of transport which is powered by electricity.

	HEV	PHEV	REEV	BEV	FCEV
<b>Advantages</b>	<ul style="list-style-type: none"> <li>Higher energy efficiency compared to ICE</li> <li>Flexible charging options</li> <li>Long driving range</li> </ul>	<ul style="list-style-type: none"> <li>High energy efficiency</li> <li>Home/Workplace recharge</li> <li>Developed fuel station network</li> <li>Buying and use incentives applicable in specific countries</li> </ul>	<ul style="list-style-type: none"> <li>High energy efficiency</li> <li>Home/Workplace recharge</li> <li>Developed fuel station network</li> <li>Low exhaust emissions</li> <li>Buying and use incentives applicable in specific countries</li> </ul>	<ul style="list-style-type: none"> <li>High energy efficiency</li> <li>Home/Workplace recharge</li> <li>Low engine noise</li> <li>Zero exhaust emissions</li> <li>Buying and use incentives applicable in specific countries</li> </ul>	<ul style="list-style-type: none"> <li>High energy efficiency</li> <li>Low engine noise</li> <li>Zero exhaust emissions</li> <li>Buying and use incentives applicable in specific countries</li> </ul>
<b>Disadvantages</b>	<ul style="list-style-type: none"> <li>Technologically complex</li> <li>High exhaust emissions</li> <li>Fossil fuel dependency</li> <li>High engine noise</li> </ul>	<ul style="list-style-type: none"> <li>Technologically complex</li> <li>Higher price compared to ICE</li> <li>High engine noise</li> </ul>	<ul style="list-style-type: none"> <li>Technologically complex</li> <li>Higher price compared to ICE and PHEV</li> <li>Shorter driving ranges than HEV and PHEV</li> </ul>	<ul style="list-style-type: none"> <li>Technological uncertainty (esp. battery performance)</li> <li>Higher price compared to ICE</li> <li>Few charging stations</li> <li>Long charging times</li> <li>Short driving ranges</li> </ul>	<ul style="list-style-type: none"> <li>Technologically complex and uncertain</li> <li>Highest price of all options</li> <li>Limited commercial availability</li> <li>No developed refueling network</li> </ul>

Fuel tank   
 Battery   
 H<sub>2</sub> Hydrogen tank   
 FC Fuel Cell   
 ICE   
 Electric motor   
 Electrified ancillary components

ICE = Internal Combustion Engine; HEV = Hybrid Electric Vehicle; PHEV = Plug-in Hybrid Electric Vehicle; REEV = Range-Extended Electric Vehicle; BEV = Battery Electric Vehicle; FCEV = Fuel-Cell Electric Vehicle; Source: Oliver Wyman "E-Mobility 2035" study

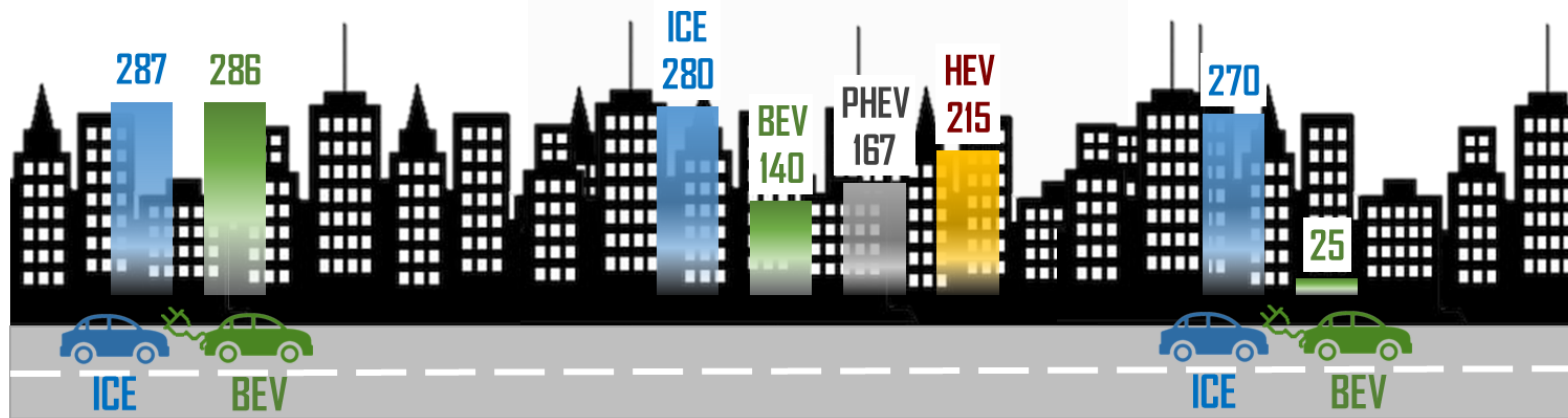
Source: Oliver Wyman (2018), Future automotive industry structure until 2030



# How much CO<sub>2</sub> can Electric Vehicle really save?

## CO<sub>2</sub> Emission From Well-to-Wheel (g/km)

Calculate from D-segment passenger car.



## Electricity Energy Source

Source: Calculated by Thailand Automotive Institute, Using U.S. Department of Energy, Argonne GREET Model and Electricity grid scenario of Thailand From EGAT.



Coal



Thailand\*  
NG 43%  
Hydro 9%  
Coal 19%  
Import 29%

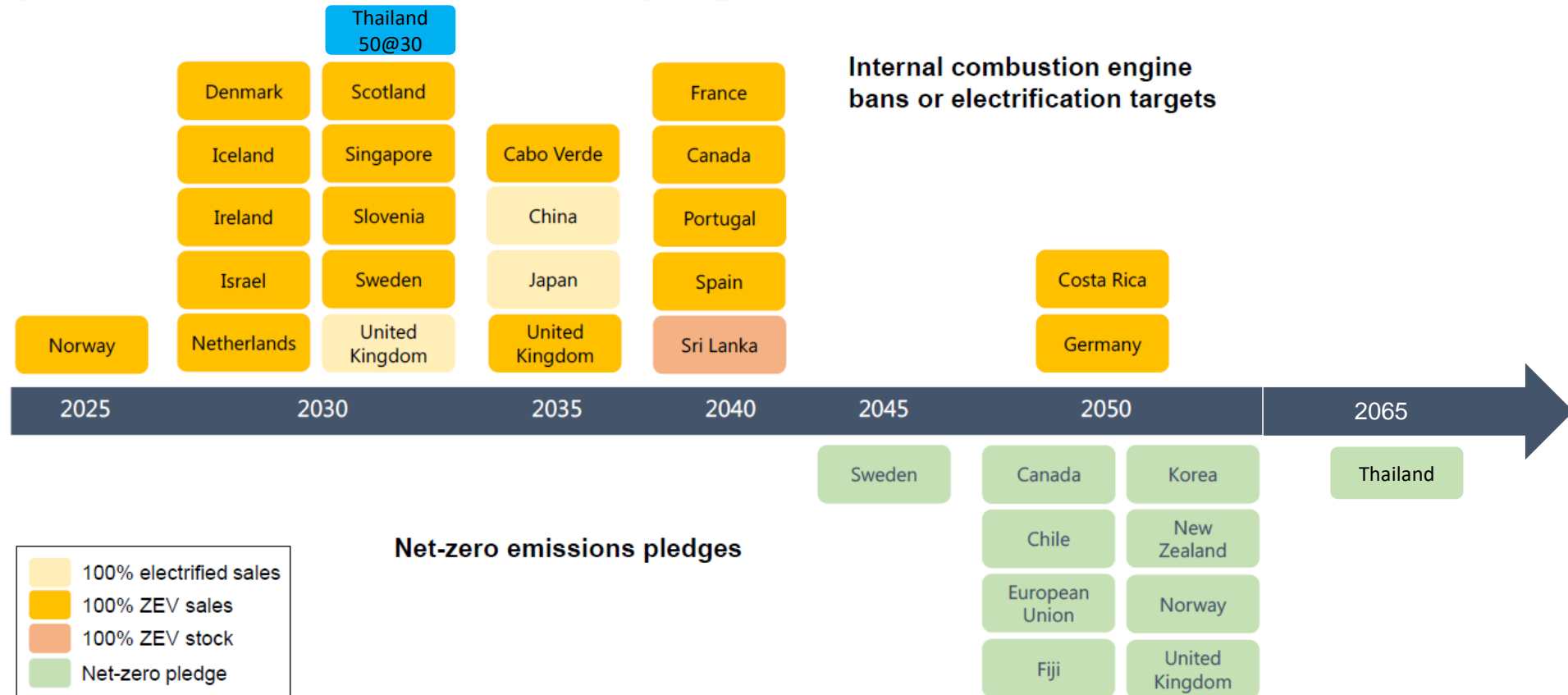


Renewable

Note: \* Thailand electricity energy source excludes small power plant from private sector.

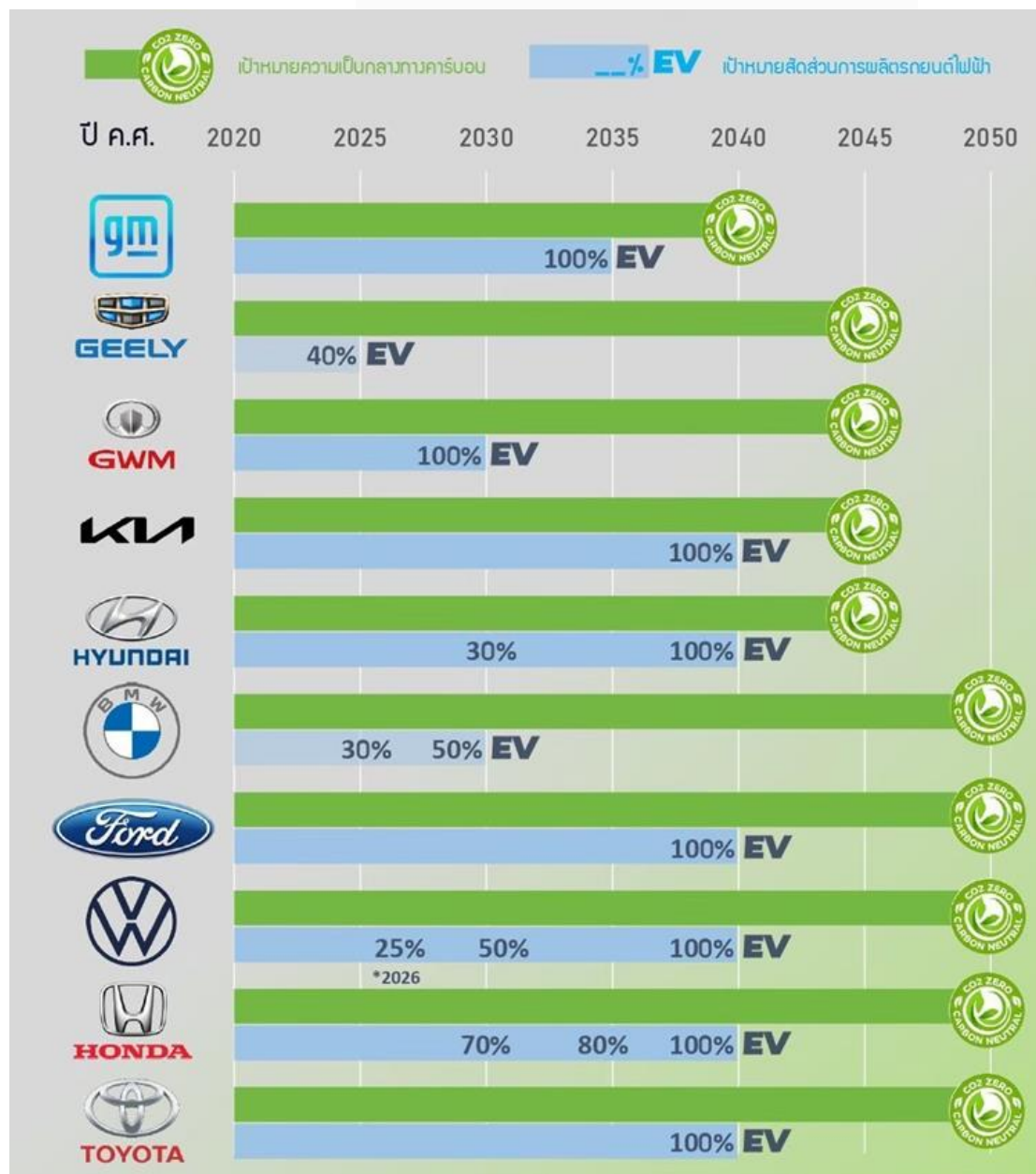
# Countries' Electric Vehicle Targets

More than 20 countries have electrification targets or ICE bans for cars, and 8 countries plus the European Union have announced net-zero pledges

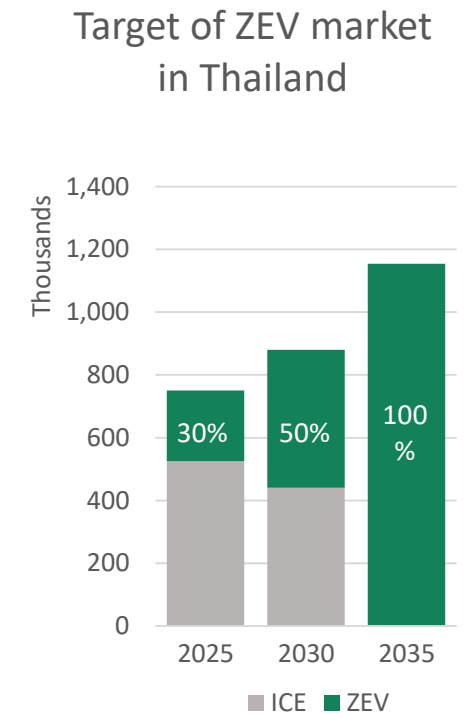
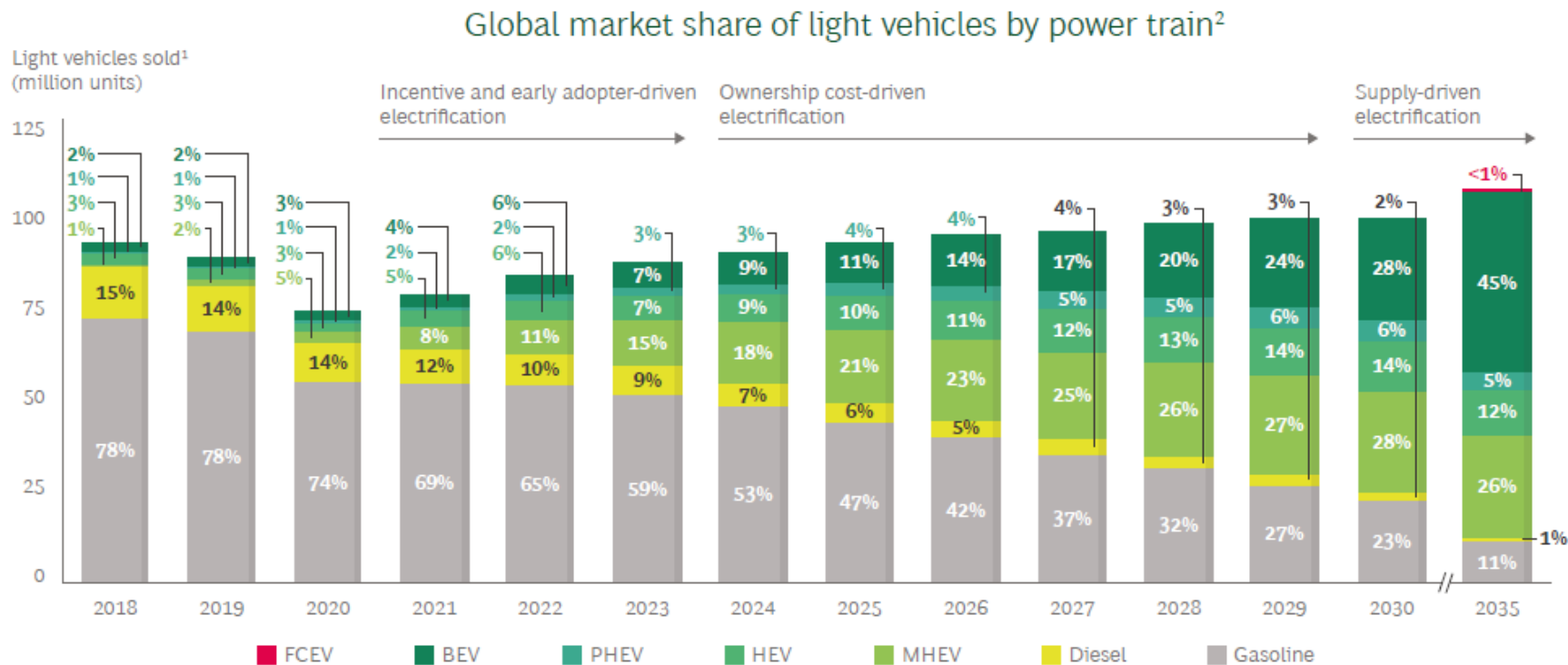


# Carmaker's Carbon Neutrality Target

Collected by Thailand Automotive Institute (Feb 2021)



# Global Electric Vehicle Forecast by 2030



Source: Boston Consulting Group (April 2021), Why Electric Cars Can't Come Fast Enough

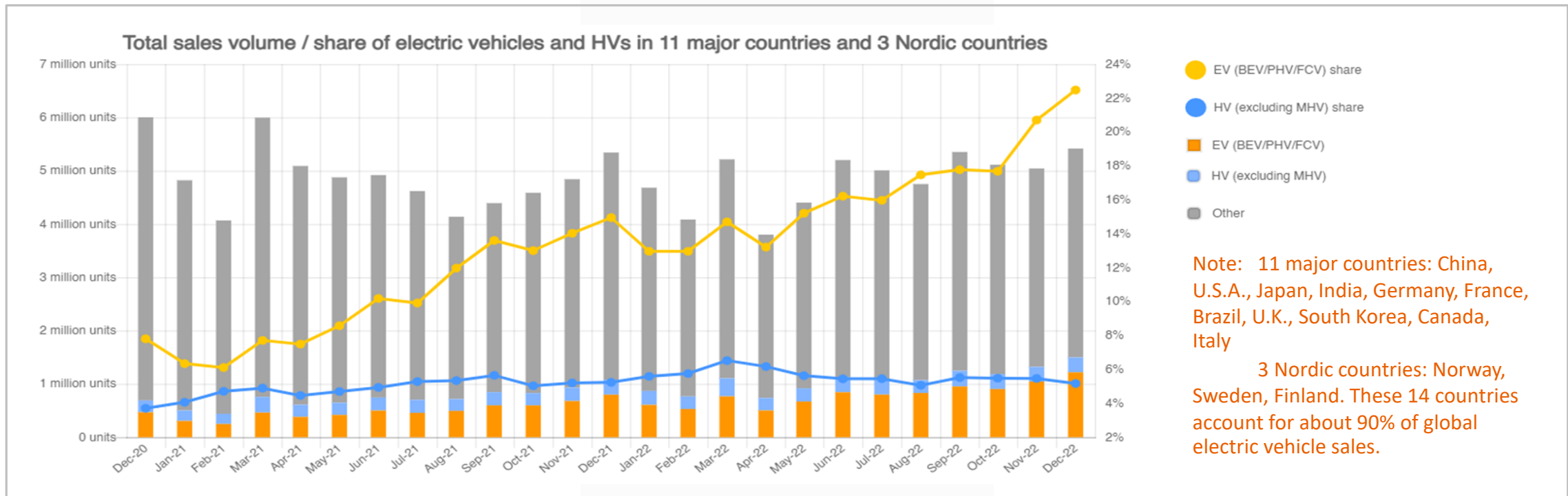
**Note:** FCEV=fuel-cell electric, BEV=battery electric, PHEV=plug-in hybrid electric, HEV=full hybrid electric, MHEV=mild hybrid electric. Because of rounding, the percentage total for a particular year may not equal 100%.

<sup>1</sup>Sales for 2018, 2019, and 2020 are actual data. Data for 2021 onward are BCG projections.

<sup>2</sup>Forecast includes cars, SUVs, and all other light passenger vehicles except heavy-duty vans.

Source: Thailand National Electric Vehicle Policy Committee (March 2021)

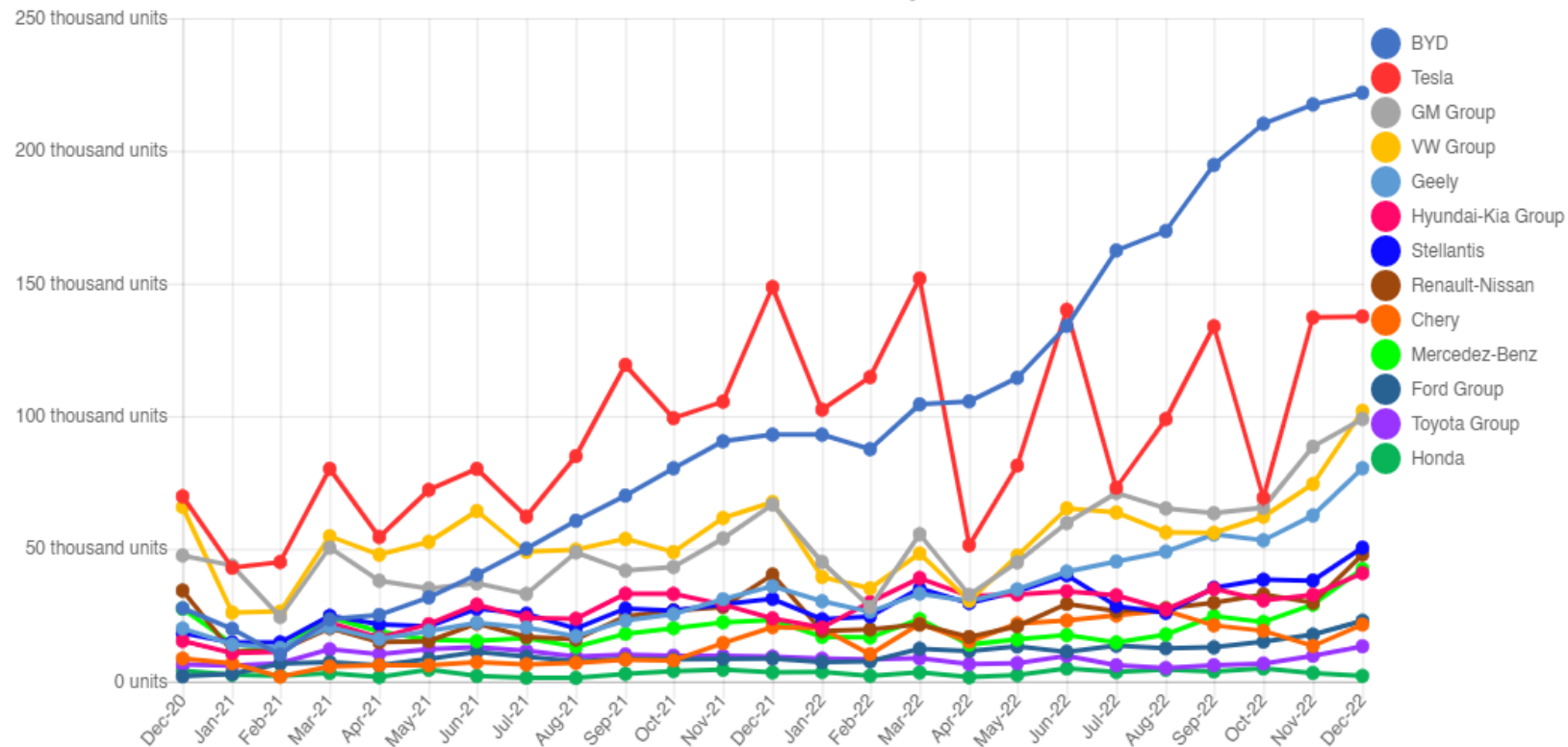
# Global Electric Vehicle Sales (1/2)



- Annual sales totaled 9.668 million units, up 62.7% from the previous year.
- The share of electric vehicles in total sales for the full year 2022 was 16.6%, up 6.3 points from 2021. The share of HVs was also up 0.7 points from the previous year to 5.6%, but the growth rate was moderate.

# Global Electric Vehicle Sales (2/2)

Electric vehicle sales of major OEMs



- The top three manufacturers were BYD, Tesla, and GM (including SAIC-GM-Wuling), as in the previous month.
- The 1-2 OEM positions remain unchanged, held by BYD and Tesla.
- The VW Group, whose models such as the VW ID.4, ID.3, and Audi Q4 e-tron are performing well, overtook GM to claim third place. BYD is still growing steadily in volume, while Tesla has experienced slower growth in sales in recent months.

# Electric Vehicle Technology Trends

## Range has changed!



Photos:  
Vehicle manufacturers

Shift2Electric.com

## Lithium-ion battery-pack price outlook

Lithium-ion battery pack price  
(real 2021 \$/kWh)

BloombergNEF



# Vehicle Development Philosophy

Save Time



Save Life



Serve Life



Save Cost



Save Earth



5S



CASE

Connected



Autonomous



Shared Mobility



Electric

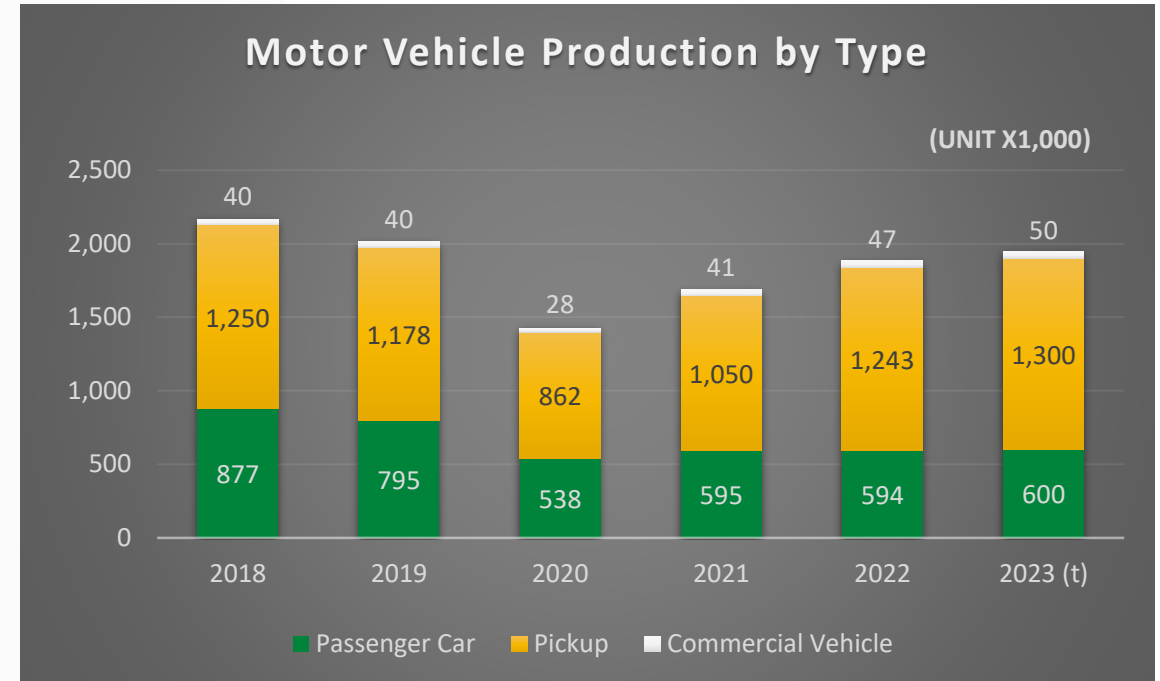
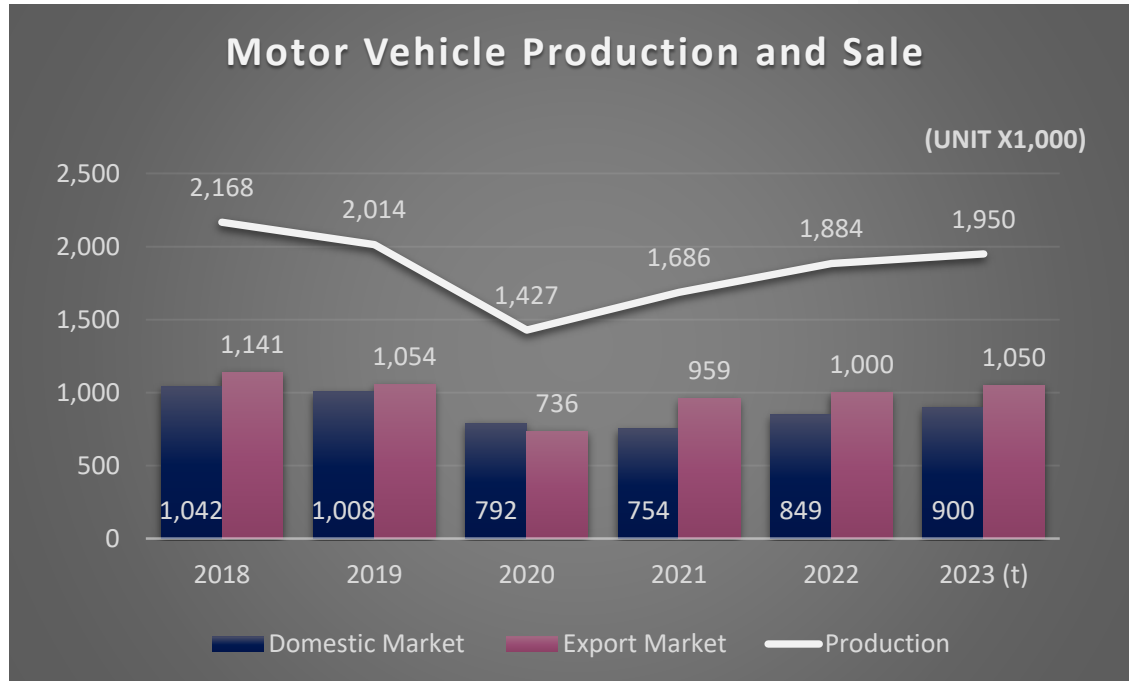






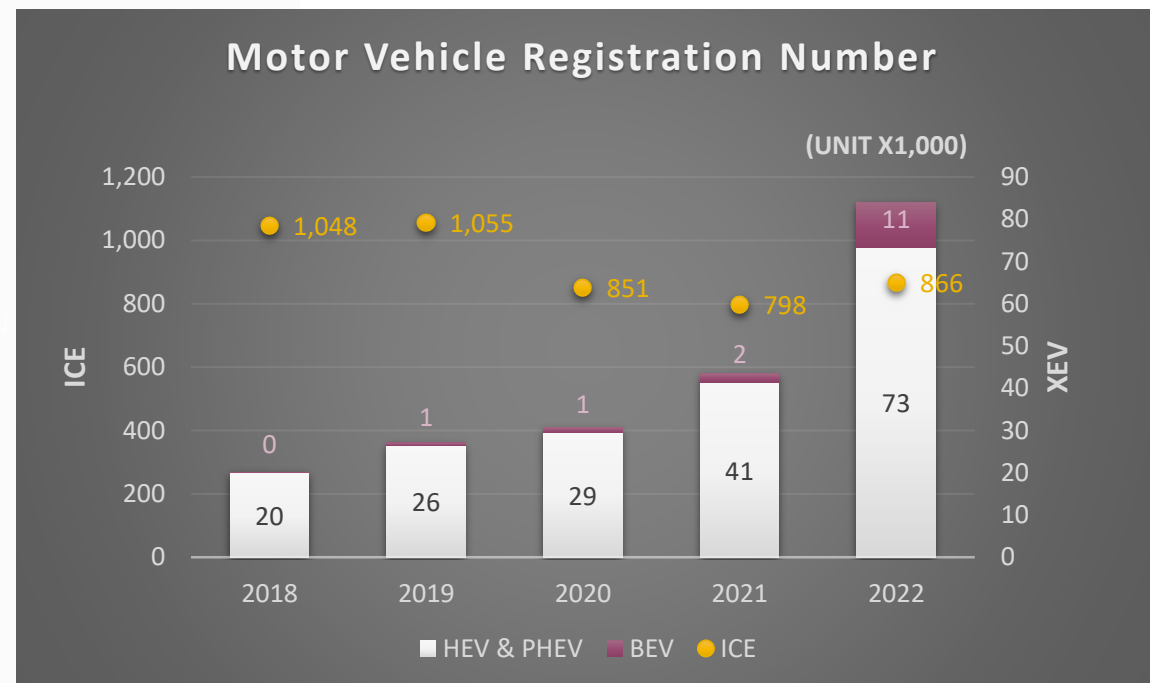
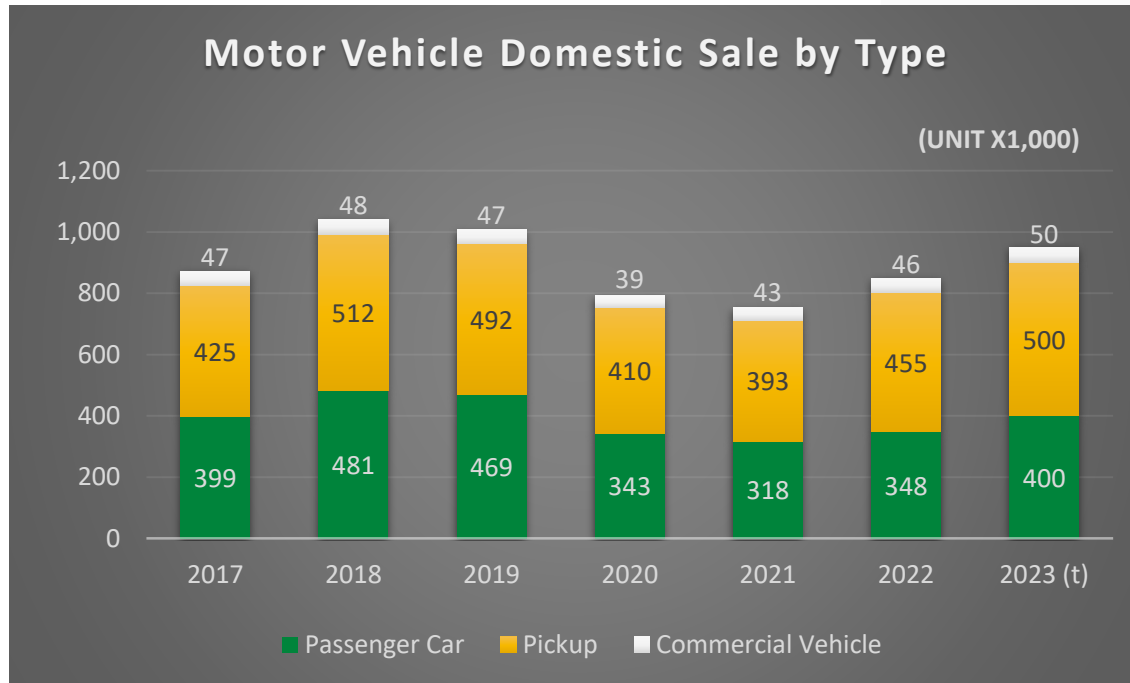
# Situation of Thai Automotive Industry

# Motor Vehicle Production



- In 2022, Thailand's car production totaled 1.88 million, 0.84 million cars were assembled for domestic market and 1 million for export. Total car production is forecast at 1.95 million in 2023, up 3.5% from 2022.
- Pickups represented 62% of total car production in Thailand, while passenger cars shared 35% and other commercial vehicles (trucks, vans and buses) 2%. The country's BEV production was still small.

# Motor Vehicle Domestic Sale

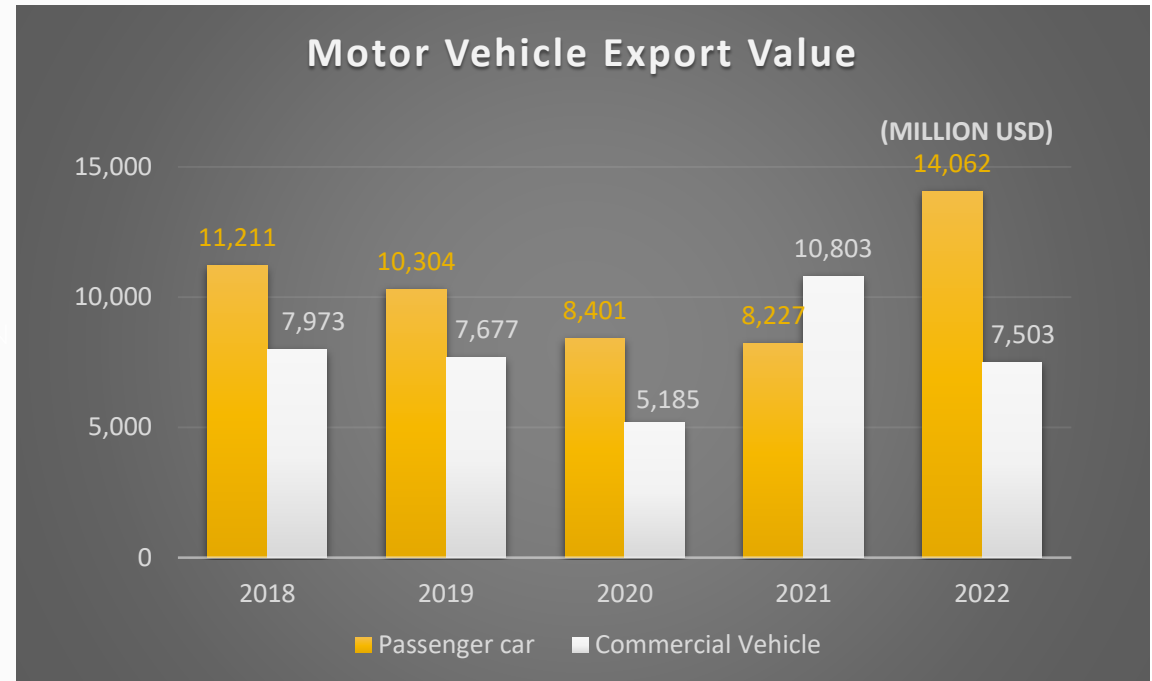
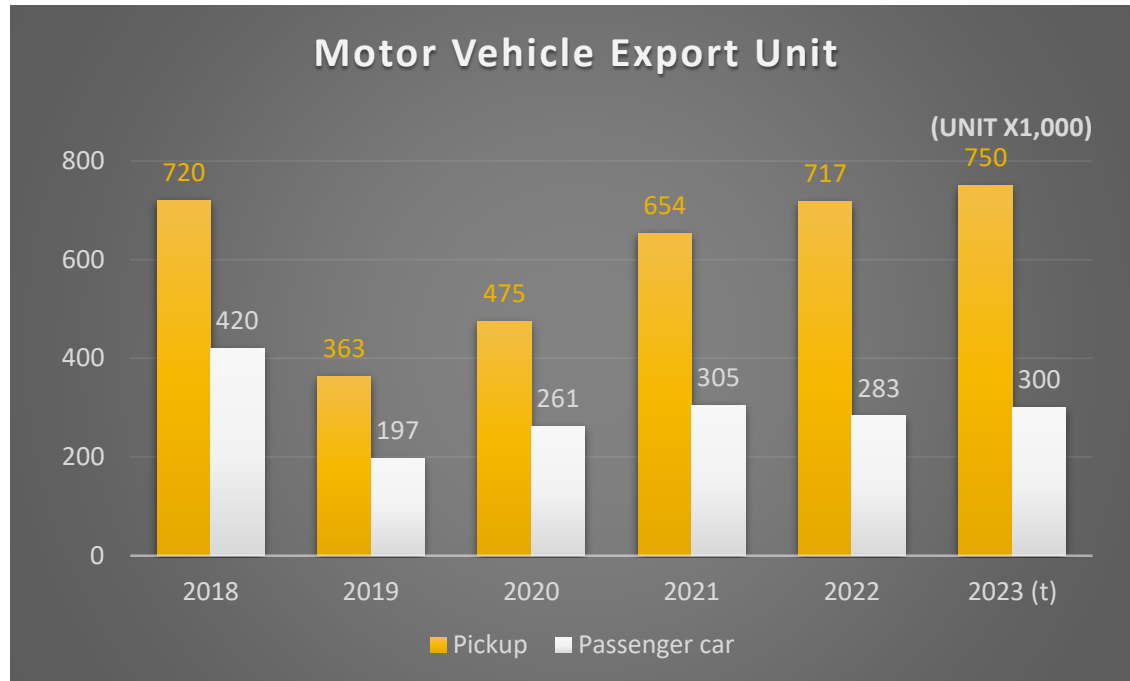


- Thailand's domestic car sales totaled 0.84 million in 2022, up 12% from a year ago. The 2023 figure is estimated at 0.90 million. Pickups accounts for 54% of domestic sales, while passenger cars at 41% and other commercial vehicles (trucks, vans and buses) at 5%.
- BEV car registration continued to rise with an increase of 413% in 2022. Almost BEVs for domestic sales were imported particularly from China. Although newly-registered BEV cars surged when compared with the previous year's figure, its share to total cars newly registered in Thailand was still small at only about 1%.

Source: Automotive Industry Club - The Federation Of Thai Industries and Department of Land transport

Note: (t) = Targeted by Automotive Industry Club - The Federation Of Thai Industries

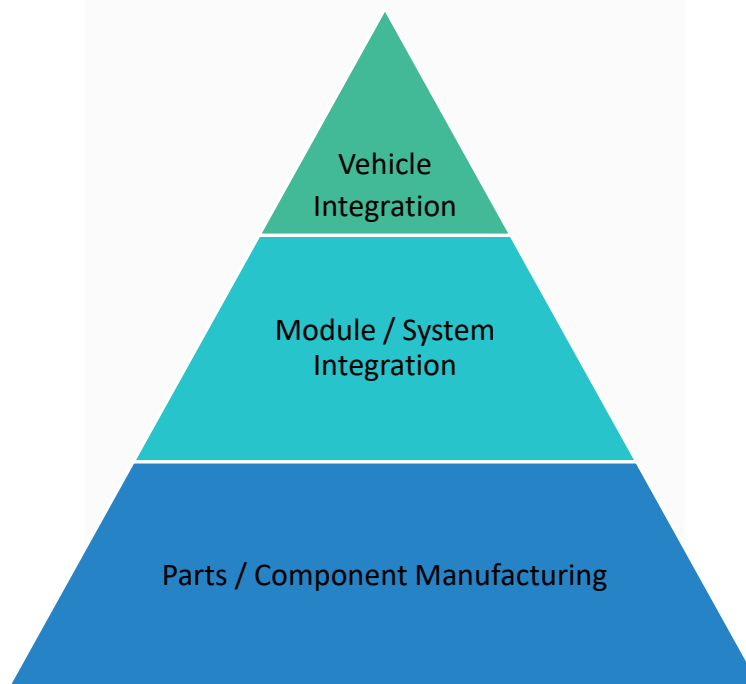
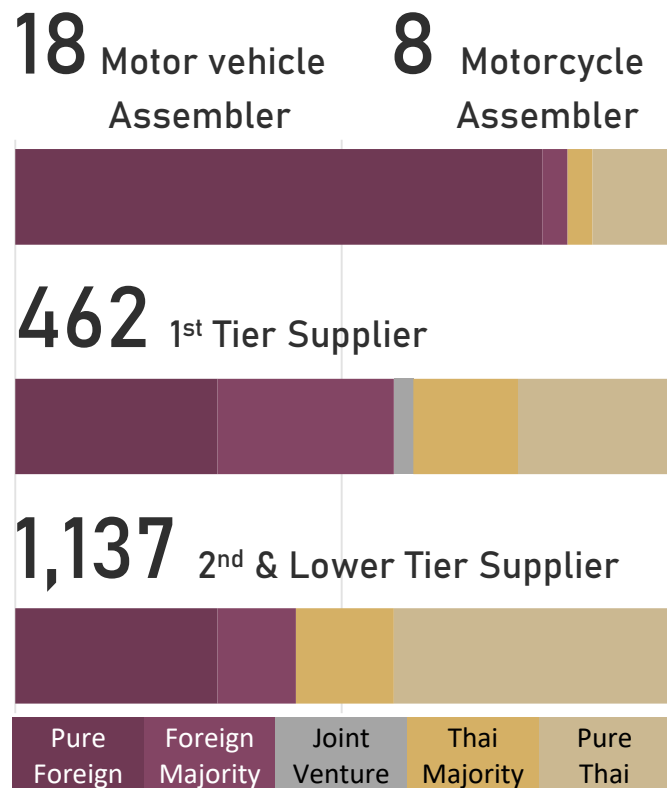
# Motor Vehicle Domestic Sale and Export



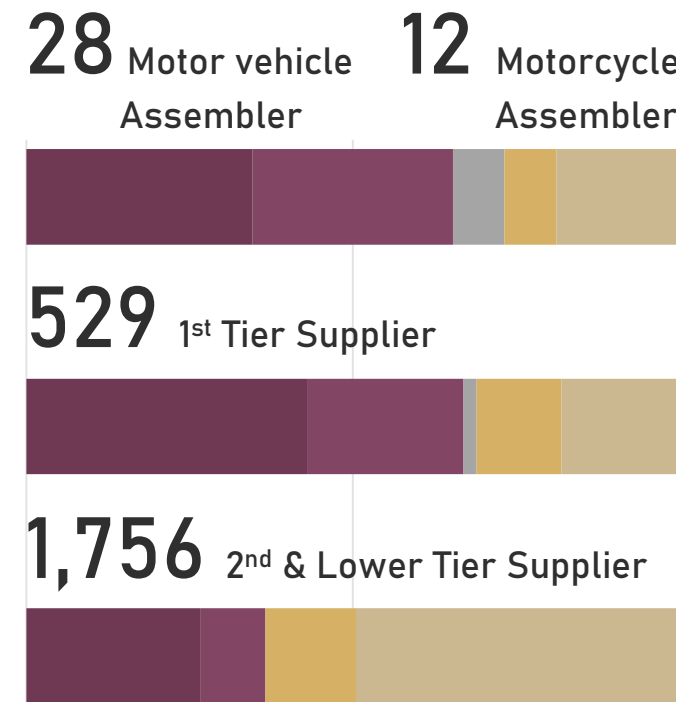
- One million cars were exported in 2022, up 10% from a year before. The 2023 figure is projected at 1.00 million cars.
- About 72% of total car exports went to pickups, while the remaining 28% passenger cars. In terms of value, passenger cars made up of 65% of total export value.

# Thai Automotive Industry Structure

## 2014



## 2022



# Thailand's Vision on Electric Vehicle

*“To be one of the most important EV production bases and component parts in 2035”*

The National Electric Vehicle  
Policy Committee, March 2021

## ZEV Cumulative volume target in 2030

*(Zero Emission Vehicle (ZEV) = BEV & FCEV)*

Vehicle type	Production	Use	Public Charging Station
Passenger cars & Pick-up trucks	2,935,000	2,050,000	12,000 (Fast charge)
Trucks & Buses	156,000	160,000	n.a.
Motorcycles	3,133,000	3,200,000	1,450 (1 Station = 8 outlet)



# Thailand EV Promotion Measures



## 1. Supply side measures

- 1.1 Investment promotion scheme
- 1.2 EV and charger standards
- 1.3 Establishment of testing facility
- 1.4 Supply chain transition program
- 1.5 End-of-Life Vehicle (ELV) program



## 2. Demand side measures

- 2.1 EV package of incentives
- 2.2 Registration tax reduction



## 3. Installation of public charging stations



# Excise Tax Restructure

1

For the ICE and HEV, only CO<sub>2</sub> emissions will be taken into account. It does not use fuel or vehicle type criteria.

2

Set different excise tax rates for PHEV and HEV.

3

Gradually adjust the excise tax rate on ICE, HEV, and PHEV in 3 phases in 2026, 2028, and 2030 and reduce the BEV tax.

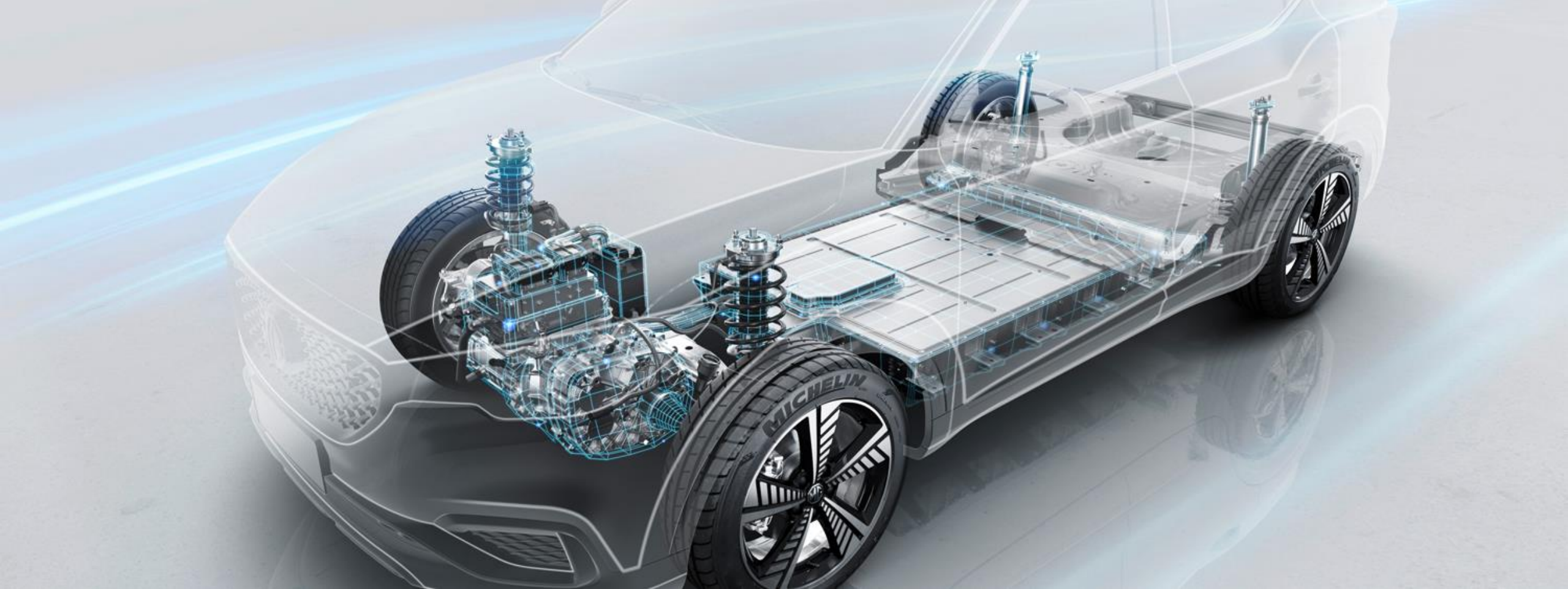
4

Promote pickup trucks, which is considered taking into account the reduction of CO<sub>2</sub> emissions and supporting renewable fuels such as biodiesel and electric pickup trucks.

5

While reducing CO<sub>2</sub> emissions, it encourages the use of vehicles with Advanced Driver Assistance Systems (ADAS).





**Next-Generation Automotive  
are Disrupting Automotive Supply Chains**

# Transition from ICE to BEV will affect supply chain



**DISRUPT PART**

- Internal combustion engine
- Exhaust system
- Fuel system
- Transmission
- Brakes booster

**COMMON PART**

- Wheels and tires
- Seats
- Body
- Interior
- Climate control
- Frame and Axles
- Suspension
- Steering

**NEW PART Electrification**

- Electric drivetrain
- Battery / Fuel cell

**NEW PART Digital**

- ADAS and sensors
- Electronics
- Infotainment and communication

**Software**

**SALE CHANNEL**

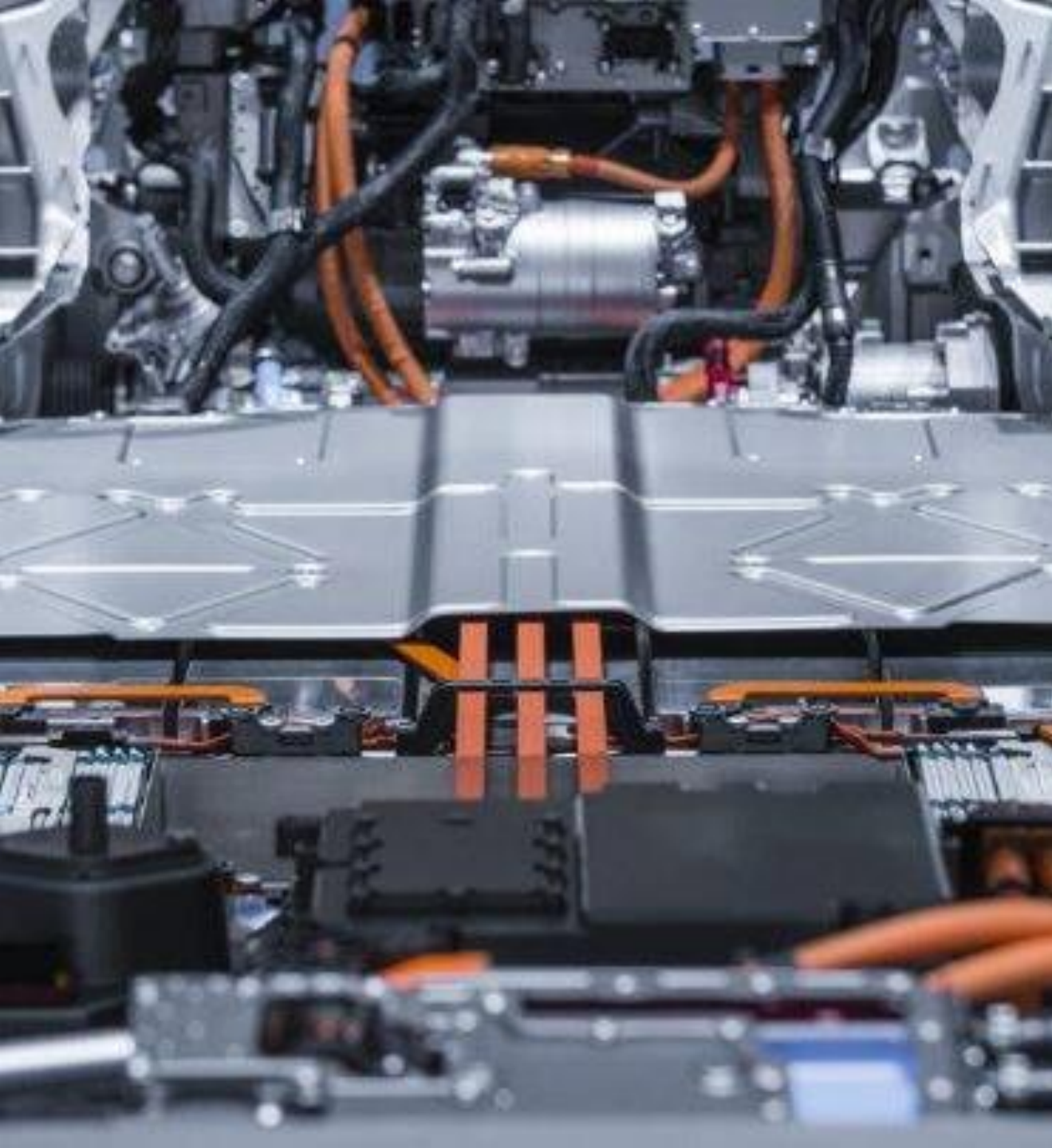
- Online sale

**MAINTENANCE AND RAPAIR**

- Customize service
- Preventive maintenance

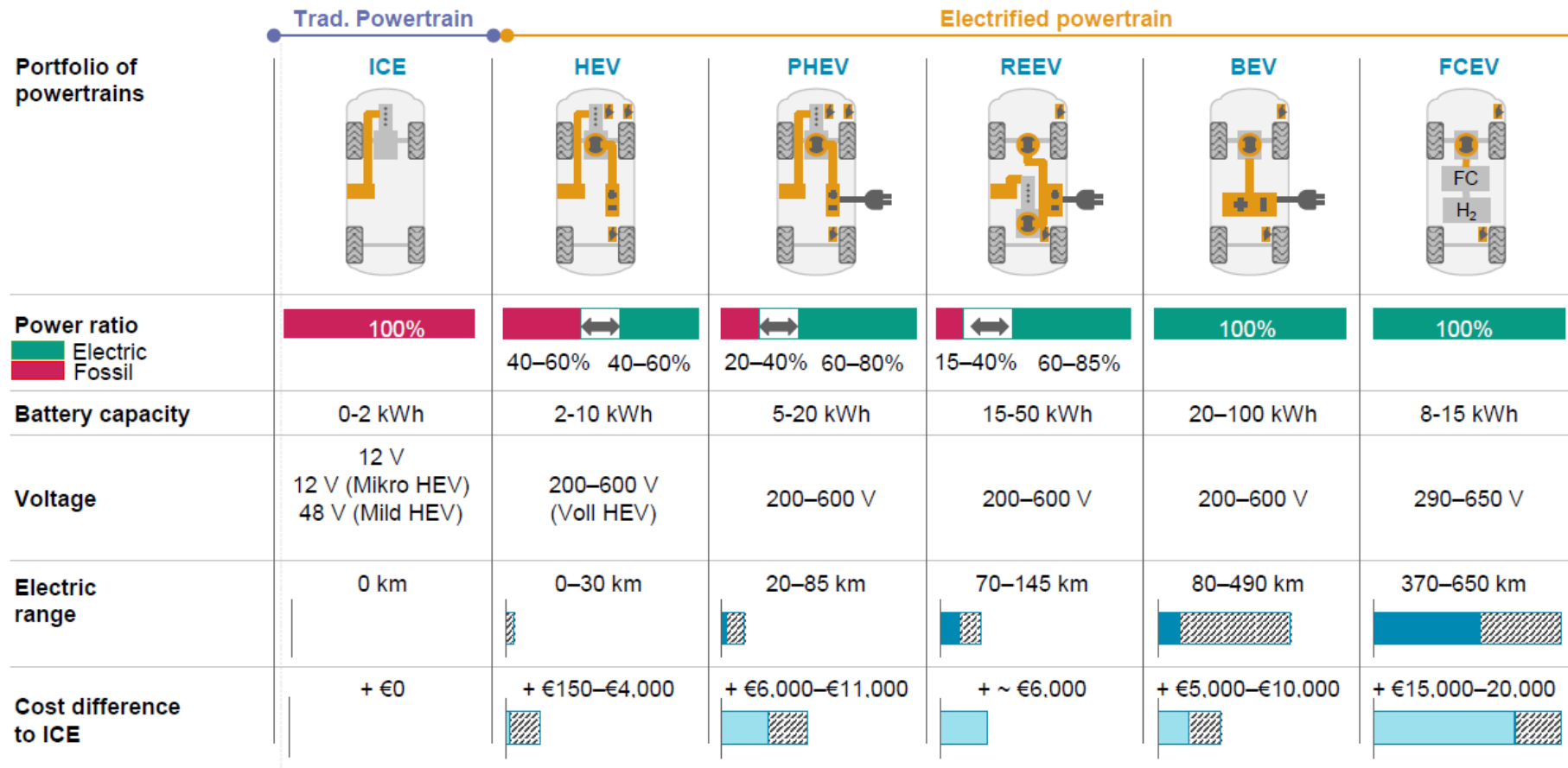
**WASTE MANAGEMENT**

- Reuse / Remanufacturing
- Recycle



# Change in Product

# Evolution of the powertrain portfolio



Fuel tank
 + Battery
 H<sub>2</sub> Hydrogen tank
 FC Fuel Cell
 ... ICE
 ⚙️ Electric motor
 ⚡ Electrified ancillary components

Source: Oliver Wyman (2018), Future automotive industry structure until 2030

# EV Implications on vehicle content

	HEV	PHEV	REEV	BEV	FCEV
ADDITIONAL COMPONENTS			Range extender		Fuel Cell
					Hydrogen tank
		Electric heating/cooling	Electric heating/cooling	Electric heating/cooling	Electric heating/cooling
	E-brake power assist	Electric brake power assist	Electric brake power assist	Electric brake power assist	Electric brake power assist
	High voltage wiring	HV wiring (incl. plug conn.)	HV wiring (incl. range ext.)	HV wiring	HV wiring
	Power electronics	PE (incl. charging electr.)	PE (incl. charging electr.)	PE (incl. charging electr.)	PE
	Gear box integration	Gear box integration	Fixed gearing	Fixed gearing	Fixed gearing
	E-machine (<60 kW)	Electric machine (<120 kW)	E-machine (50–200 kW)	E-machine (50–200 kW)	E-machine (100–113 kW)
Battery (<2.5 kWh)	Battery (<18 kWh)	Battery (16–33 kWh)	Battery (22–90 kWh)	Battery (<2 kWh)	
REDUNDANT COMPONENTS	Starter motor	Starter motor	Aux. systems (incl. starter)	Aux. systems (incl. starter)	Aux. systems (incl. starter)
	Electric generator	Electric generator	Electric generator	Electric generator	Electric generator
			Engine	Engine	Engine
			(Full) gear box	(Full) gear box	(Full) gear box
			Cooling	Cooling	Cooling
			Reduced fuel tank	Fuel supply (tank, pump,...)	Fuel supply (tank, pump,...)
			Reduced exhaust system	Exhaust system	Exhaust system

**Add. components:**

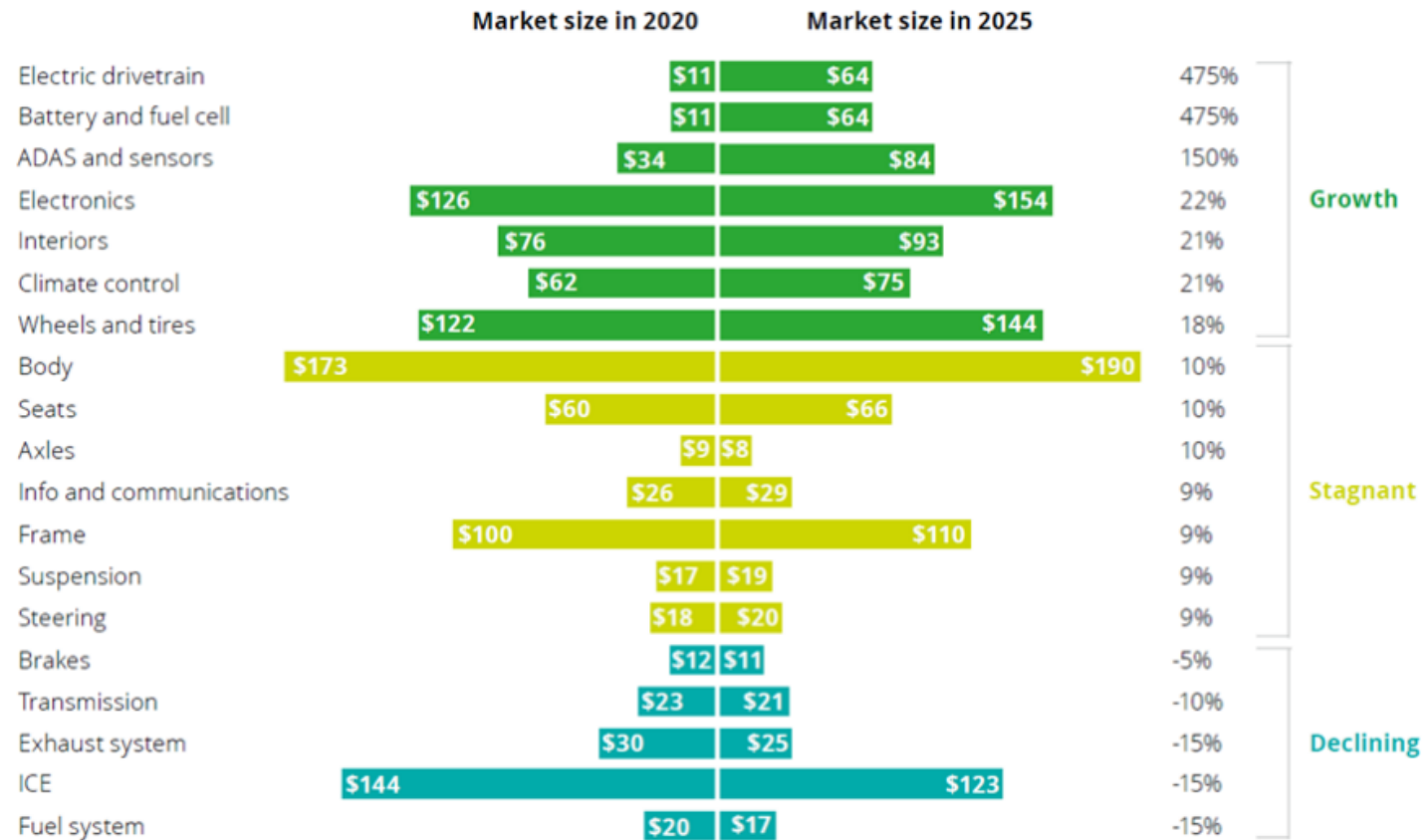
■ As in previous stage    
 ■ New compared to previous stage

**Redundant components:**

■ As in previous stage    
 ■ New compared to previous stage

# Auto part in next-generation automotive

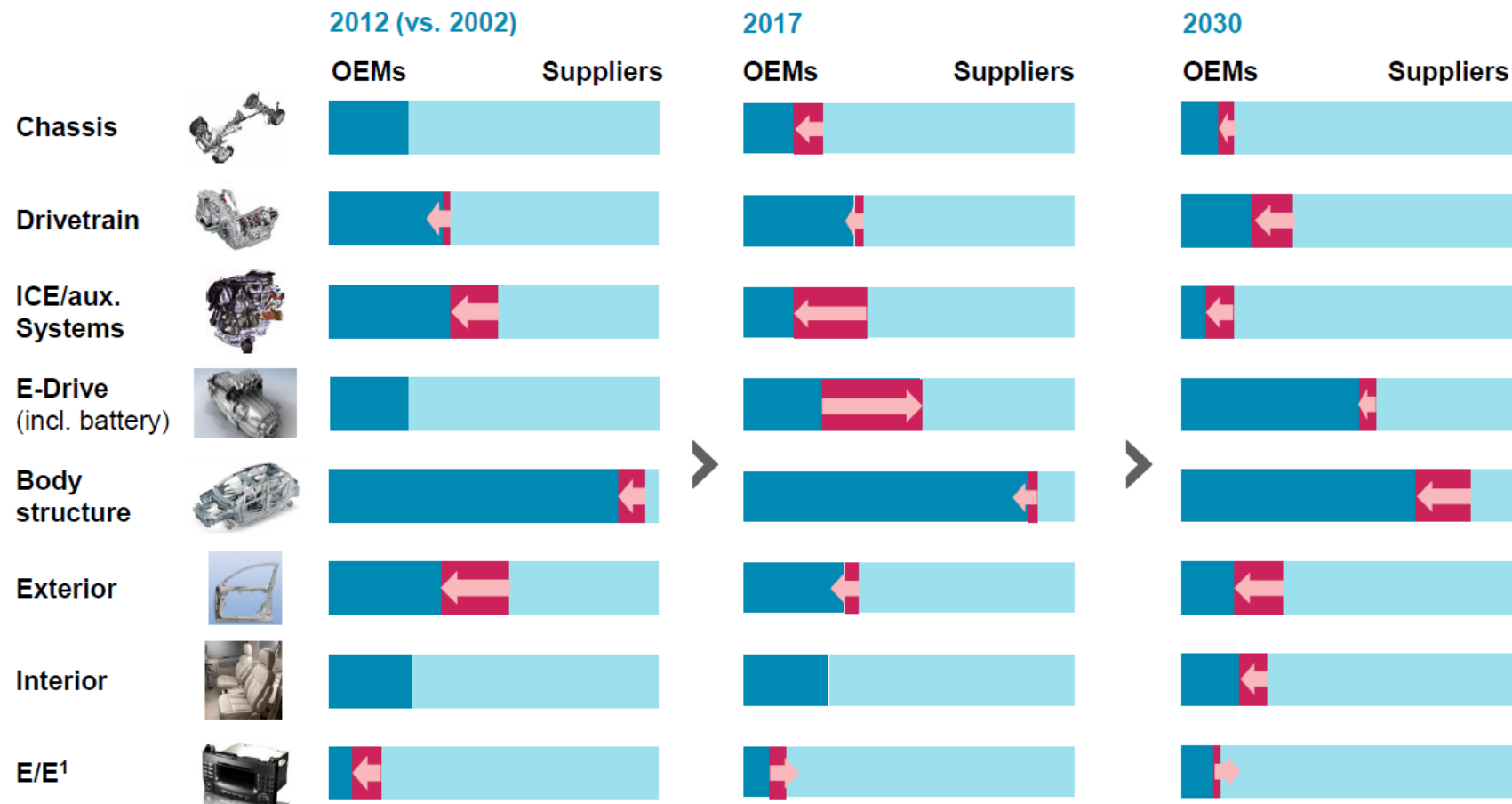
Transition from ICE to BEV will affect the market size of the supply chain





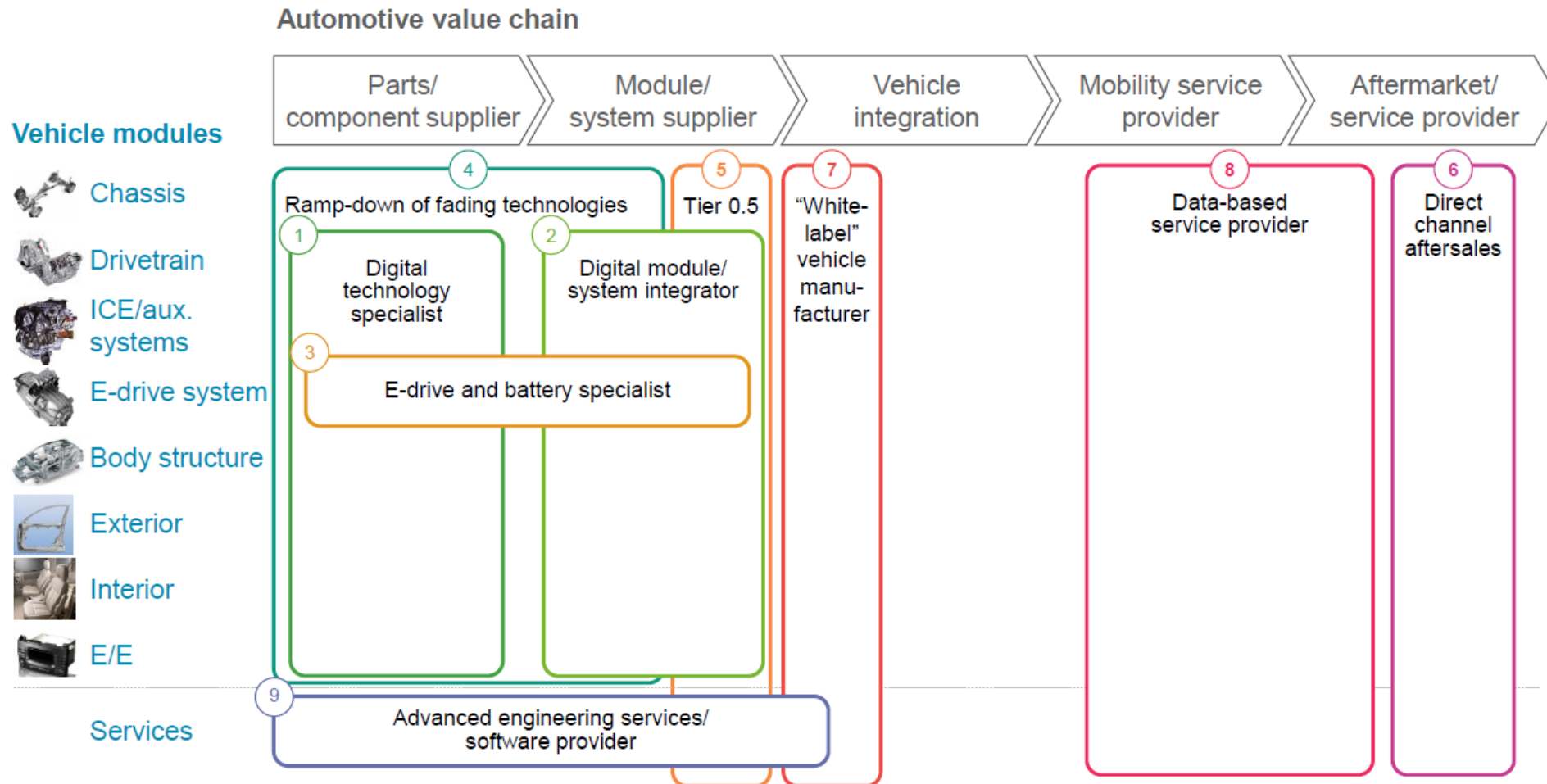
# Change in supply chain

# Vertical shifts in automotive value creation until 2030

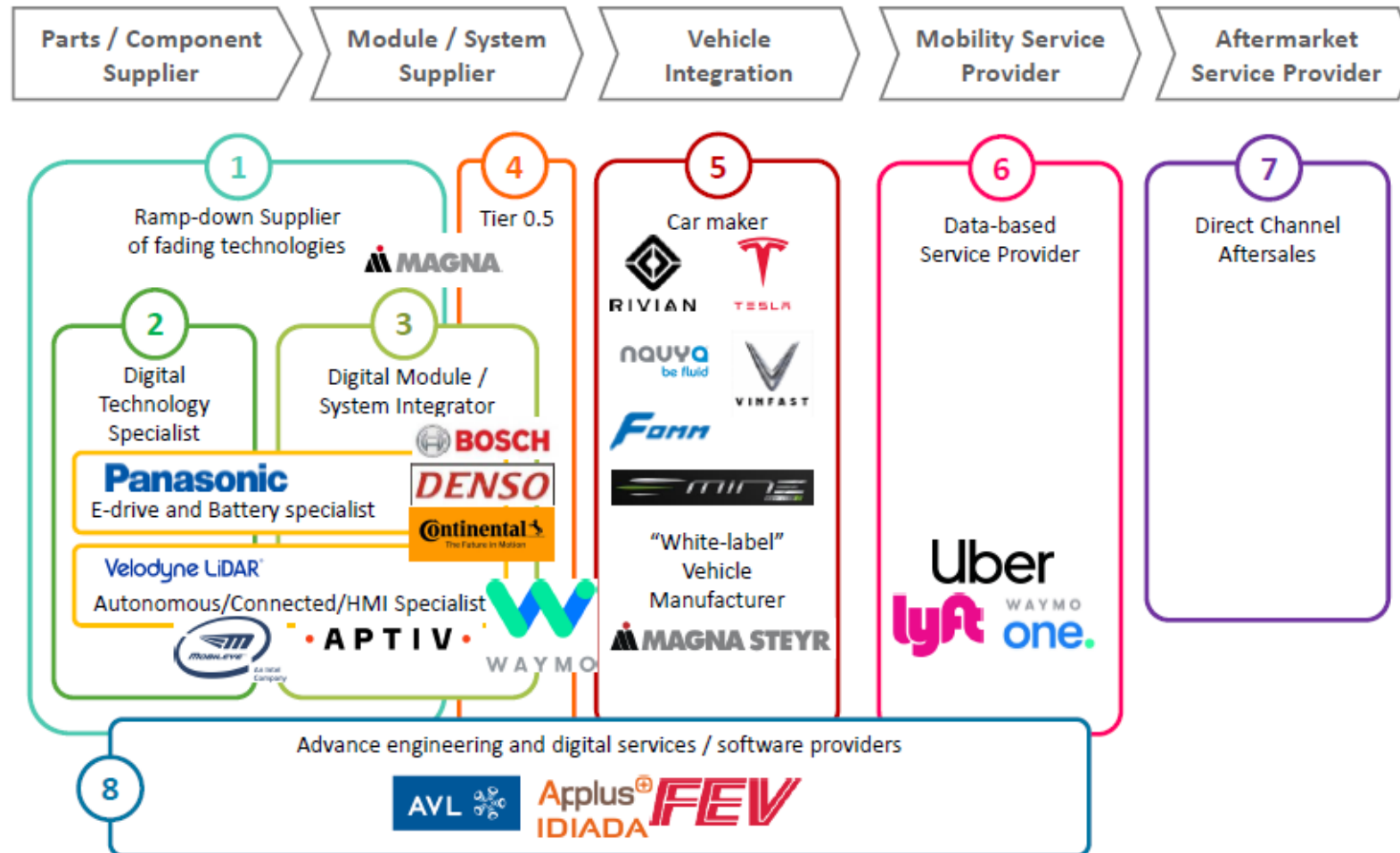




# Supplier business models 2030 (1/2)



# Supplier business models 2030 (2/2)





# Change in Process

# Technological Trends in the Automotive Industry [1/2]

## Vehicle Manufacturing Value Chain



## New technology from the 4.0 industry revolution

- AI aided design
- Digital twin

- Additive manufacturing (3D printing)
- Automation

- Automation

- Automation

- Personalized marketing
- Data driven marketing
- Digital marketing

- Shred service / Vehicle on demand

- On-the-air update
- Predictive maintenance
- Advance maintenance management

- Product life cycle management

# Technological Trends in the Automotive Industry [2/2]

## Vehicle Manufacturing Value Chain



## New technology from the next-generation automotive technology

- EV system development & design
- CAV package development & design
- Software development

- Electronic assembly
- Motor manufacturing
- Battery cell manufacturing
- Battery packing
- Optical sensor manufacturing

- EV platform integration
- CAV stack integration
- X in the loop simulation

- EV platform assembly
- CAV package assembly
- Infotainment assembly
- CAV end of line testing

- EV / CAV Transition advertising

- Mobility Service Platform Development
- Marketing
- Fleet management

- Battery maintenance
- Electrical safety check
- Sensor calibration

- Battery Repacking
- Battery Inspection
- Electronic waste management



# Change in Labor Knowledge and Skill

# New knowledge and skill for the next-generation automotive industry

## Vehicle Manufacturing Value Chain



### New Knowledge

1. Advance Digital Technology
2. CASE General Information
3. Multi Discipline Knowledge (Cyber-physical System, Mechatronic Eng.)
4. Electrical Knowledge (Electrical Eng., E&E/Sensor MFG, E&E/Sensor QC/QA)
5. Data Science
6. Computer and Software
7. Fully Automation MFG Process
8. New/Advance Material
9. Material Recycling and Recovery
10. Fleet Management

### New Skill

1. Advance Digital Skill
2. CASE Operation, Testing and Validation Skill
3. Multi Discipline Integration Skill (Cyber-physical System Integration.)
4. Electrical Skill. (E&E/Sensor MFG, E&E/Sensor Inspection, Testing and Validation, E&E Mechanic)
5. Data Analytic
6. Software / Application Development
7. Automation Machine Operation
8. Business Development

# New Job for the next-generation automotive industry

## New Job

### 1. Sustainable Management

### 2. Advanced Engineering

- 2.1 Advanced material engineer
- 2.2 Chemical engineer
- 2.3 E&E/Sensor QC/QA
- 2.4 Simulation modelling engineer

### 3. C.A.S.E. Technology

- 3.1 Battery management engineer
- 3.2 Upskilled car mechanic/maintainer
- 3.3 CAV testing engineer
- 3.4 Engineering business development

### 4. Automotive programming

- 4.1 Infotainment programmer
- 4.2 Cybersecurity specialist

### 5. Data science

- 5.1 Big data analytics
- 5.2 Data center operator
- 5.3 Data management specialist
- 5.4 Remote fleet manager
- 5.5 Machine learning engineer

### 6. Artificial Intelligence (AI)

- 6.1 AI Vision processing engineer
- 6.2 AI Ethics researcher/engineer

### 7. Advanced Manufacturing

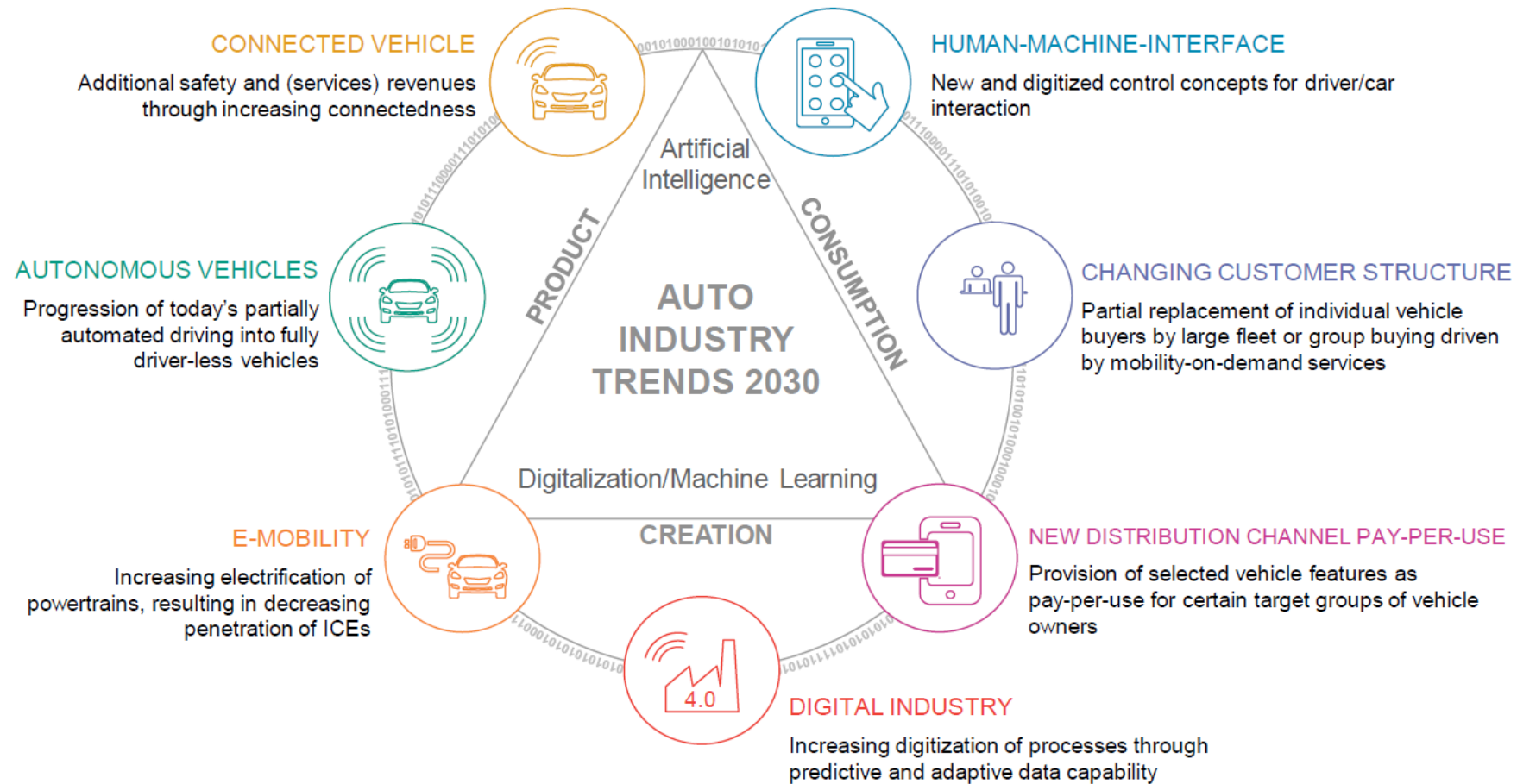
- 7.1 Electrical and electronic equipment assemblers
- 7.2 Electromechanical equipment assemblers
- 7.3 E&E module integrator
- 7.4 Additive manufacturing engineer
- 7.5 Fully automation MFG engineer

### 8. Vehicle End-of-life

- 8.1 Modern ELV specialists
- 8.2 Block chain developer
- 8.3 Cloud PLM operator



# Automotive industry trends until 2030



# THE WIND OF CHANGE

Change in technology of  
car product

“C.A.S.E.”

Change in production  
technology

“Industry 4.0”

Change in Players

“New Comers -  
More competition”

Change in Customers  
Behavior

“Adoption of new  
technology and concern  
of sustainability”

# Thank you

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