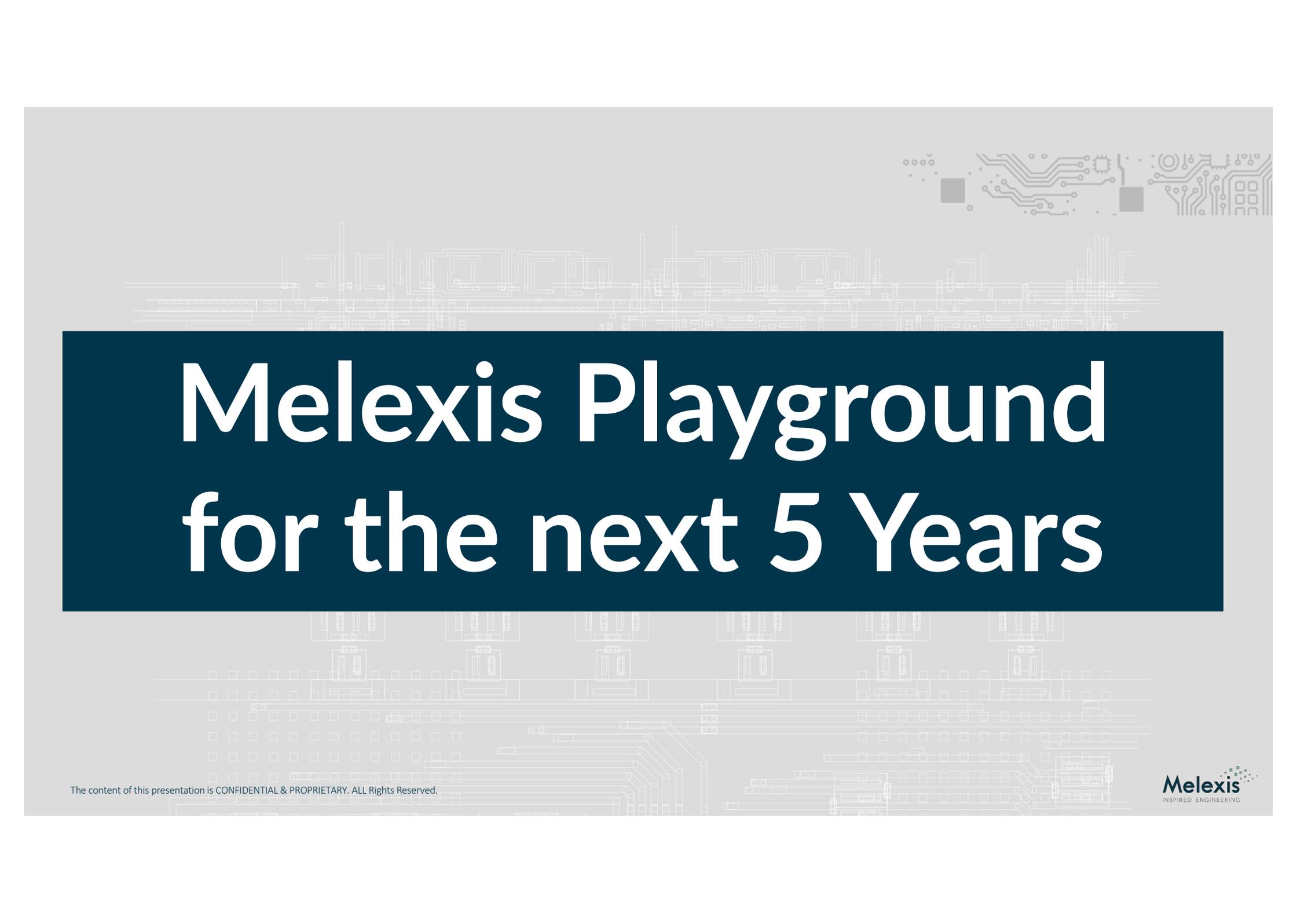




Sam Maddalena – Vincent Hiligsmann  
Analyst Day  
Wed. 5 Dec. 18



# Melexis Playground for the next 5 Years

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# Automotive Trends

Zero Emissions



(xHEV & xEV)

User Experience



(Customization)

Zero Traffic Fatalities



(Assisted & Autonomous Drive)

Communication



(V2V - V2I - V2X)

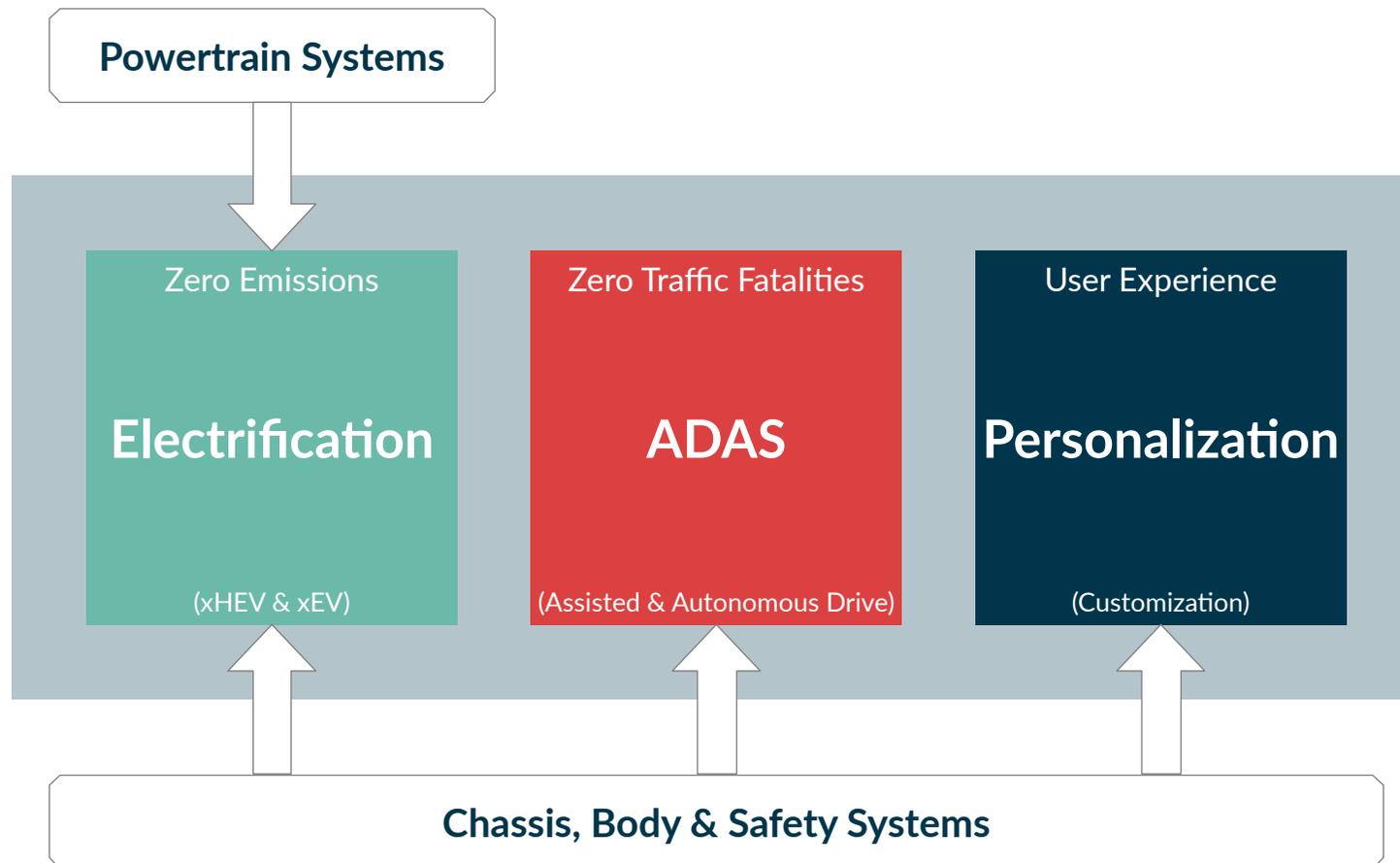
# Melexis vs Automotive Trends

Melexis enables  
**edge sensing & edge driving**

# Melexis vs Automotive Trends

Melexis engineers small, smart  
**Sensing** and **Driving** nodes  
supporting  
in-vehicle edge computing systems

# Melexis vs Automotive Trends



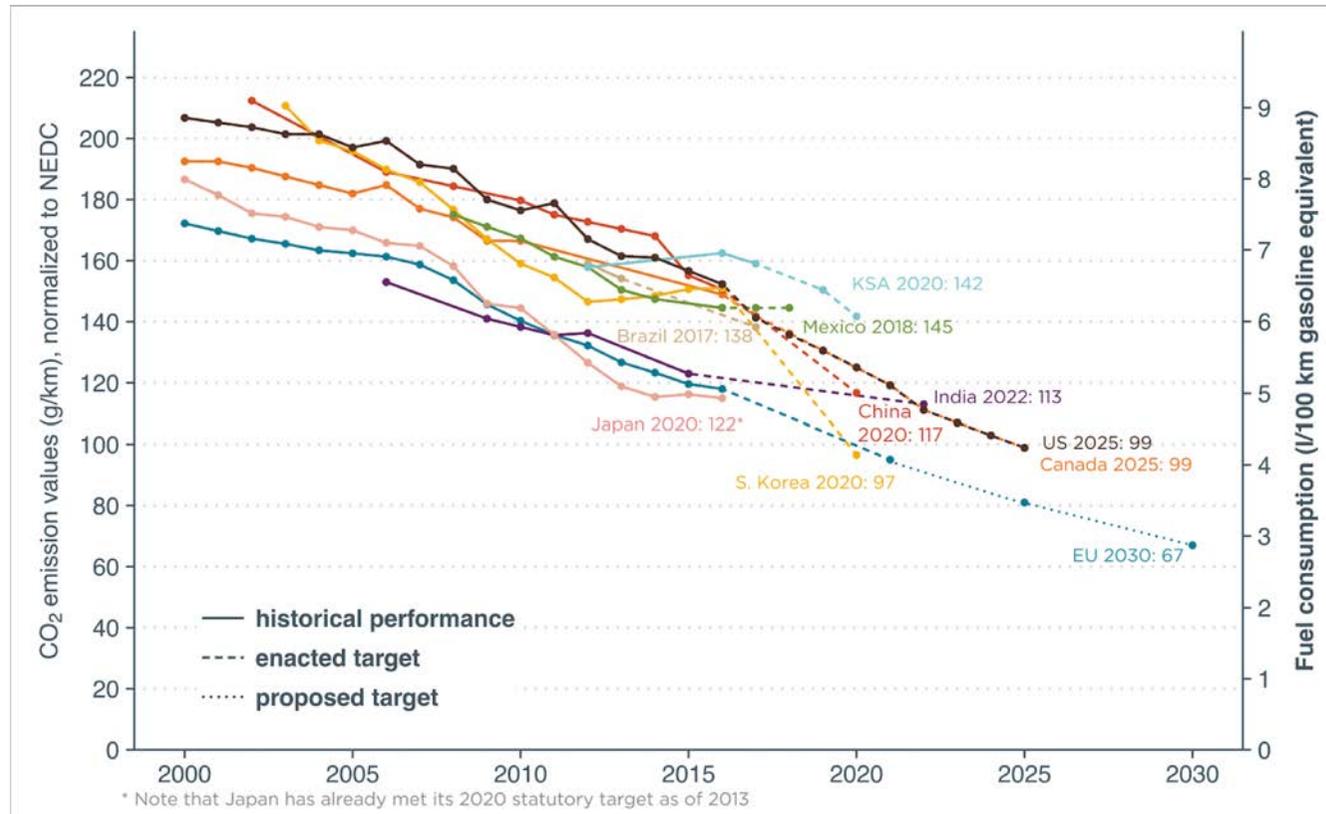


# Powertrain Systems

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# Powertrain Systems

## Growth Driver: Regulations – Emission Norms



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Source: ICCT – International Council on Clean Transportation

# Powertrain Systems



## Growth Driver: Regulations – Emission Norms

Euro Norm	5b	6b	6d-temp	6c	6d
From	1 Sep. 11	1 Sep. 14	1 Sep. 17	1 Sep. 18	1 Jan. 20
Cycle	NEDC		WLTP		
Conformity factor NOx RDE			2.1	1.5	
<b>Gasoline Engine</b>					
HC (mg/km)			100		
NOx (mg/km)			60		
CO (mg/km)			1000		
PM (mg/km)			4.5		
PM (/km)	-	6 x 10 <sup>12</sup>		6 x 10 <sup>11</sup>	
<b>Diesel Engine</b>					
NOx (mg/km)	180			80	
HC + NOx (mg/km)	230			170	
CO (mg/km)			500		
PM (mg/km)			4.5		
PM (/km)			6 x 10 <sup>11</sup>		

RDE: ReaDriving Emission Test – NEDC: New European Drive Cycle – WLTP: Worldwide Light-Duty Vehicle Test Procedure

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Source: ACEA – European Automobile Manufacturers Association

# Electrification

## Recent Press Clippings



### EU Parliament proposes tougher CO2 limits on cars and vans

October 4th 2018 | Multiple countries | Fuel sources

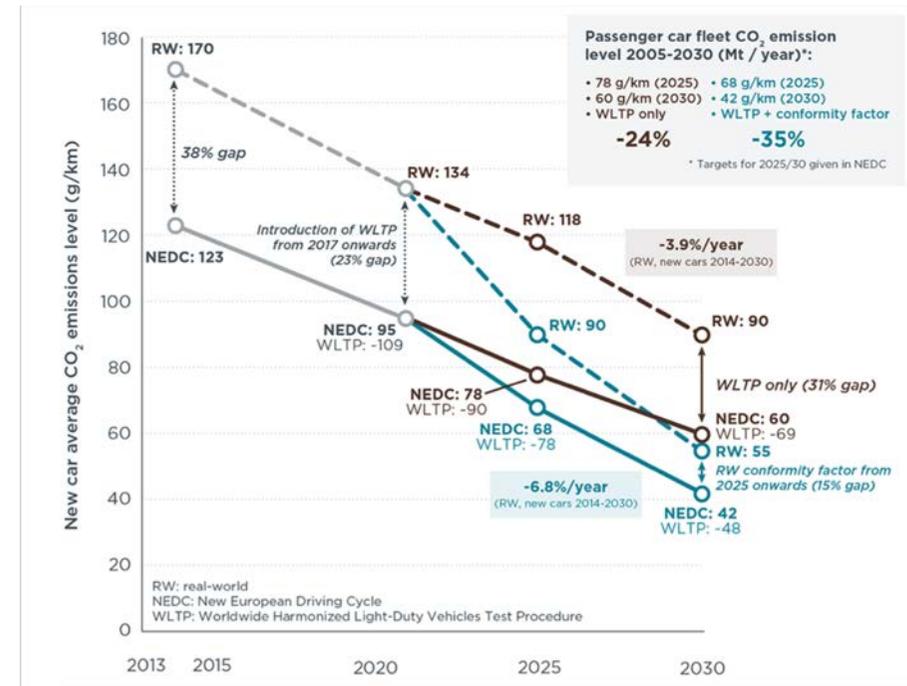
Parliament voted to raise the targets set by the EU Commission and set new goals for electric vehicle adoption.

Members of the European Parliament approved a draft law on October 3rd that would require vehicle-makers to cut carbon dioxide (CO2) emissions from across their new car and van fleets by 20% by 2025 and 40% by 2030, compared with 2021 levels. The Parliament also wants 35% of new cars sold from 2030 to be low-emission electric or hybrid models, up from just 1.5% in 2017. The interim target for 2025 is 20%.

### Chinese electric vehicle market is poised for explosive growth, says expert

- For the next couple of years, the market share of China's electric vehicles will grow by 40 percent, said Jacob George, vice president and general manager of Asia Pacific at U.S.-based global marketing information services company J.D. Power.
- China has said it aims to see total annual sales of 2 million electric and gasoline-electric hybrid vehicles by 2020 and for manufacturers to at least have one electronic vehicle produced by 2019.

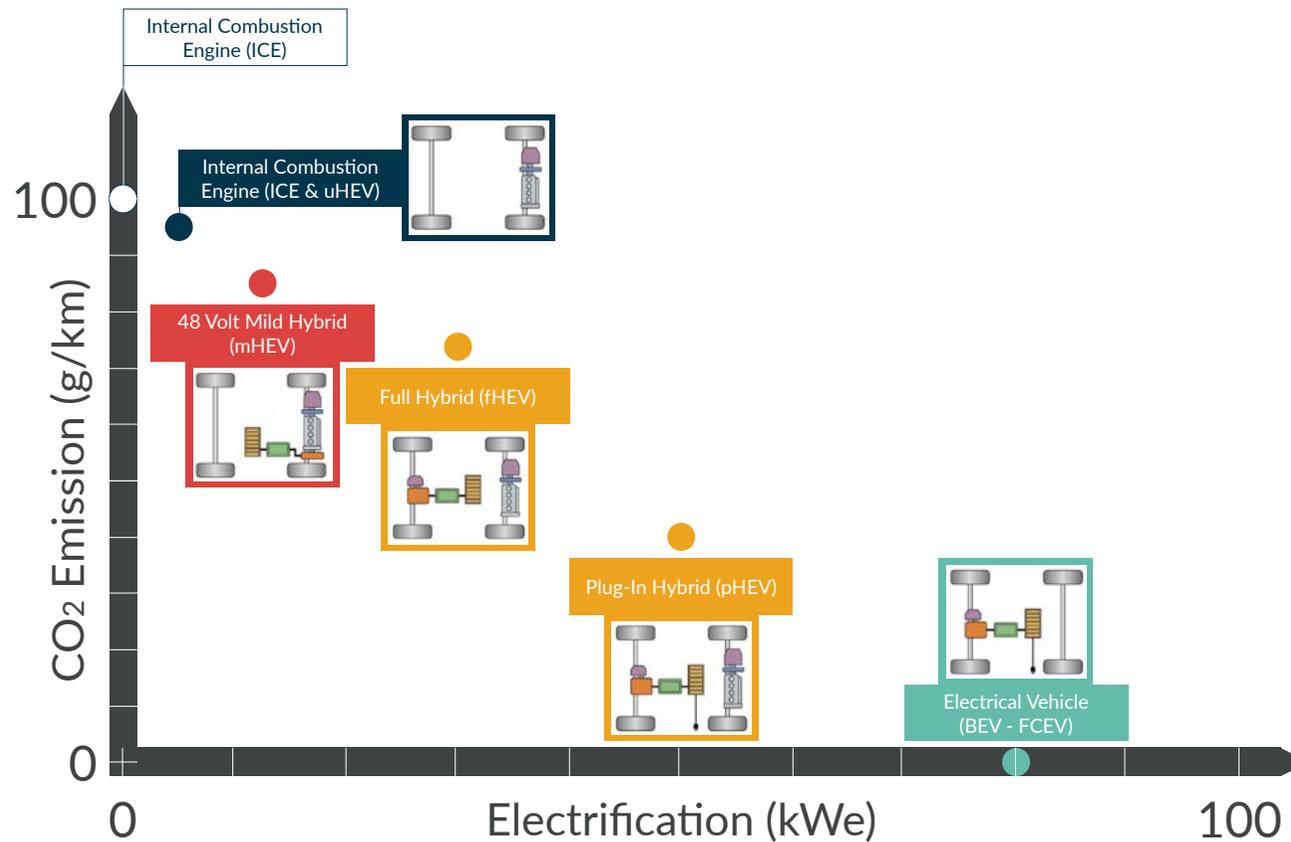
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Source: ICCT – International Council on Clean Transportation

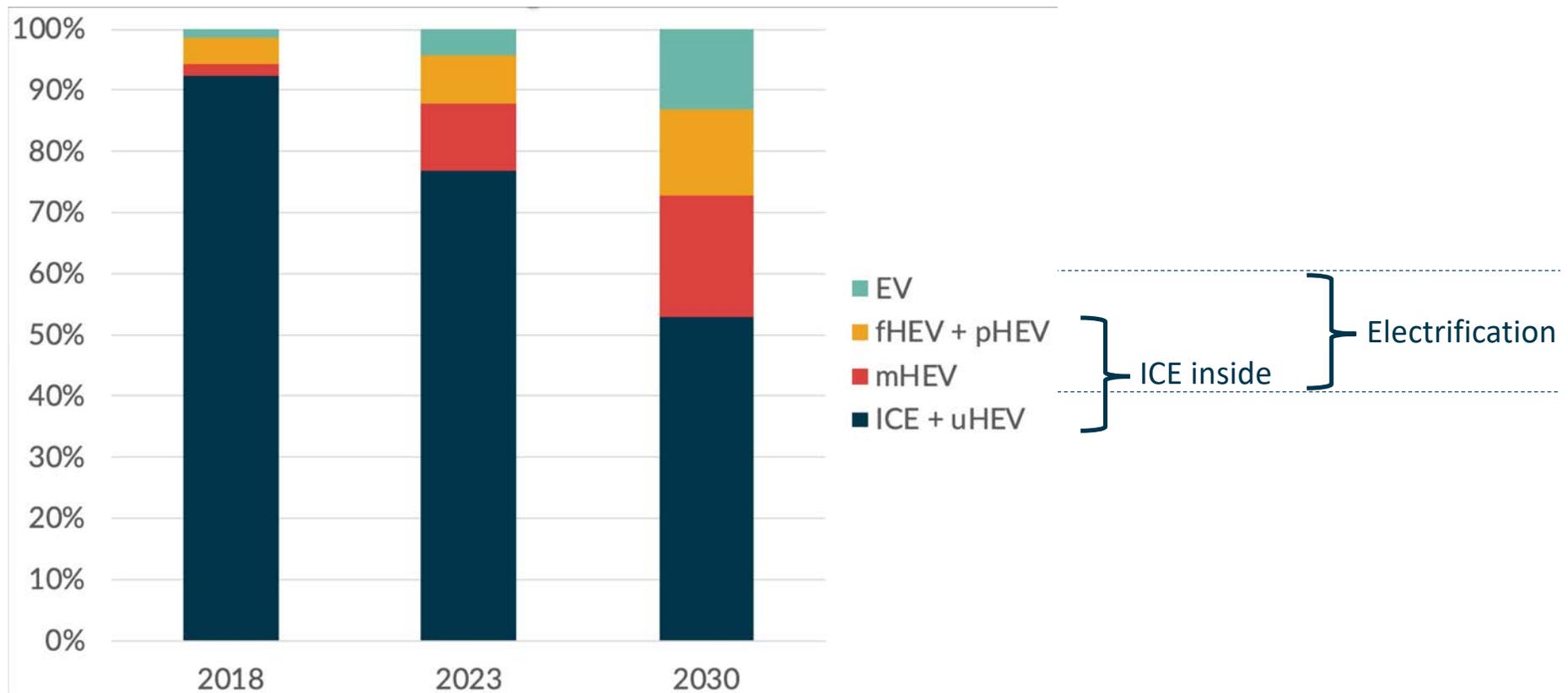
# Powertrain Systems

## Levels of Electrification



# Powertrain Systems

## Electrification – Segmentation – Market Split



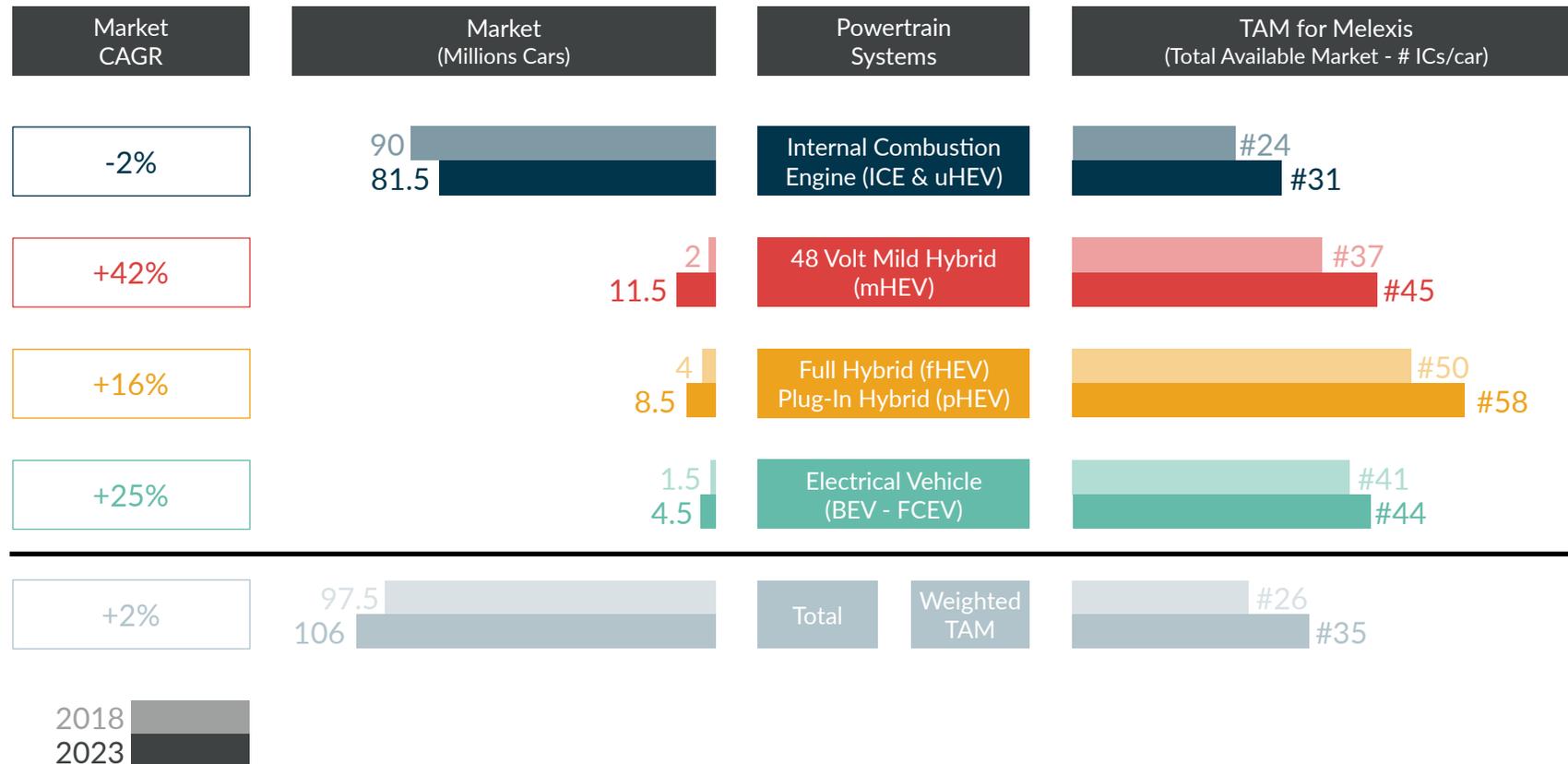
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Source: Strategy Analytics

# Powertrain Systems



## Electrification – Segmentation – TAM



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Source: Strategy Analytics and Melexis estimates

# ICE + uHEV

90  
81.5

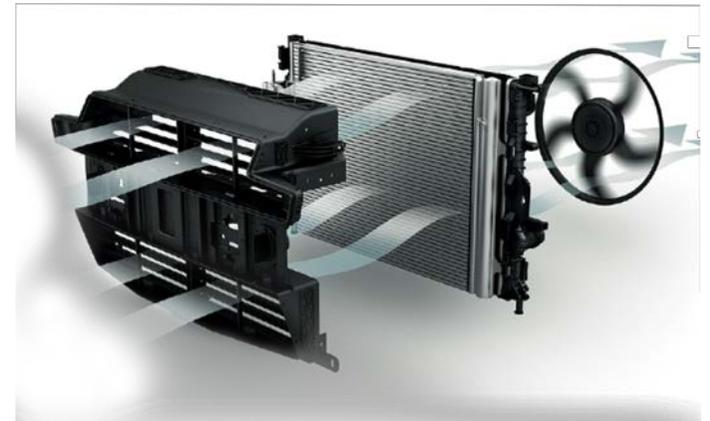
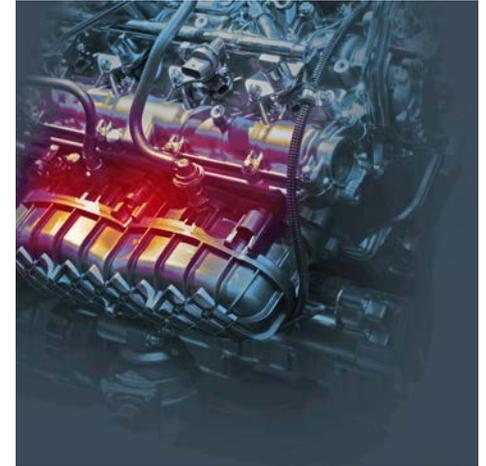
Internal Combustion  
Engine (ICE & uHEV)

#24  
#31

- Down-sized Engine (GDI, Turbo)
- Thermal Management
- Start-Stop Unit

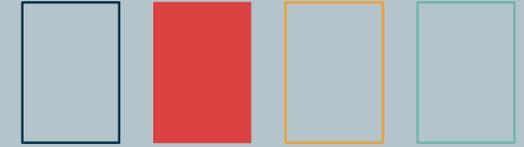


# ICE + uHEV



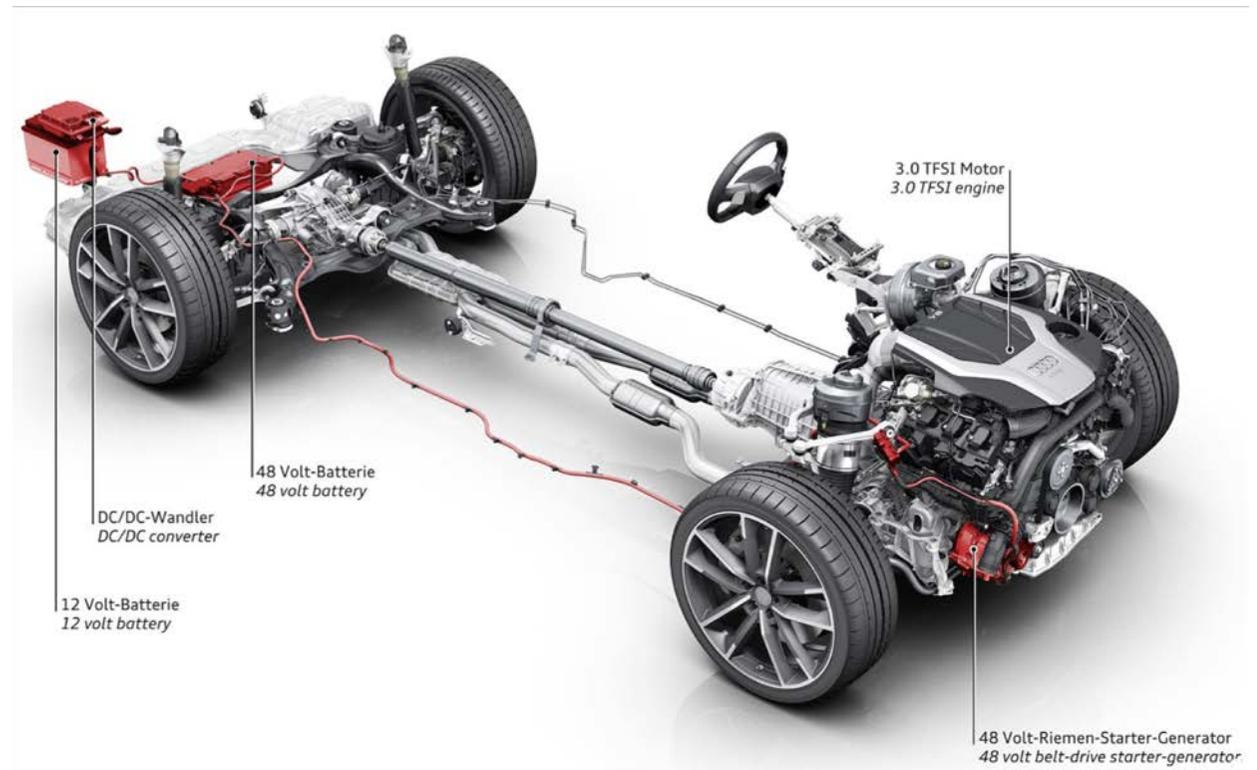
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# mHEV



11.5 <sup>2</sup> 48 Volt Mild Hybrid (mHEV) #37 #45

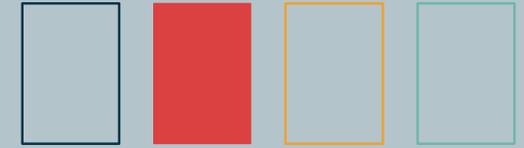
- Down-sized Engine (GDI, Turbo)
- Thermal Management
- 48 V Starter-Generator Unit
- e-Turbo
- Battery Monitoring
- DC/DC Converter (48-to-12)



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Source visual:<https://www.ni.audi.be/be/web/nl/modellen/a6/a6-avant/layer/drawer-powertrain.html>

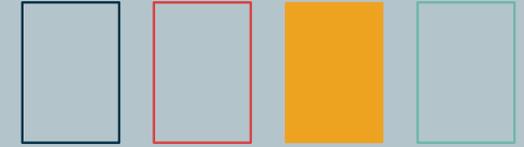
# mHEV



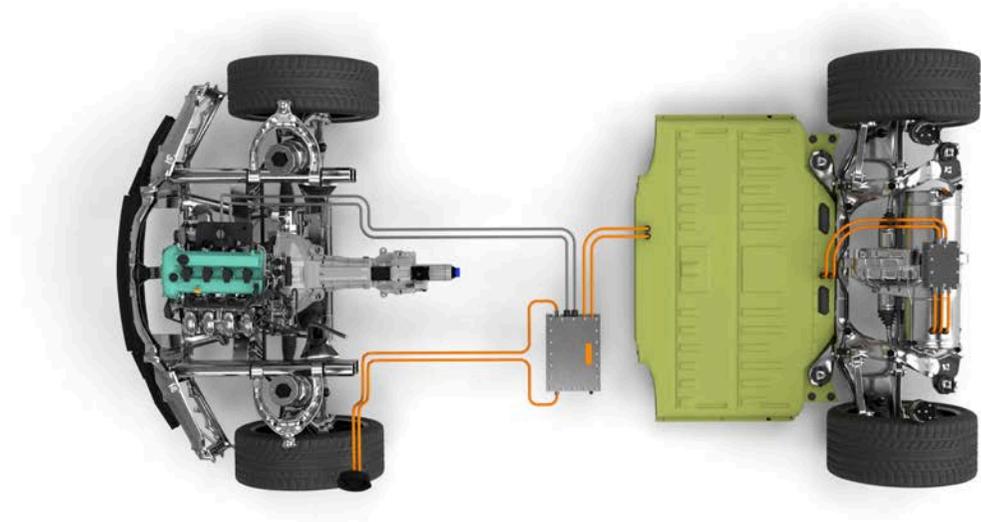
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Source visuals: <https://www.greencarcongress.com/2017/07/20170711-a8.html>  
<https://www.continental-automotive.com/en-gl/Passenger-Cars/Powertrain/Electrification/48-Volt-Mild-Hybrid/48-Volt-Auxiliaries/48V-e-Compressor>

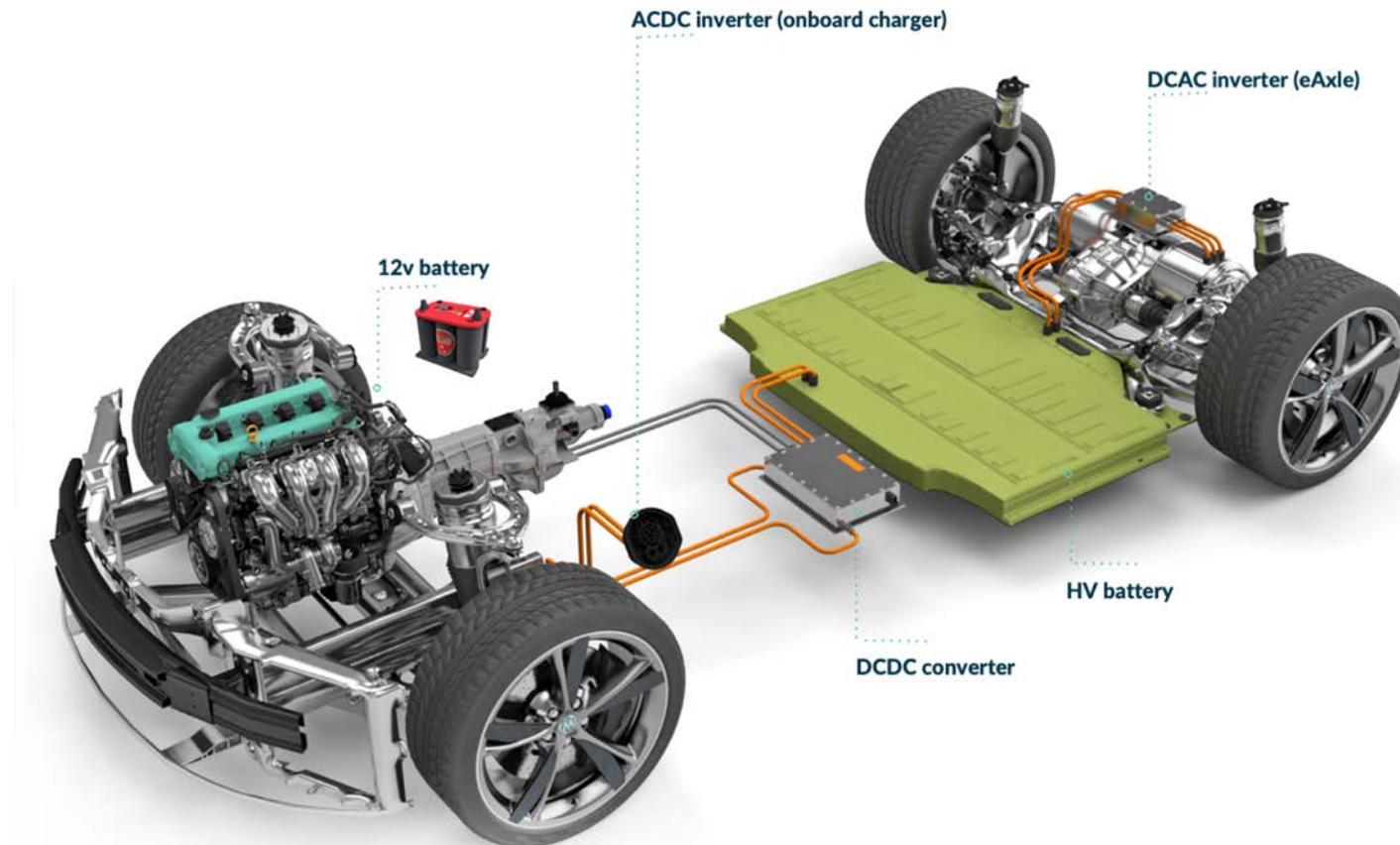
# fHEV + pHEV



- Down-sized Engine (GDI, Turbo)
- Thermal Management
- High-Voltage Inverter
- Battery Monitoring
- DC/DC Converters
- On-Board Charger (OBC)



# fHEV + pHEV



# EV



1.5 |  
4.5 |

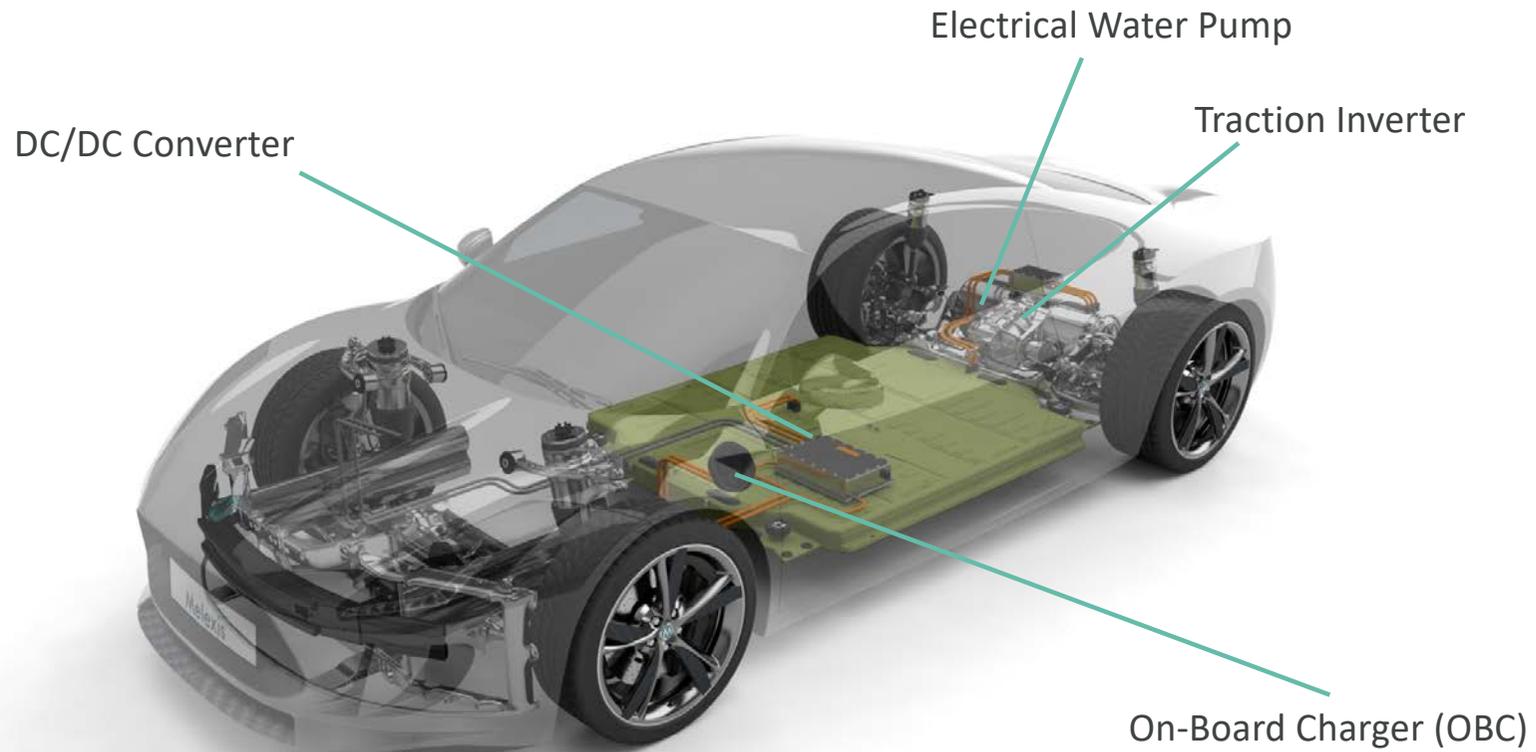
Electrical Vehicle  
(BEV - FCEV)

#41  
#44

- Thermal Management
- High-Voltage Inverter(s)
- Battery Monitoring
- DC/DC Converters
- On-Board Charger (OBC)



# EV





# Chassis, Body & Safety Systems

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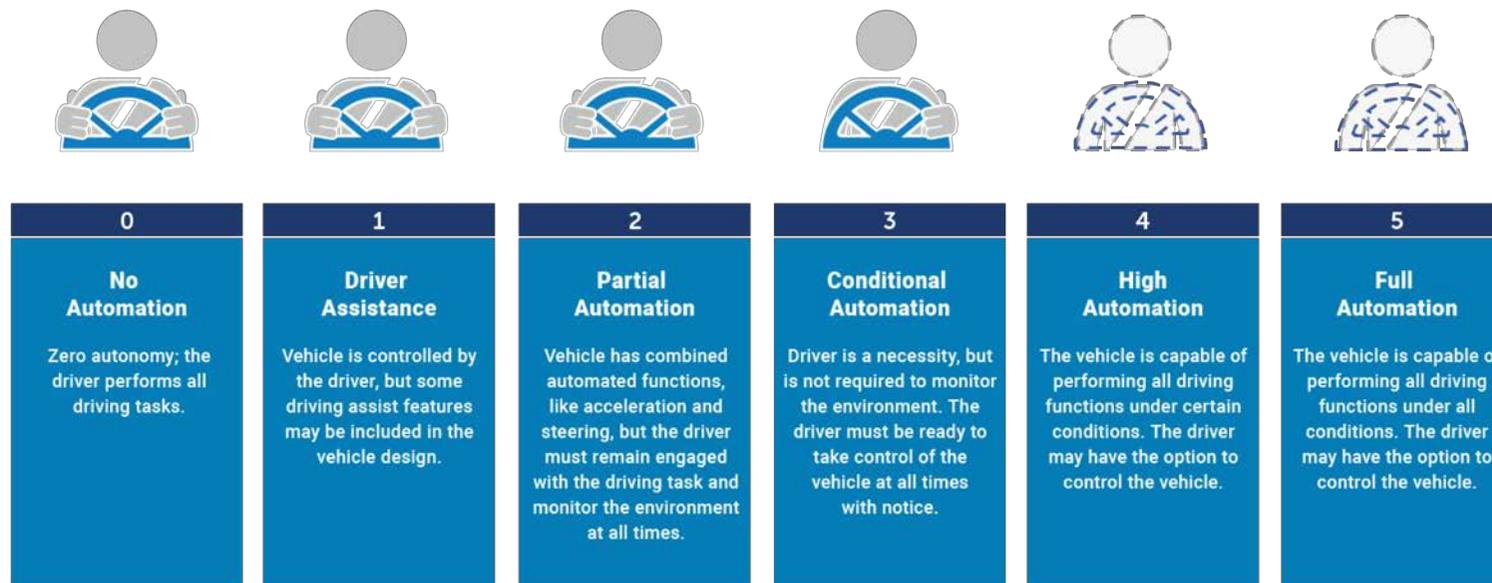
# Chassis – Body – Safety Systems

## SAE Automation Levels (SAE J-3016)



SOCIETY OF AUTOMOTIVE ENGINEERS (SAE) AUTOMATION LEVELS

Full Automation



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Source visual: Society of Automotive Engineers (SAE)



# Chassis – Body – Safety Systems

## Segmentation - TAM



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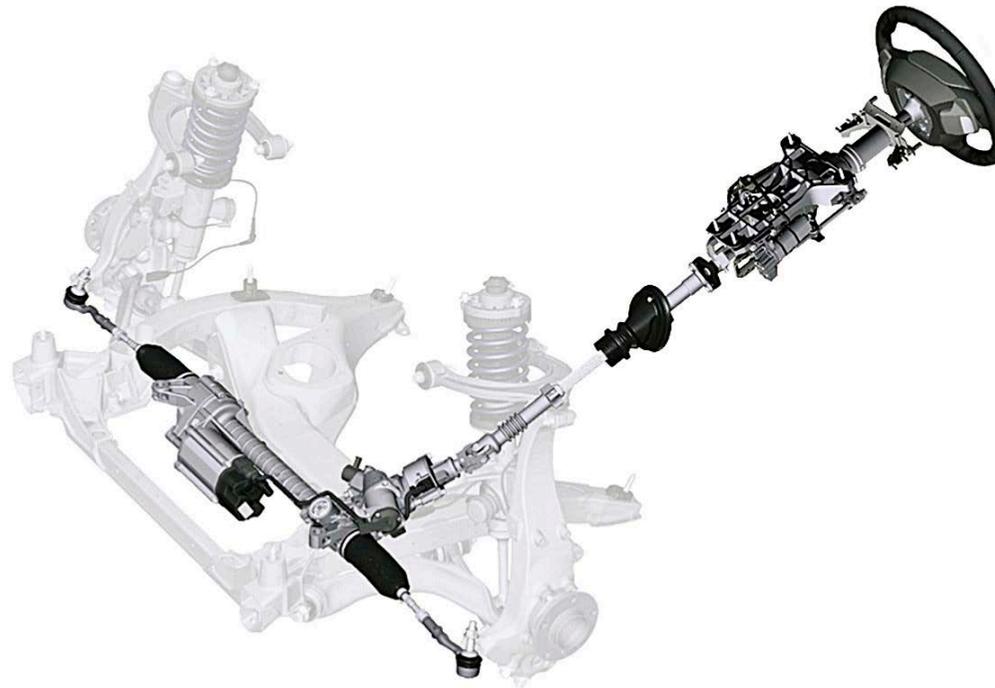
# Chassis - Steering

Chassis - Steering

#9

#12

- Market Trend = ADAS



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Source visual: <http://fertyimg.pw/Cremallera-de-direccin-hidraulica-Nissan-Tecnologia-t.html>

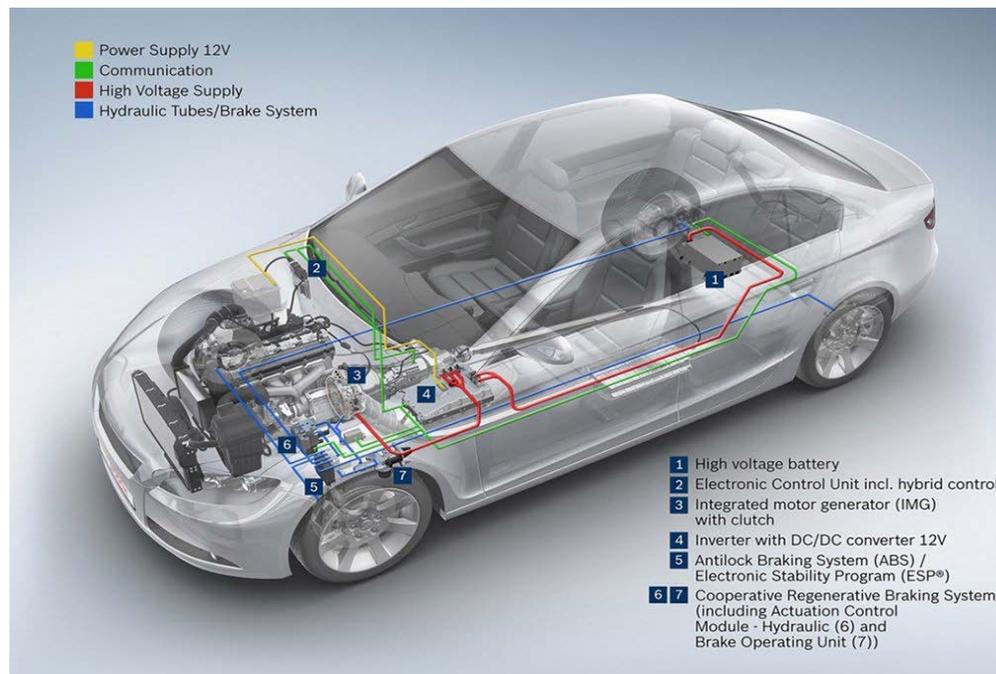
# Chassis - Braking

Chassis - Braking

#9

#11

- Market Trends = ADAS, Electrification



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Source visual: <https://www.autoevolution.com/news/bosch-parallel-full-hybrid-system-explained-23159.html>

# Body - Lighting



Body - Lighting

#6

#20

- Market Trends = Personalization, ADAS & Electrification



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Source visuals: BMW - <https://newatlas.com/bmw-530e-iperformance-review-hybrid/49934/>

# Body - HVAC

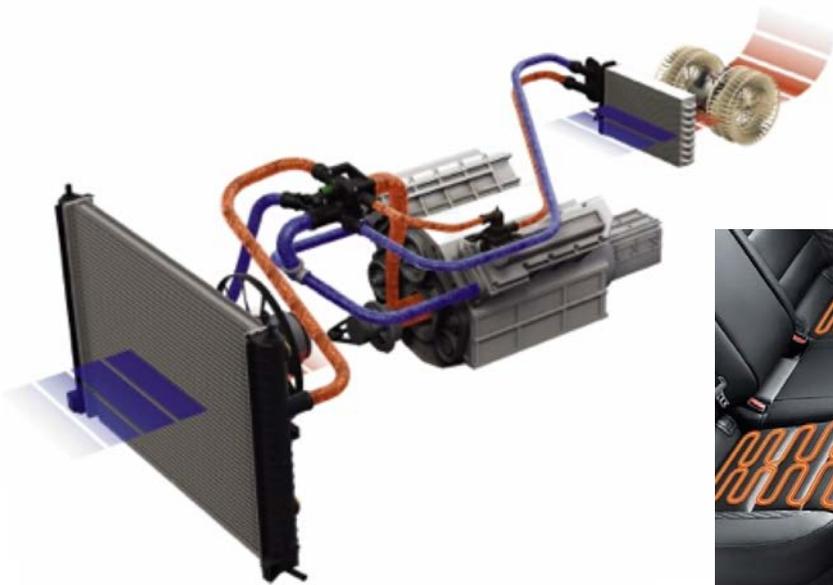


Body - HVAC

#6

#9

- Market Trends = Electrification & ADAS



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Source visuals: <https://www.autozeitung.de/klimaanlage-auto-wartung-funktion-187651.html>  
<http://www.autobytel.com/car-buying-guides/features/10-top-cars-with-air-conditioned-cooled-seats-131989/>

# Body – Others ↔ Seating System



Body - others

#22

#42

- Market Trends = ADAS & Personalization



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Source visual: <https://www.renault.com.sa/vehicles/new-vehicles/talisman/equipment.html>

# Body – Others ↔ Power Tailgate



Body - others

#22

#42

- Trend = Personalization



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Source visual: Youtube: X5 Rear Hatch | BMW Genius How-To

# Body – Others → Time-of-Flight/3D



Body - others

#22

#42

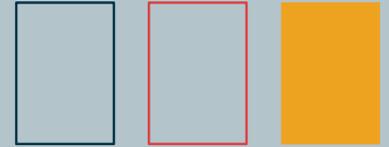
- Market Trends = ADAS & Personalization



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Source visuals: BMW - Melexis

# (Passive) Safety



(Passive) Safety

14

#18

- Market Trends = ADAS



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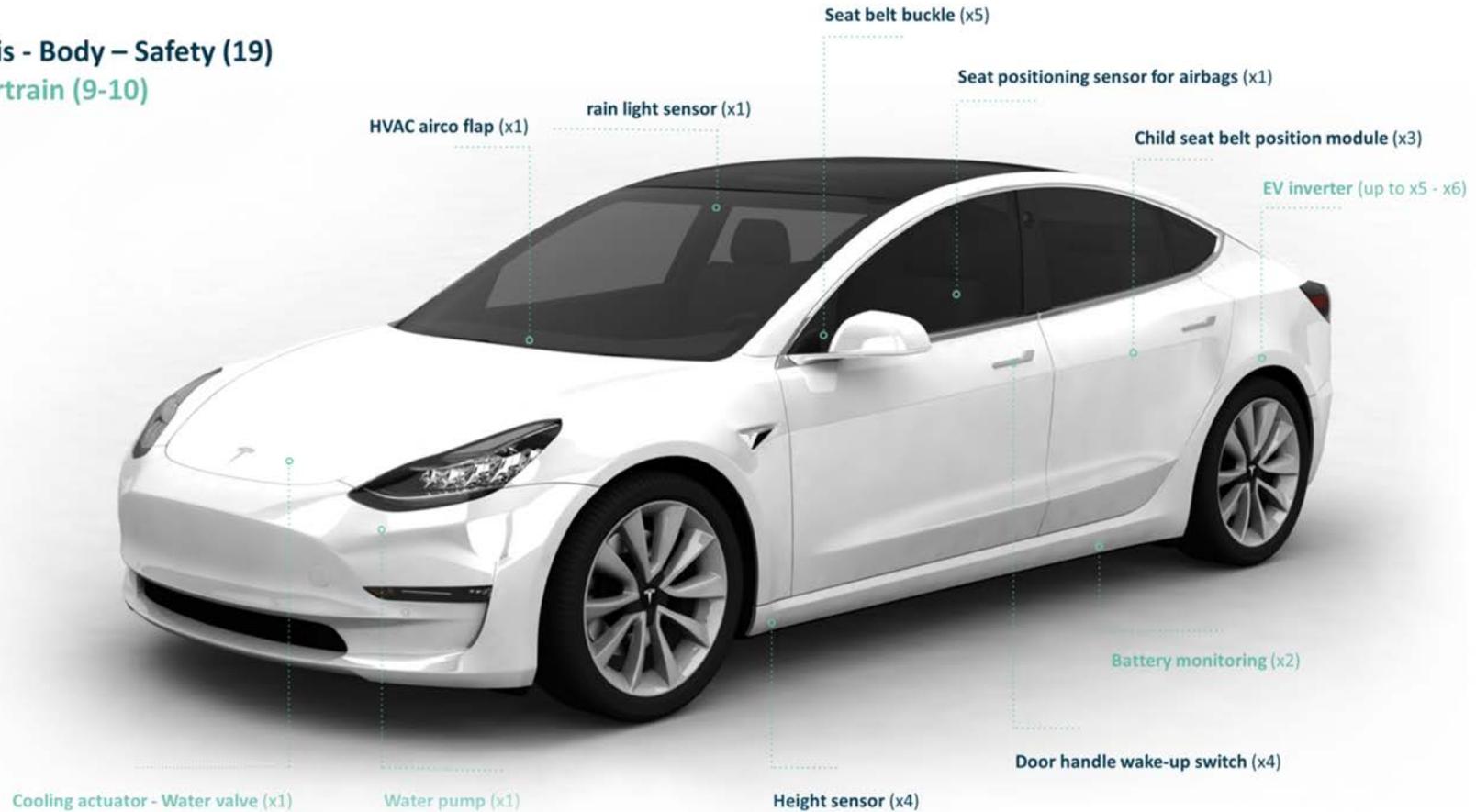
# Melexis *inside...*

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# Tesla Model 3

\* Chassis - Body – Safety (19)

\* Powertrain (9-10)



# BMW 530e

\* Chassis - Body – Safety (>30)

\* Powertrain (11)



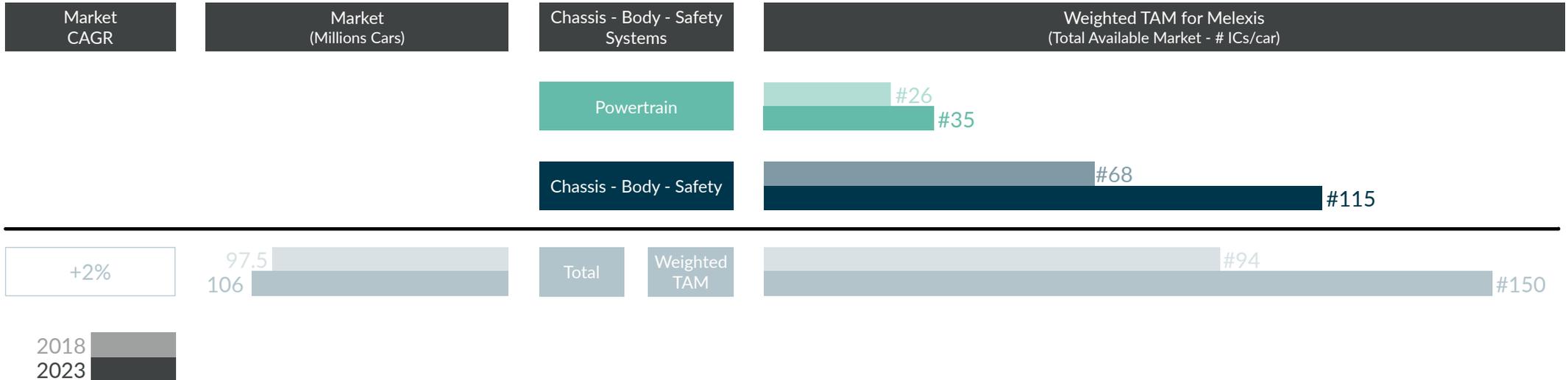
(1)GPU – Graphics Processing Unit  
(2)LIN – Local Interconnect Network



# Conclusion

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# Conclusion



## Take-Away

Melexis enables  
**edge sensing & edge driving**

We are all geared up, on  
our way to **20 ICs/car**