



# MEETING THE CO<sub>2</sub> CHALLENGE

## IMPLICATIONS FOR THE AUTOMOTIVE INDUSTRY

Discussion paper

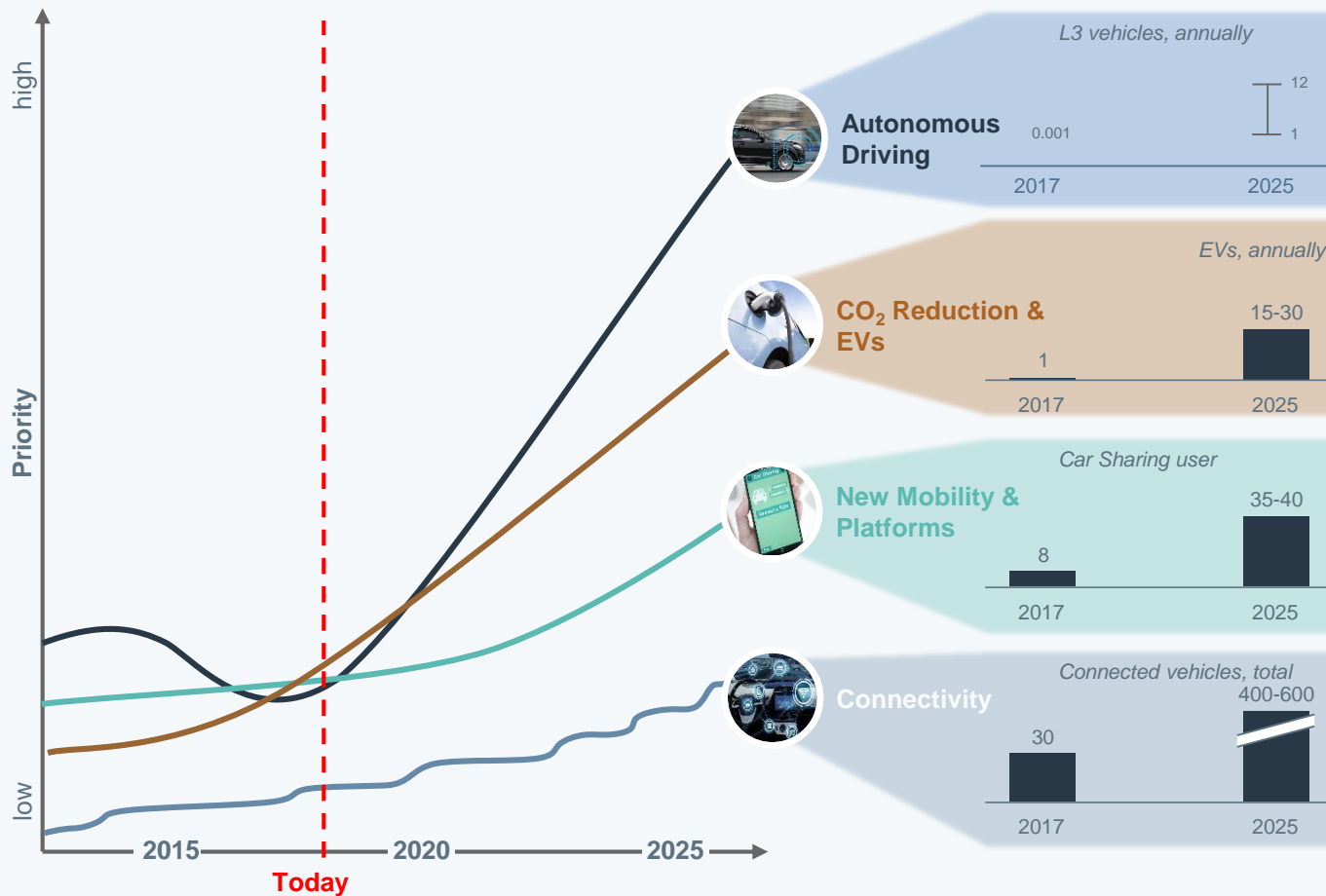
**PA CONSULTING GROUP**

**JUNE 2018**

# CO<sub>2</sub> TARGET ACHIEVEMENT

TOP items in the automotive agenda

PRIORITY OF CURRENT MEGATRENDS IN THE AUTOMOTIVE INDUSTRY AND CHANGE IN NUMBERS GLOBALLY\*



## IMPLICATIONS

THE STRATEGIC PRIORITISATION OF THE MEGATRENDS TAKES PLACE IN THOSE MAIN AREAS:

- Resources & invest
- Return
- Time-to-Impact

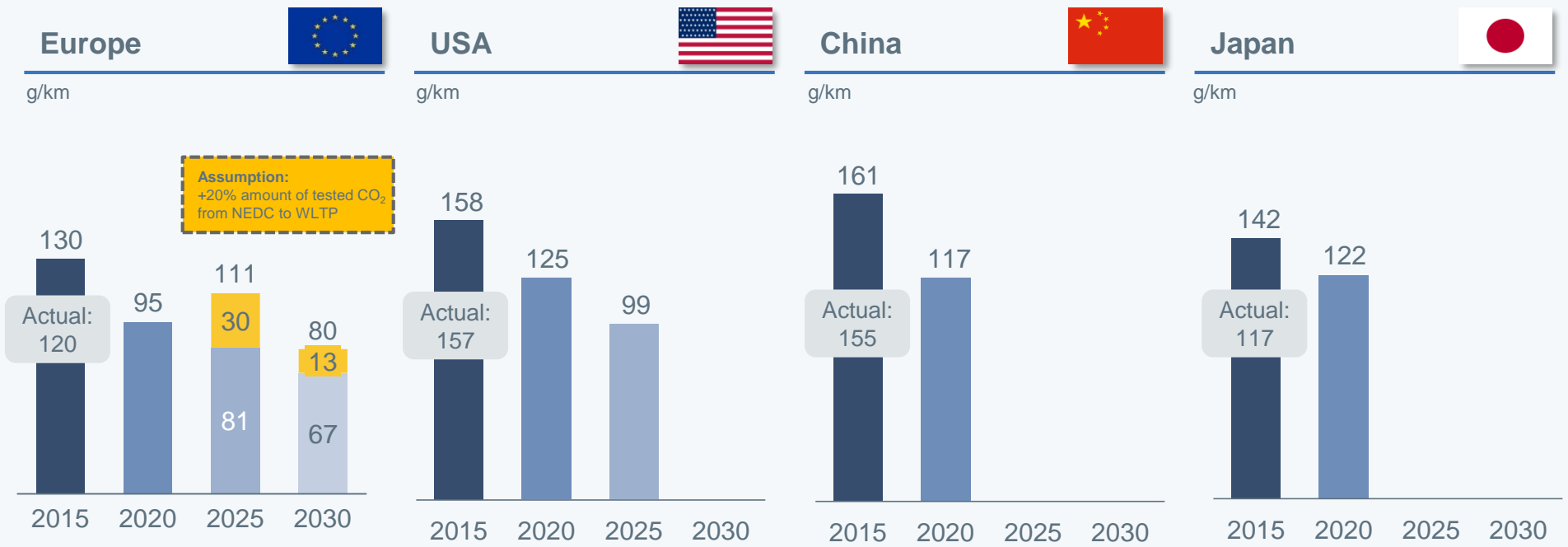
THE FOLLOWING DEVELOPMENT CAN BE OBSERVED:


- **Autonomous driving** after the first hype phase now rising sharply again and **dominating in the future**
- **CO<sub>2</sub> reduction** with increasing relevance by **tightening targets and impending driving bans**
- **Mobility platforms** currently stagnating and in a **consolidation phase** from 2020
- **Connectivity** is evolving along ever shorter release cycles

\*in million vehicles; Source: Citibank 2017, IHS Global Insight 2017, Statistica 2017, Frost & Sullivan 2016, Autofacts 2017, PA analysis 2017

# THE EU CO2 GUIDELINES ARE THE STRICTEST IN THE WORLD

New WLTP test cycle from 2025 leads to a further tightening



 A shorter phase-in period will apply to the target of 95g/km. **95%** of each manufacturer's new cars will have to comply with the limit value curve in **2020**, increasing to **100% in 2021**.  
 Penalty: 95 € / g CO<sub>2</sub> over the target x number of registered cars in EU27  
 Super-credits will also apply in the second stage of emission reductions, **from 2020 to 2022**. Each low-emitting car (**below 50g/km**) will be counted as::

- 2 vehicles in 2020
- 1.67 in 2021
- 1.33 in 2022
- 1 from 2023 for this second step, there will be a cap on the scheme's contribution to the target of 7.5g/km per manufacturer over the three years.

**2025 targets are 15% below 2020 and 2030 targets 30% below 2020**

# THREATENING DRIVING BANS AND GOVERNMENT INCENTIVES

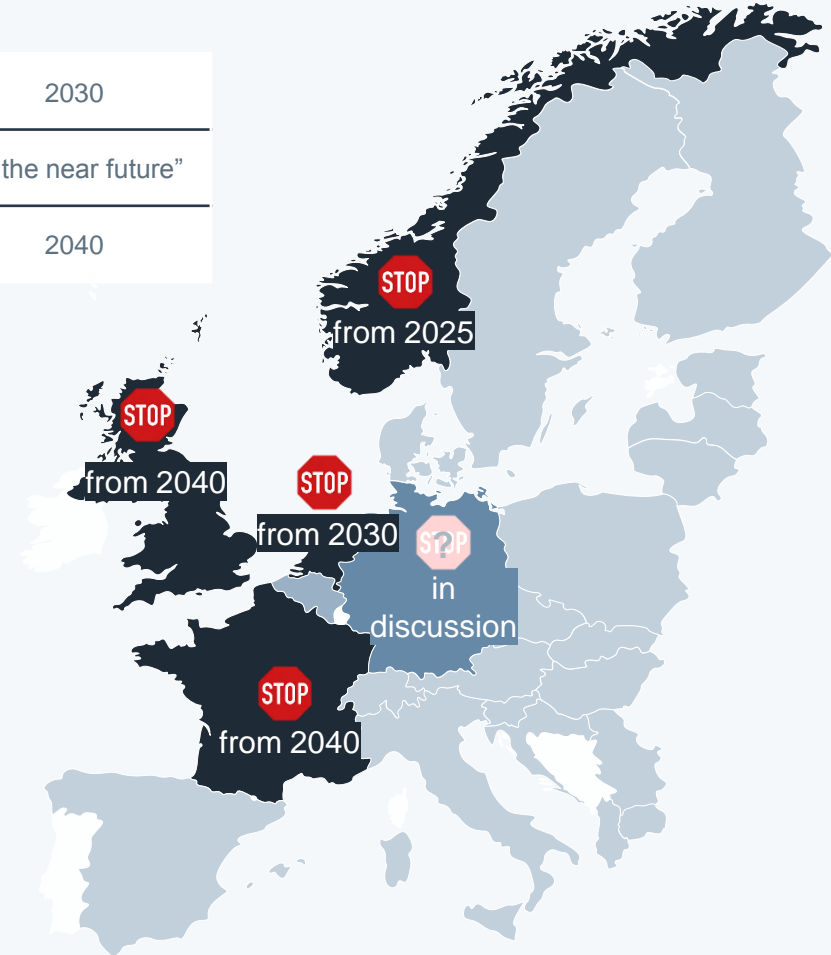
Pressure for action for car makers continues to grow

## Government incentives for BEVs & HEVs

	Subsidies at purchase	Vehicle tax reduction	VAT Reduction	Financial incentives	Other incentives (like free parking, use of bus lanes)
Austria	x	x	x	x	x
Belgium	x	x		x	
Denmark		x			x
Finland	x	x			
France	x	x		x	x
Germany	x	x		x	x
Greece		x		x	
Ireland	x	x	x	x	x
Italy		x			
Netherlands		x		x	
Norway		x	x	x	x
Portugal	x	x		x	x
Spain	x	x		x	x
Sweden	x	x		x	
Switzerland		x		x	
United Kingdom	x	x		x	x











## Planned driving bans for combustion engines

	India	2030
	China	"in the near future"
	California	2040



# 7 OUT OF 11 OEMS ARE LIKELY TO MISS THE TARGET EMISSIONS 2021

Without higher sales of e-vehicles, fines will amount to billions

OEM groups	Deviation in 2021 (CO <sub>2</sub> in g/km)	Penalty 2021 (in Mio. €)	Penalty 2021 in % of EBIT in 2017	Planned activities	Total BEV und PHEV to reach 2021 (000s)
	-13.4	-		<ul style="list-style-type: none"> <li>Master in downsizing and in platform thinking</li> <li>OEM with the highest PHEV, new Brand Polestar</li> <li>New models after 2019 with electrical motors</li> </ul>	100
	-11.0	-		<ul style="list-style-type: none"> <li>Pioneer in hybrid cars</li> <li>Starting so switch to electrical cars and fuel cells</li> <li>Toyota will have 10 new electrified models by 2020</li> </ul>	40
	-4.6	-		<ul style="list-style-type: none"> <li>Pioneer of electrical cars of traditional OEM's</li> <li>Zoe / Leaf – most sold e- vehicle globally</li> <li>Renault will introduce 8 electric models &amp; 12 electrified models by 2022</li> </ul>	300
	-1.1	-		<ul style="list-style-type: none"> <li>High efficient new engine platform diesel/petrol</li> <li>Will introduce I- Pace in 2018 – 400-500 km</li> <li>All new cars will offer an electric power train from 2020</li> </ul>	40
DAIMLER	1.4	200	1%	<ul style="list-style-type: none"> <li>smart will be transformed into a e- Car brand 2020</li> <li>EQ - electrical brand</li> <li>Daimler introduces Diesel PHEVs in C, E and GLC</li> </ul>	130
	2.4	290	7%	<ul style="list-style-type: none"> <li>Put their money on fuel cells, hydrogen and electrical</li> <li>8 electric cars by 2020, dedicated EV platform</li> <li>Successful launch of Ioniq as EV, hybrid and plug-in hybrid</li> </ul>	130
	2.4	570	17%	<ul style="list-style-type: none"> <li>PSA conventional engines are more CO<sub>2</sub> efficient than from Opel</li> <li>Low Emission Vehicles Business Unit created to reach PSA's CO<sub>2</sub> objectives</li> <li>PSA to share powertrain platform with Opel (e.g. Grandland X, Corsa, Combo)</li> </ul>	150
	2.8	1,200	8%	<ul style="list-style-type: none"> <li>New innovative e- Platform introduced to market in 2019</li> <li>Will invest 34 bn. € for 50 E- cars and Autonomous driving until 2030</li> <li>Porsche targets for 50% hybrid or battery models of entire sales by 2025</li> </ul>	400
	3.7	500	5%	<ul style="list-style-type: none"> <li>Weak EV pipeline until 2020</li> <li>12 electric cars by 2025</li> <li>Sold &gt; 100.000 electric cars in 2018 globally</li> </ul>	150
	4.0	455	8%	<ul style="list-style-type: none"> <li>Currently one EV (Focus EV) and 4 hybrids</li> <li>\$11bn on 40 new electric car models by 2022</li> <li>16 will be fully electric and the rest will be plug-in hybrids</li> </ul>	70
	10.1	1,300	21%	<ul style="list-style-type: none"> <li>The Jeep success contradicts CO<sub>2</sub> reduction =&gt; Wrangler PHEV offer 2020</li> <li>OEM with the highest car share with gas engines: 6-11%</li> <li>FCA will most likely stop selling diesel cars from 2022 onwards</li> </ul>	130



# FUTURE MOBILITY PERFORMANCE SCORE

## SIX KEY FACTORS FOR CAR MAKERS' E-MOBILITY SUCCESS

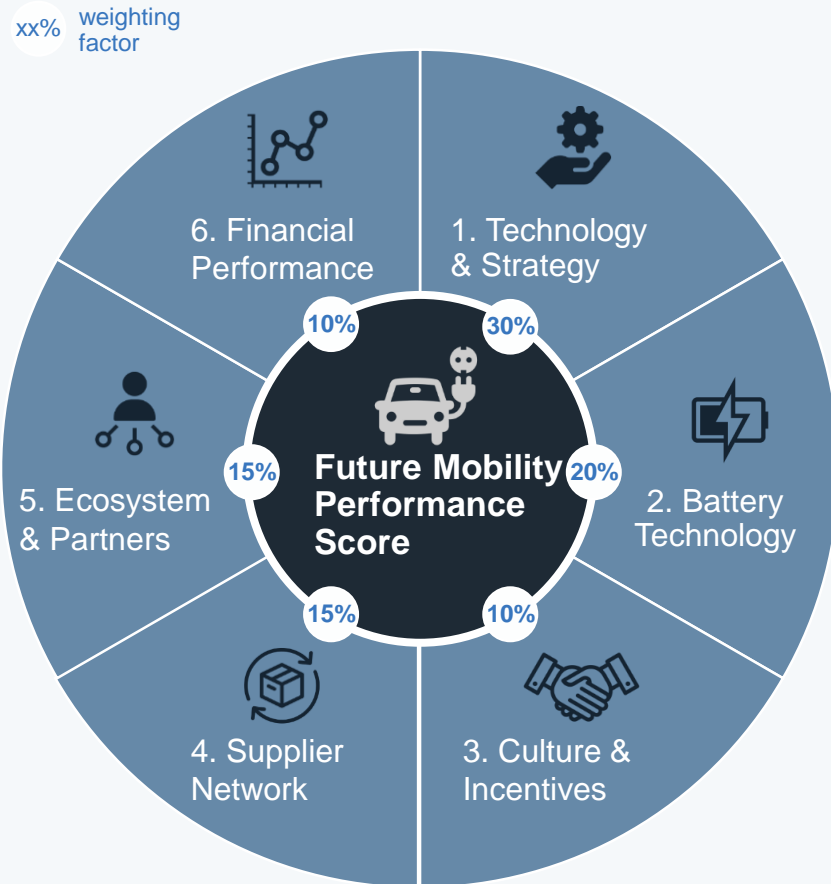
PA CONSULTING

JUNE 2018

# PA'S FUTURE MOBILITY PERFORMANCE SCORE FOR TOP 13 GLOBAL CAR MAKERS

SIX KEY FACTORS INDICATE CAR MAKER'S POTENTIAL TO SUCCEED IN E-MOBILITY

## PA's Future Mobility Performance Score



## Key success factors

### 1. Technology & Strategy

- Model portfolio & technology roadmap
- E-Branding
- Organisational strategy & set-up

### 2. Battery Technology

- Cost position & scalability
- Technology maturity
- Value creation strategy

### 3. Culture & Incentives

- Culture & leadership
- Incentive system & motivation
- New working models (e.g. agile)

### 4. Supplier Network

- Value chain integration
- Make or buy
- Raw material supply & recycling

### 5. Ecosystem & Partners

- Charging technology & stations
- 3<sup>rd</sup> party services
- Technology standards & interfaces

### 6. Financial Performance

- EBIT performance (E-Mobility investment indication)

# FUTURE MOBILITY PERFORMANCE SCORE – OUTLOOK 2019 TO 2021

TESLA WILL LEAD IN 2019 BUT DROPS TO 7<sup>TH</sup> BY 2021, WHEN DAIMLER TAKES OVER THE TOP POSITION IN OUR RANKING

## Future Mobility Performance Score – 2019 vs 2021

\*Weighting see previous slide

	Future Mobility Score 2019 (weighted*)	Rank 2019	Future Mobility Score 2021 (weighted*)	Rank 2021	Trend on rank 2019 vs 2021
Tesla	82	1	81	7	↓
Renault/Nissan/Mitsubishi	79	2	85	3	↓
BMW	78	3	87	2	↑
Hyundai Kia	72	4	79	8	↓
Daimler	71	5	88	1	↑
Volvo	70	6	83	5	↑
Volkswagen	69	7	84	4	↑
Toyota	66	8	82	6	↑
General Motors	62	9	68	10	↓
Jaguar/Land Rover	60	10	75	9	↑
PSA/Citroen/Opel	58	11	66	11	→
Ford	45	12	61	12	→
Fiat Chrysler	30	13	41	13	→

## Insights

**We see a 10 point average increase across car makers from 2019 to 2021**

- Car makers' electrification initiatives will be running on 'full power' by 2021
- Increased pressure from competition, CO<sub>2</sub> emission targets and pending diesel ban in cities
- New cross-industry players are entering the market, e.g. Dyson.

### German premium brands taking over top ranks

- Launch of the European high power charging initiative (creating 400 fast-charging stations) by major car makers, e.g. Ford, BMW, Daimler and VW
- Clear strategy and portfolio are mission critical and being addressed by top car makers, such as Daimler and BMW
- Battery know-how stays relevant, yet access to raw materials (cobalt, lithium) and a clear value chain strategy is becoming more important in the long-run

### Tesla faces uncertainty and loses traction

- Strong starting position with Model S sales outperforming Daimler S-class / BMW 7 in 2017 and a battery partnership with Panasonic
- Locked in with one battery supplier limits flexibility to react to new technology innovations and market volatility
- Uncertain future with regard to Model 3 production ramp-up and profit expectations, some doubts on volumes

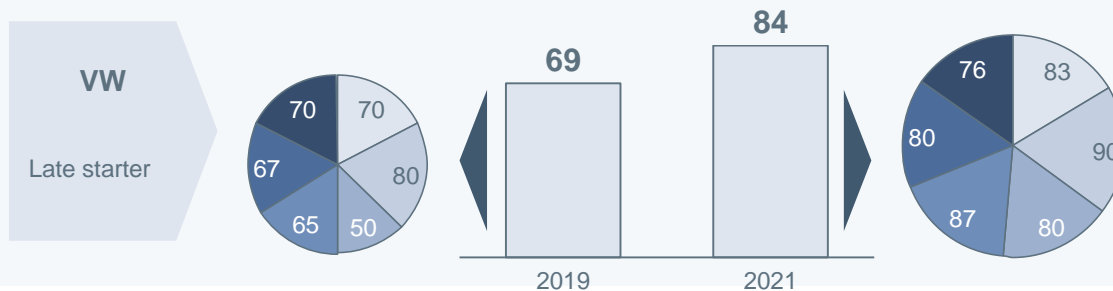
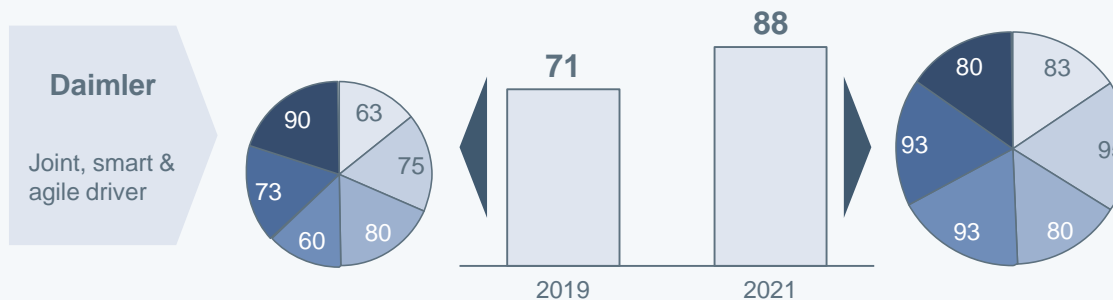
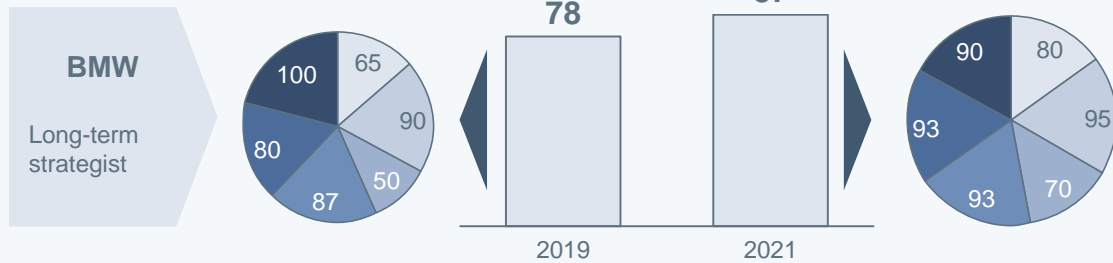


# FUTURE MOBILITY PERFORMANCE SCORE – SPOTLIGHT ON GERMAN CAR MAKERS

INCREASE IS DRIVEN BY A RAMP-UP AND EXTENSION OF PRODUCT PORTFOLIOS

## Future Mobility Score & key success factors 2019 vs 2021

Technology & Strategy
  Culture & Incentives
  Ecosystem & Partners  
 Battery Technology
  Supplier Network
  Financial Performance



## Insights

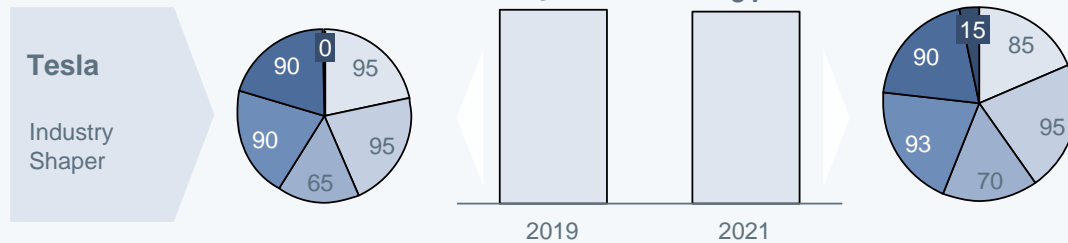
- Strong starting point with highest total sales of EVs and PHEVs globally (more than 100,000) and gradual broadening of product portfolio. However, no major innovations until iNext in 2021. (13 PHEV/BEV models by 2018, 12 EV models by 2025)
  - Increased focus on the EV ecosystem through a service portfolio and charging station installation (e.g. car sharing, European charging initiative)
  - Strongest raw material strategy
  - Industry leader in profit and productivity
- 
- Internal alignment and commitment to EV (CASE Business Unit, Factory 56, Brand EQ, agile development)
  - Full-scale electrification of all Smarts by 2020
  - Increased focus on the EV ecosystem through a service portfolio and charging station installation – similar to BMW
  - Limited robustness of raw material strategy
- 
- Fast acceleration and huge volume potential across multiple brands
  - Gradual ramp-up with 48 volt mild hybrid, 14 PHEV/BEV models (2018) and e-platform (2019)
  - Initial plans for in-house battery production (focus on modules with potential for cell production), raw material strategy yet to evolve further – need to rethink
  - Potential investment in ECU development and production
  - Strong board level commitment for e-mobility
  - Sales incentives models yet to be improved

# FUTURE MOBILITY PERFORMANCE SCORE – SPOTLIGHT ON TESLA, HYUNDAI KIA

E-MOBILITY INDEX INCREASE IS DRIVEN BY A RAMP-UP AND EXTENSION OF PRODUCT PORTFOLIOS

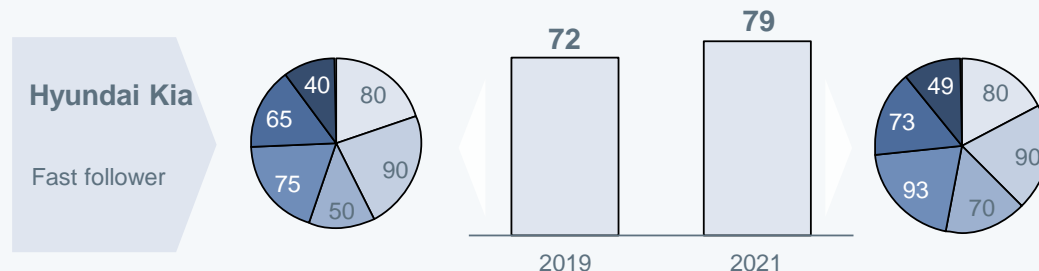
## Future Mobility Score & key success factors 2019 vs 2021

■ Technology & Strategy   
 ■ Culture & Incentives   
 ■ Ecosystem & Partners  
■ Battery Technology   
 ■ Supplier Network   
 ■ Financial Performance



## Insights

- Tesla is 4 years ahead of the competition in terms of powertrain development and is catching up on the remaining car development
- Tesla is working on too many projects and business units (cars, Hyperloop, SpaceX, Solar City,...) => focus
- Globalisation into China and Europe requires lots of management attention and experience
- Trumps tariff policy is not in favour of Tesla's expansion e.g. China
- Tesla is suffering from a severe brain drain, lot of key management people are leaving the firm due to the culture
- Tesla is a great and cool brand, but will struggle to recruit potential automotive experts because of stable stock price
- Auto Industry benchmark: Appr. 6 weeks until full production from SOP and then stable production while Tesla needed 1 full year as a minimum, and still not being stable
- Tesla will be profitable (Source Reuters) either at Tesla or a new owner



- Very strong pipeline and positive platform approach to share Hybrid, PHEV and BEV technology and models
- Culture and incentives does not support a very agile and high performance culture in Europe
- Management of battery suppliers to be revisited; high degree dependency on LG Chem and SK Innovation
- Ionic battery at lower range than E-Golf, high TCO cost compared to peers, Kia Soul EV long charging time without wallbox – range is impacted by heating system
- No visible raw material access strategy in place
- A limited ECO System – partnering model to be improved
- Financial performance in last quartile compared to peers

# CO<sub>2</sub> TARGETS CAN BE REACHED BY 4 LEVERS

Speed and reorientation in product development and supply chain as well as increased sales through customer focus and influencing external factors

## Levers

## Typical questions

## CO<sub>2</sub> target 2021



### Product

Develop the right offers fast

- What must the future brand / model / engine portfolio look like?
- Which R & D competencies will be decisive in the future?
- Which partnerships bring additional speed?
- How can the development process be more agile and development cycles be shortened?



### Customers

Inspire customers & increase sales

- How can the multichannel approach be optimally used?
- How can the customer experience of e-mobility be improved significantly?
- What is the optimal pricing strategy?
- What sales approaches and competences are required for sales of e-mobility products?



### Supply chain

Realize efficient products and services for the customer

- How can new drive technologies be integrated into existing plant footprint?
- Which competences are required in the future for the supply chain?
- What can strategic suppliers and partners contribute?
- How can the procurement of specific raw materials be ensured?

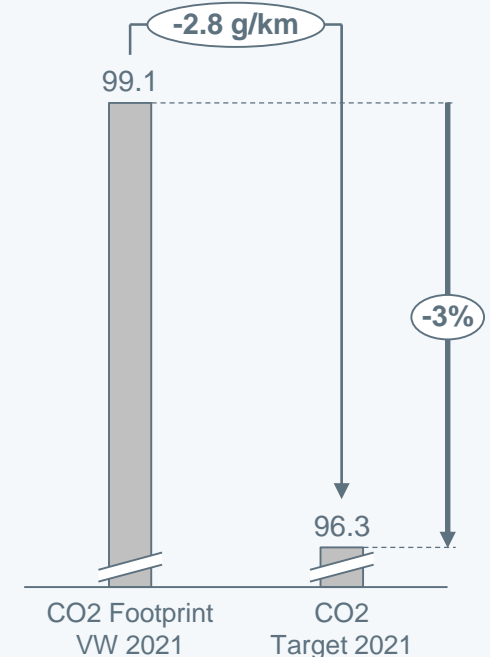


### External factors

Define incentives for additional sales

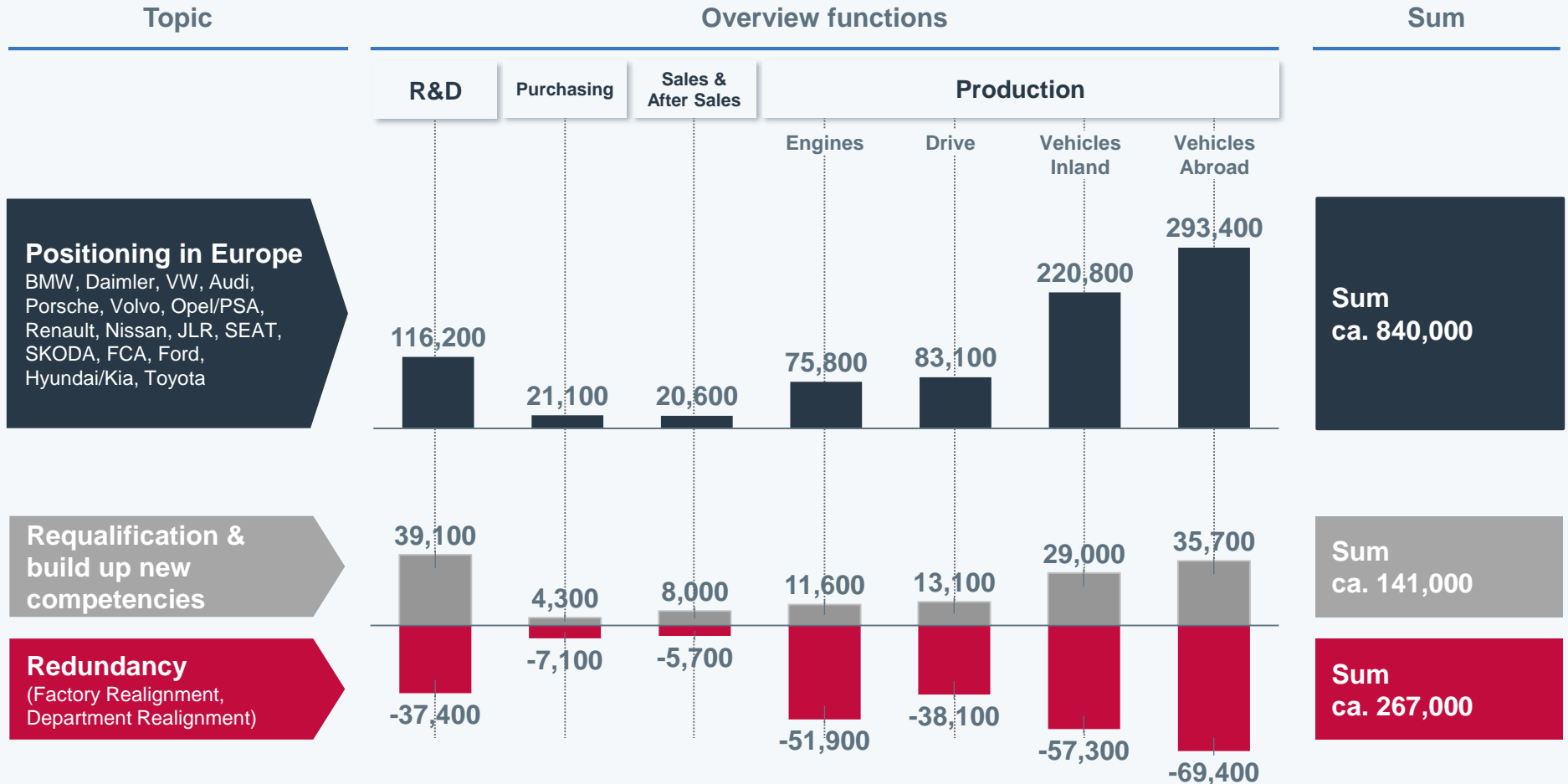
- Which activities support the expansion of e-mobility infrastructure?
- How can standardisation and the introduction of technical standards be advanced?
- How can acceptance and sales be further enhanced with government and industry cooperation?

Example: Volkswagen AG



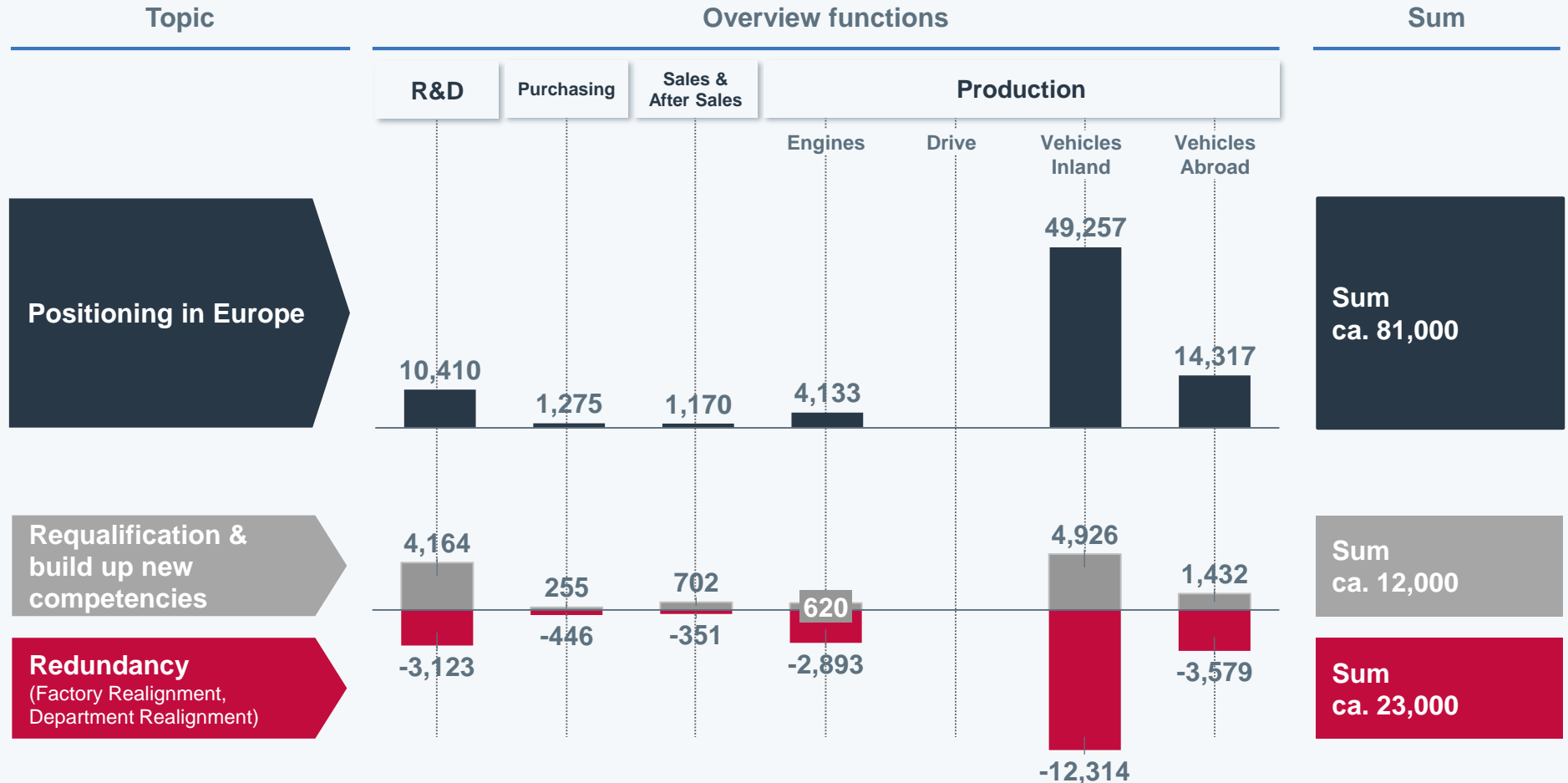
# SCOPE FOR ACTION

Across the 16 brands in Europe, 267,000 employees are redundant of which 141,000 need to be retrained



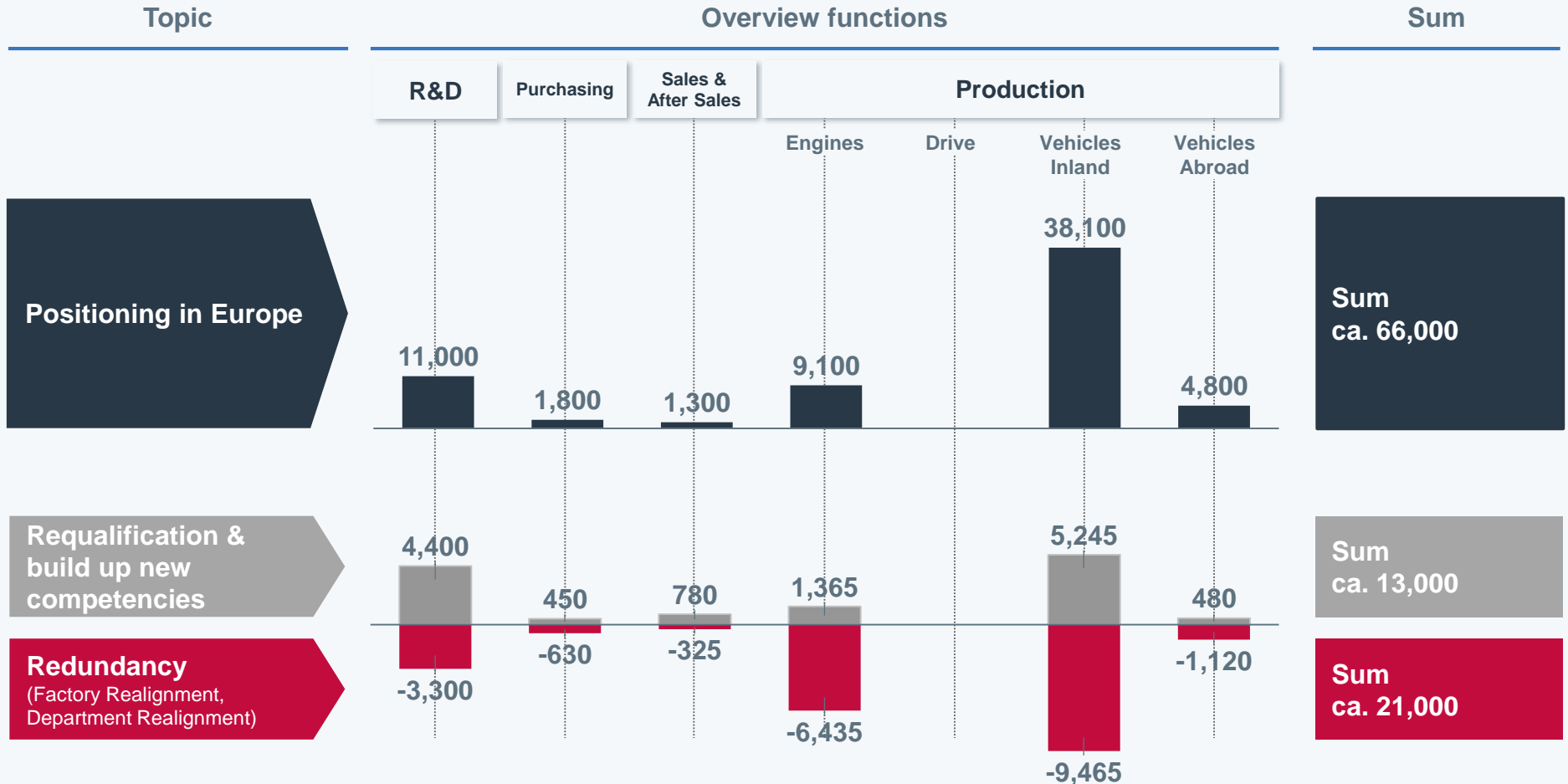
# SCOPE FOR ACTION AUDI

At Audi in Europe 23,000 employees are redundant of which 12,000 need to be retrained



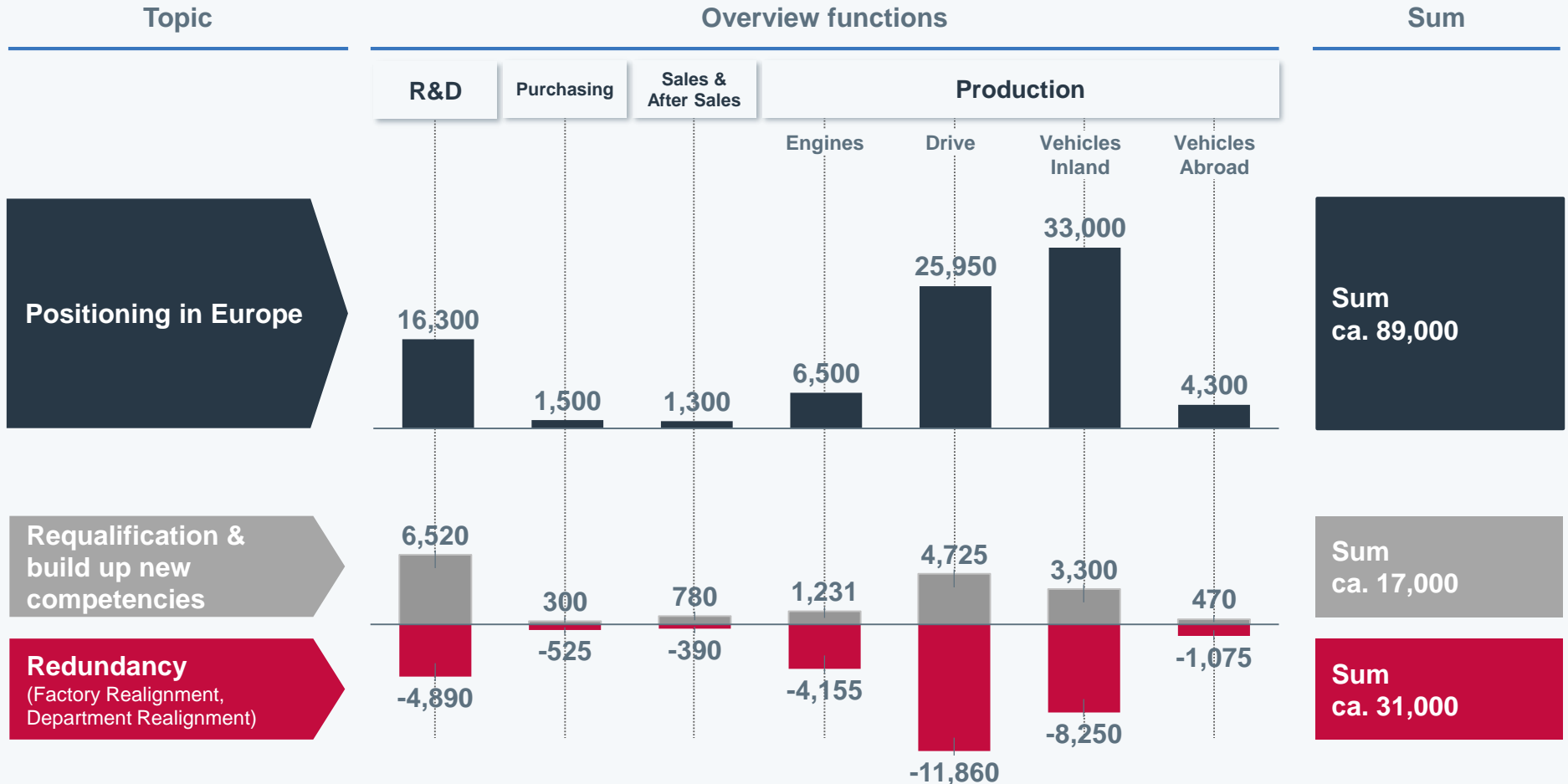
# SCOPE FOR ACTION BMW

At BMW in Europe 21,000 employees are redundant of which 13,000 need to be retrained



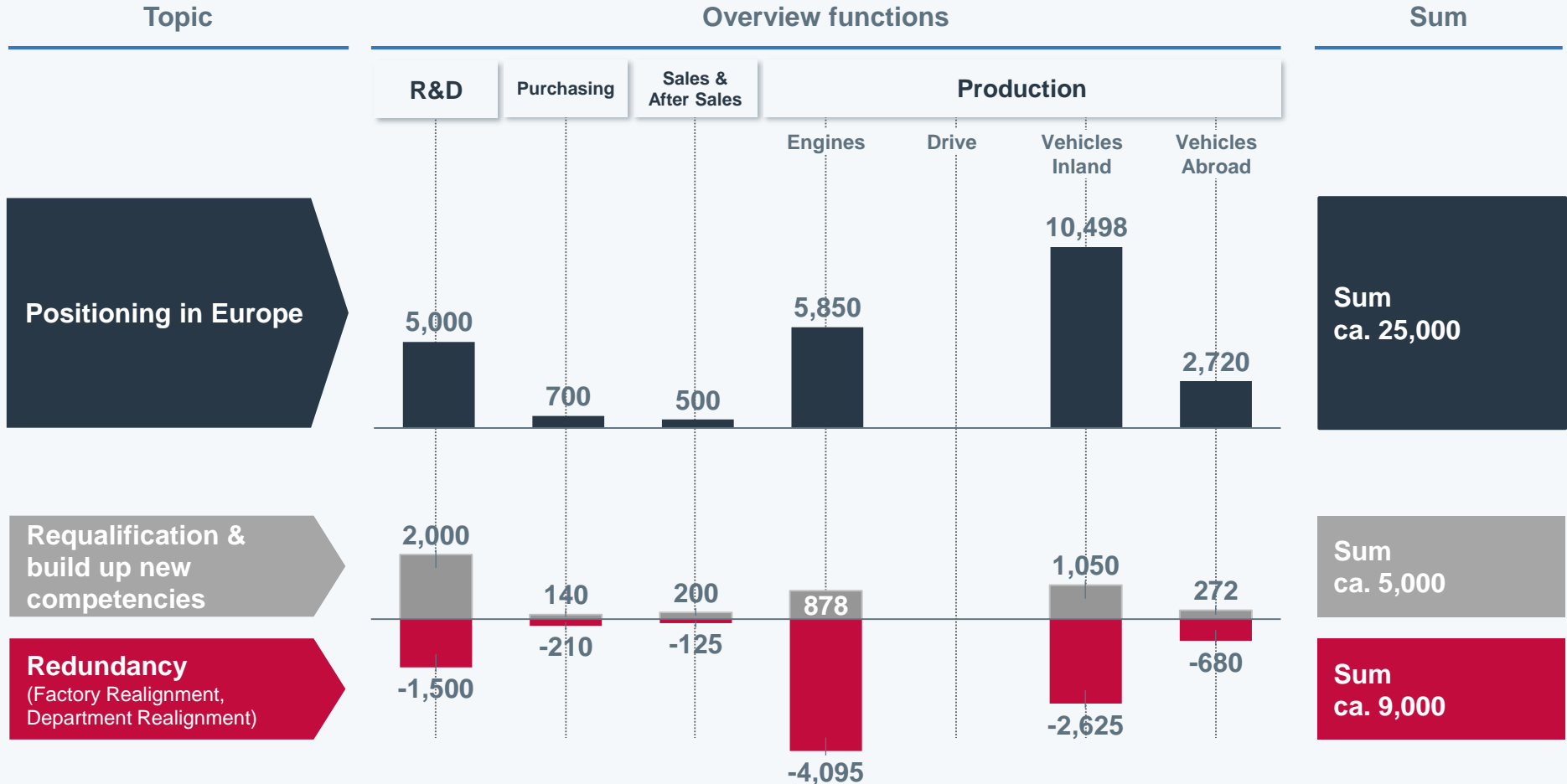
# SCOPE FOR ACTION DAIMLER

At Daimler AG in Europe 31,000 employees are redundant of which 17,000 need to be retrained



# SCOPE FOR ACTION PORSCHE

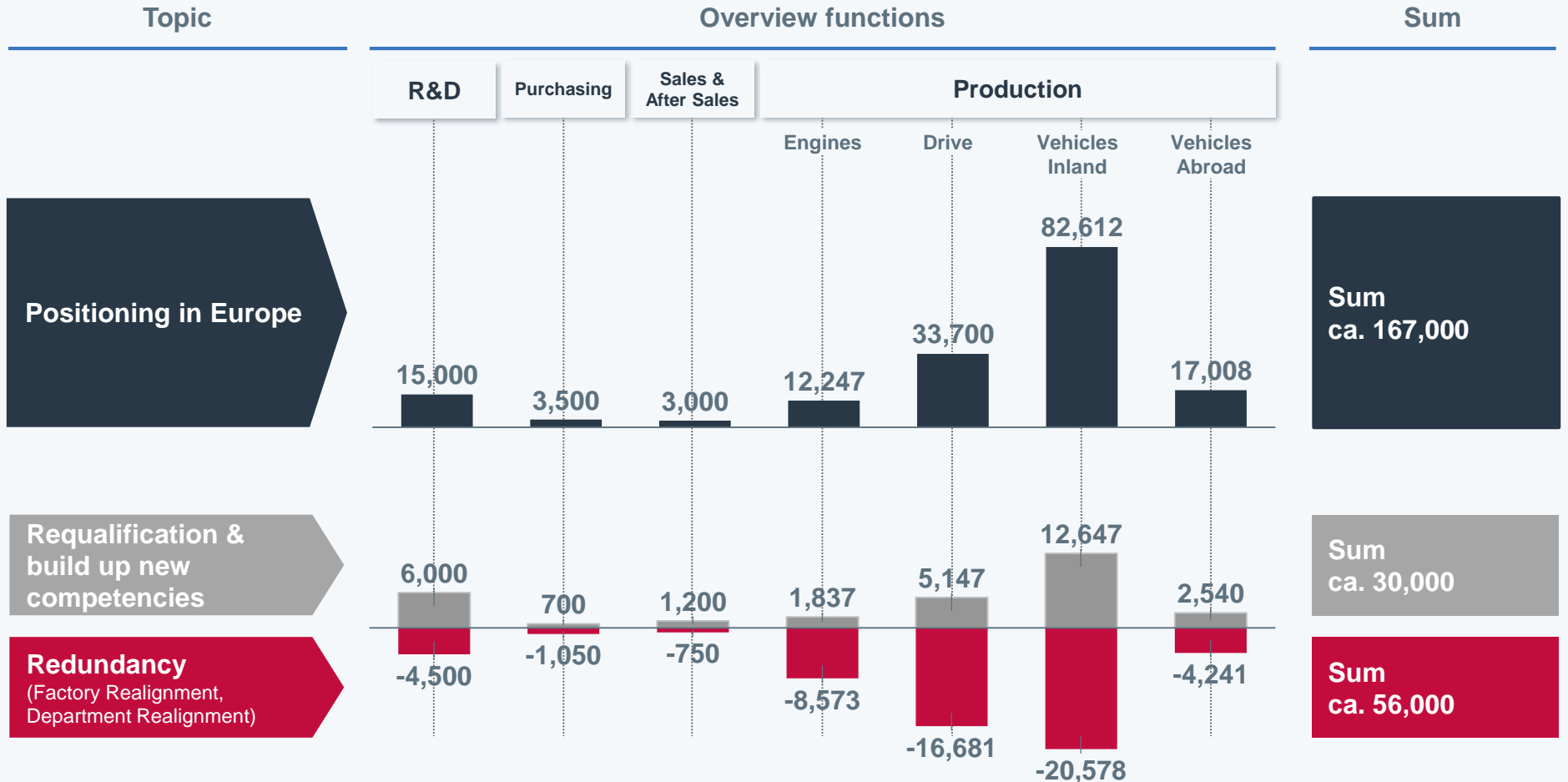
At Porsche in Europe 9,000 employees are redundant of which 5,000 need to be retrained





# SCOPE FOR ACTION VW

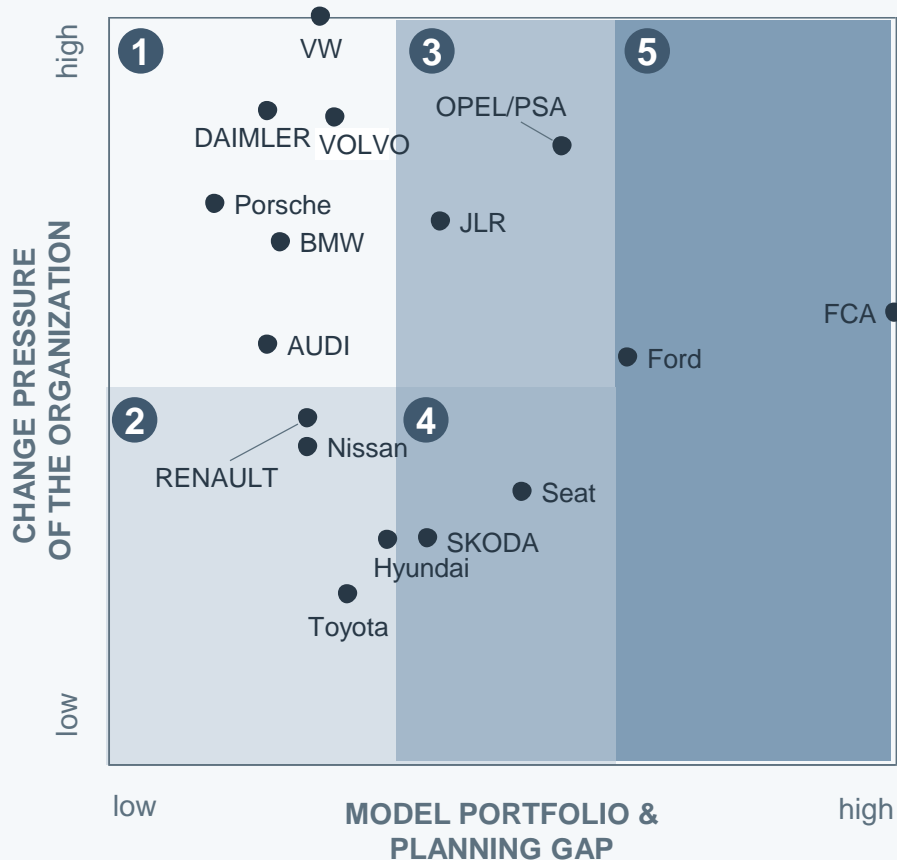
At VW in Europe 56,000 employees are redundant of which 30,000 need to be retrained



# WALK THE TALK – E-MOBILITY TRANSFORMATION MATRIX

5 ways and recommended actions for the 16 brands

## E-mobility Transformation Matrix



- 1 Transform for Leading Edge**  
 Car makers with ambitious electrification targets in a tight time frame currently with a production footprint focussed to traditional drives  
**Way forward**  
 Comprehensive transformation and creation of the necessary structures to cushion redundancy and requalification needs

---

- 2 Maintain Momentum**  
 Car makers who are successful in the market with the first e-models and have already built up competence and structures  
**Way forward**  
 Realisation of time and knowledge advantage through know-how expansion and scaling of today's platforms

---

- 3 Make or Break**  
 Car makers whose current transformation is dominated by internal (merger) and external drivers (Brexit)  
**Way forward**  
 Linking clear electrification targets with rapid development of necessary electrification structures and knowledge in the course of transformation

---

- 4 Platform Addicts**  
 Car makers whose electrification success largely depends on the transformation at group level  
**Way forward**  
 Create future-proof electrification strategy as well as group-wide connection of structures and secure local resources

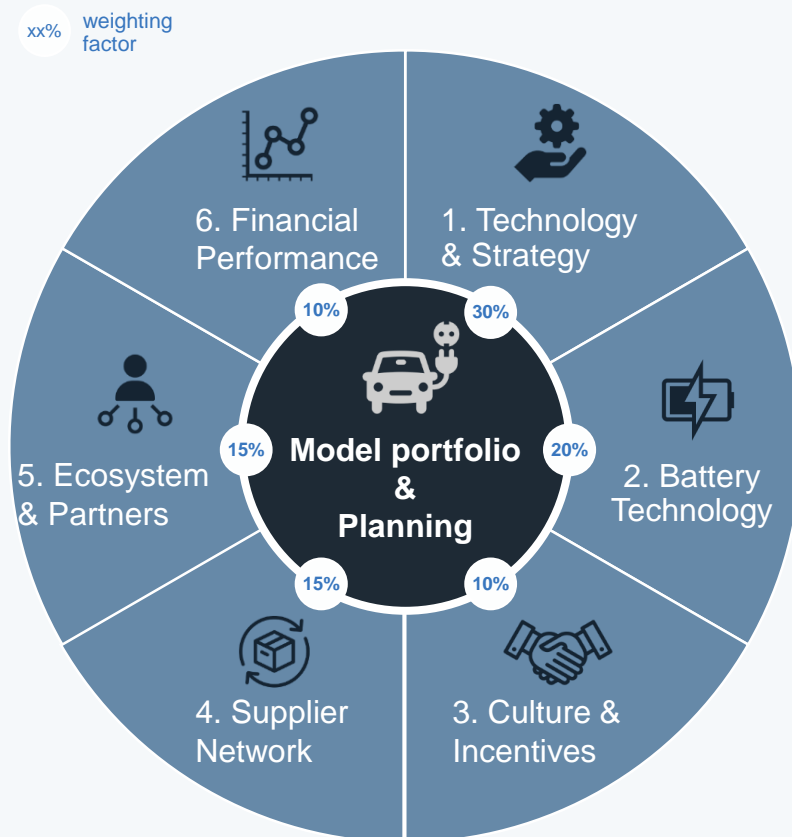
---

- 5 Big Sell Out**  
 Car makers who are threatened to lose their competitive position due to their strategic orientation  
**Way forward**  
 Create future-proof electrification strategy as well as group-wide connection of structures and secure local resources

# DIMENSIONS: E-MOBILITY TRANSFORMATION MATRIX

The two dimensions of the E-mobility Transformation Matrix are based on a number of selected factors

## Model portfolio & planning gap

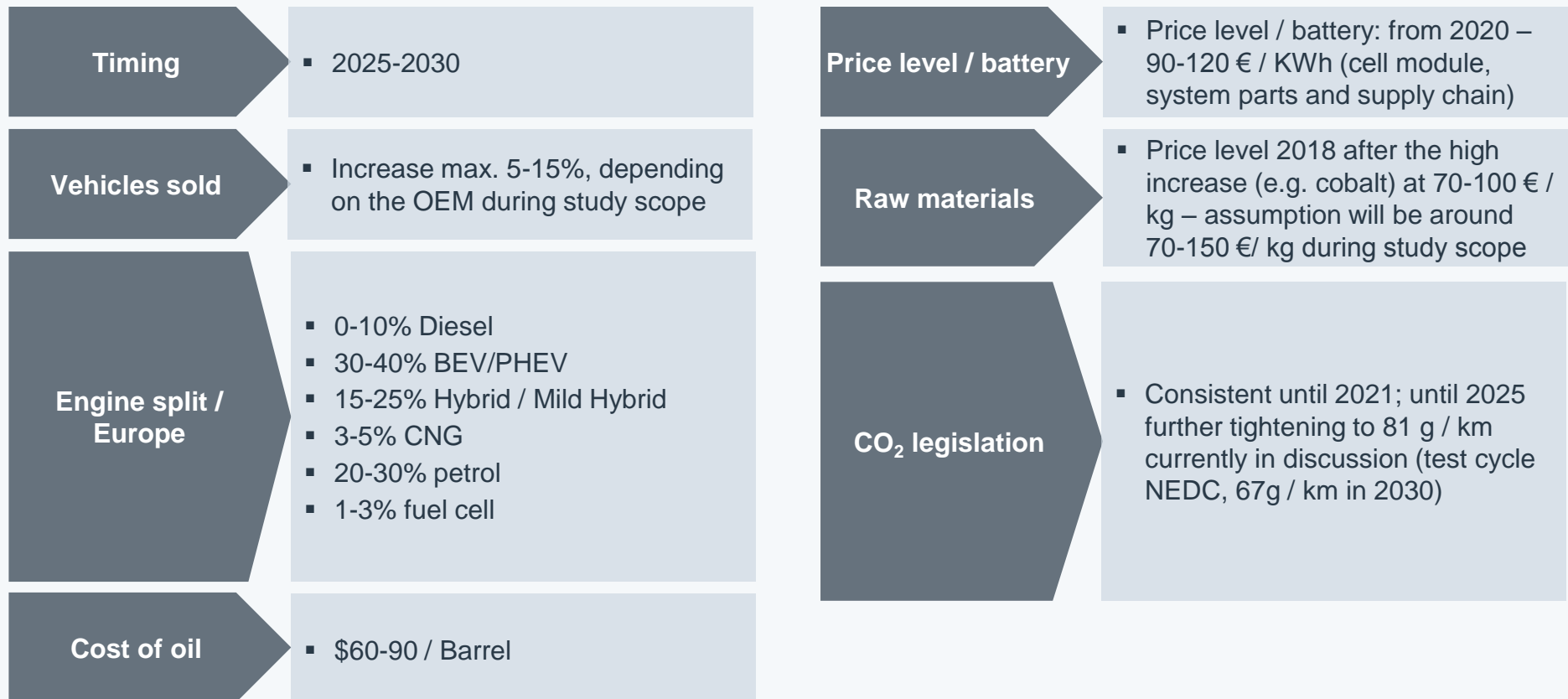


## Change pressure of the organisation



# ASSUMPTIONS: REDUNDANCY & REQUALIFICATION NEEDS

The two dimensions of the E-mobility Transformation Matrix are based on a number of selected factors



# YOUR CONTACT TO PA

**Michael Schweikl**



An der Welle 3  
60322 Frankfurt

+49 17155 728 42 (mobil)  
Michael.Schweikl@paconsulting.com

**Thomas Brand**



An der Welle 3  
60322 Frankfurt

+49 171 55 72 846 (mobil)  
Thomas.Brand@paconsulting.com