strategy&
Part of the PwC network

Powertrain study 2025 – Coming of age

The next phase in the eMobility transformation

Dr. Jörn Neuhausen, Dr. Philipp Rose, Jan-Hendrik Bomke
August 2025

Overcoming current headwinds through innovations and improved economics will determine the next phase in eMobility transformation

Executive summary

1. Across the portfolio, **multi-energy platforms** and PHEVs are regaining importance, but future **BEV platforms still lead the way** – Differentiated BEV platforms will meet diverse customer needs

2. Innovations in **energy densities, powertrain efficiency, and charging speed improve the ease of daily use of eMobility –** in particular, the improvement in charging speed (with up to 400km in 10 minutes) and efficiency gains will further drive diffusion

3. **Battery cells** to remain the **key cost driver for electric powertrains**, heavily affected by **raw material prices –** currently-available production capacities lead to lower market prices across suppliers and chemistries

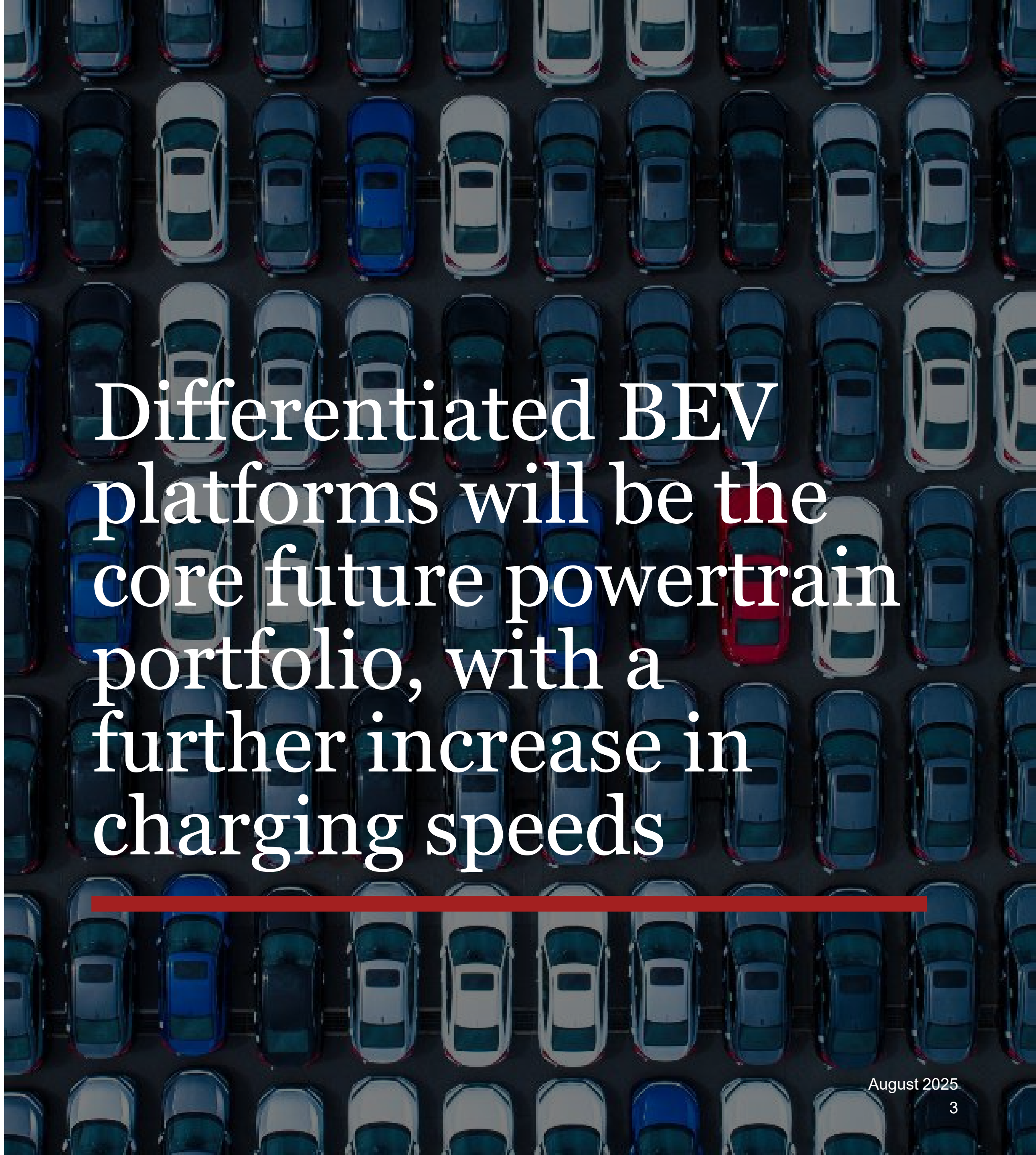
4. While **total cost of ownership parity** is reached across most segments **today**, **powertrain cost parity** will be reached **from 2030 –** as innovation speeds flatten, the residual values of used BEVs are expected to stabilize

5. Across regions short- and mid-term forecasts (**BEV diffusion** demand c. 20% in 2025 and **40% in 2030**) are slightly reduced – **long-term, transformation** with up to **60% diffusion in 2035** is expected to **prevail**, resulting in 5 TWh battery demand

6. **Successful BEV transformation** in Europe requires continued focus on **improving performance** within **short innovation cycles –** and commercial competitiveness supported by local and independent battery cell production

BEV: Battery Electric Vehicle, PHEV: Plug-in Hybrid Electric Vehicle

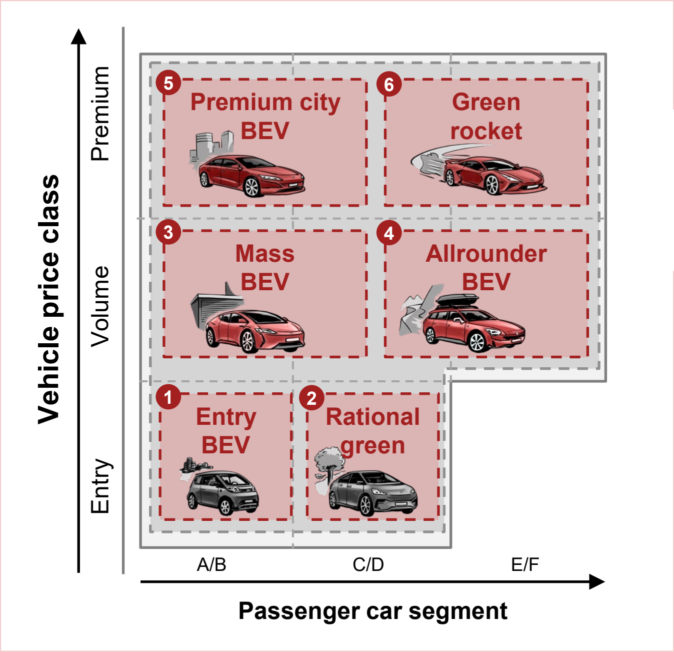
Table of contents



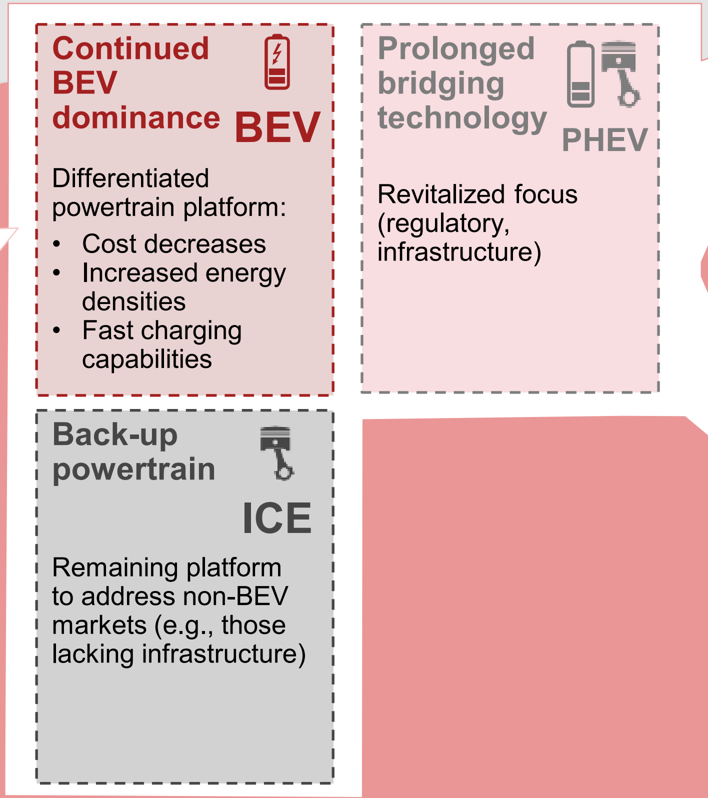
Differentiated BEV platforms will be the core future powertrain portfolio, with a further increase in charging speeds

We expect a stable 2030 powertrain portfolio dominated by BEVs – PHEVs are revitalized as a bridging technology

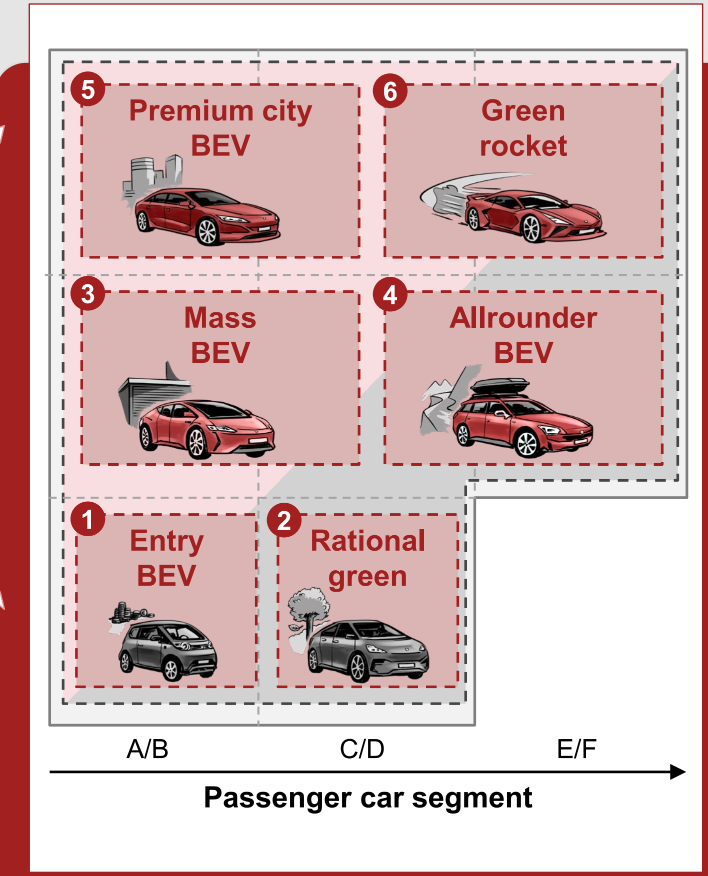
Evolution of powertrain portfolio (2030)



2030 Powertrain portfolio (as of 2023)



Powertrain developments

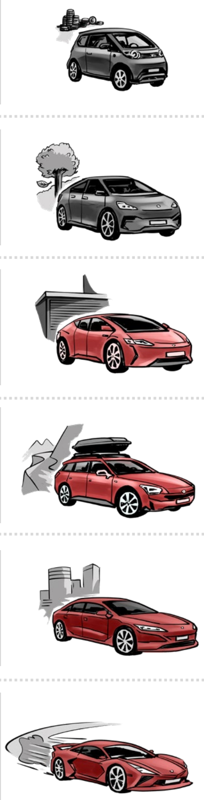


Updated BEV portfolio

Source: Strategy& analyses

Across these platforms, standard and long-range variants are expected to be offered to meet customer flexibility requirements

Customer-relevant BEV platform specifications



Archetypes	Power and efficiency: In kW	Power and efficiency: In kWh/100km	Range variations: Customer perceived ranges in km	Charge speed: Charged range/10 min for long-range variants
1 Entry BEV	70	12	250 km 340 km	c. 110 km (+/- 0)
2 Rational green	100	13	350 km 500 km	c. 250 km (+/- 0)
3 Mass BEV	150	14	400 km 500 km	c. 415 km (~270 km, +145 km)
4 Allrounder BEV	175	15	*470 km* *600 km*	c. 500 km (~330 km, +170 km)
5 Premium city BEV	300	14	500 km 650 km	c. 530 km (~400 km, +130 km)
6 Green rocket	500	17	560 km 730 km	c. 615 km (~430 km, +185 km)

Standard range variants — Long-range variants — 2023 forecast — 2026 forecast

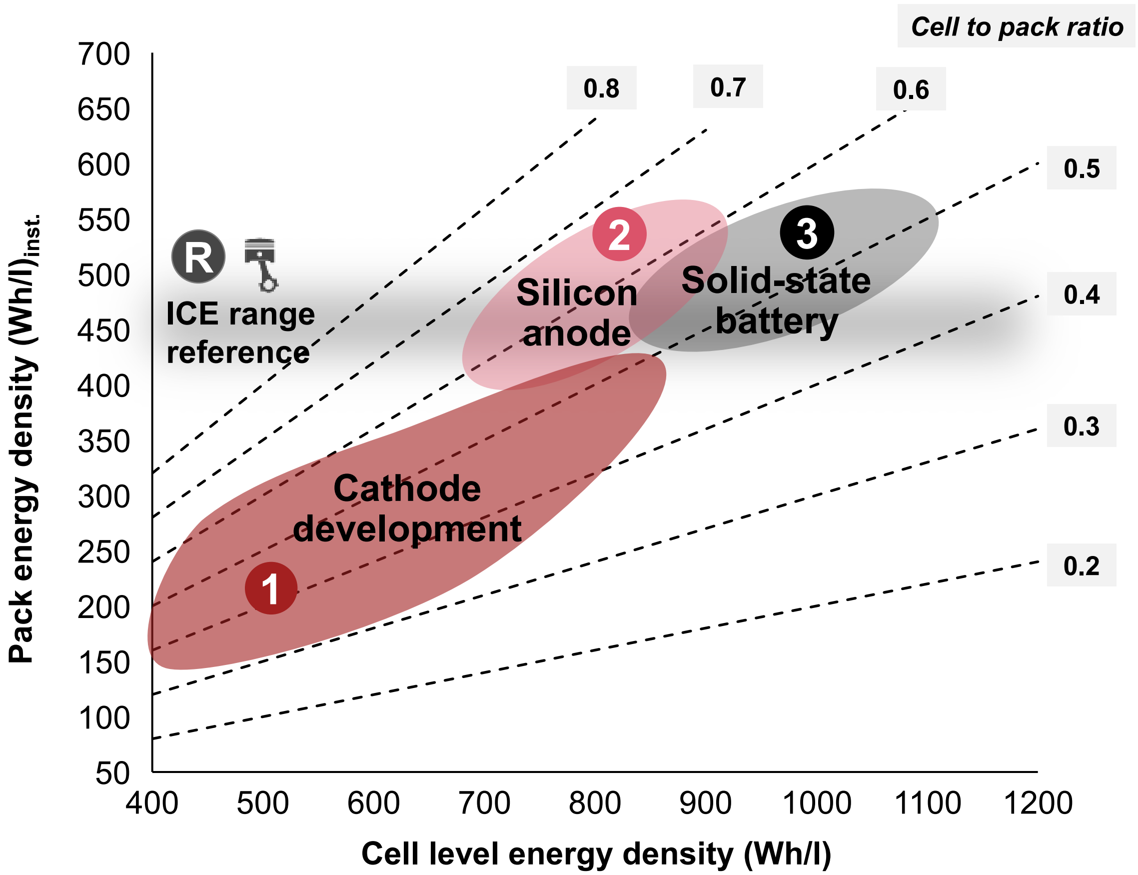
Source: Strategy& analyses

Table of contents

BEVs are closing in on the 450-500 Wh/l energy density milestone, driven by silicon anodes and advanced cathode chemistries

Cell and pack energy densities – Technology comparison

Benchmark pack and cell energy density (in Wh/l)



Technological enablers for higher pack energy density

R To compete with ICE vehicles, BEVs must reach a pack-level energy density of c.450-500 Wh/l, enabling high ranges

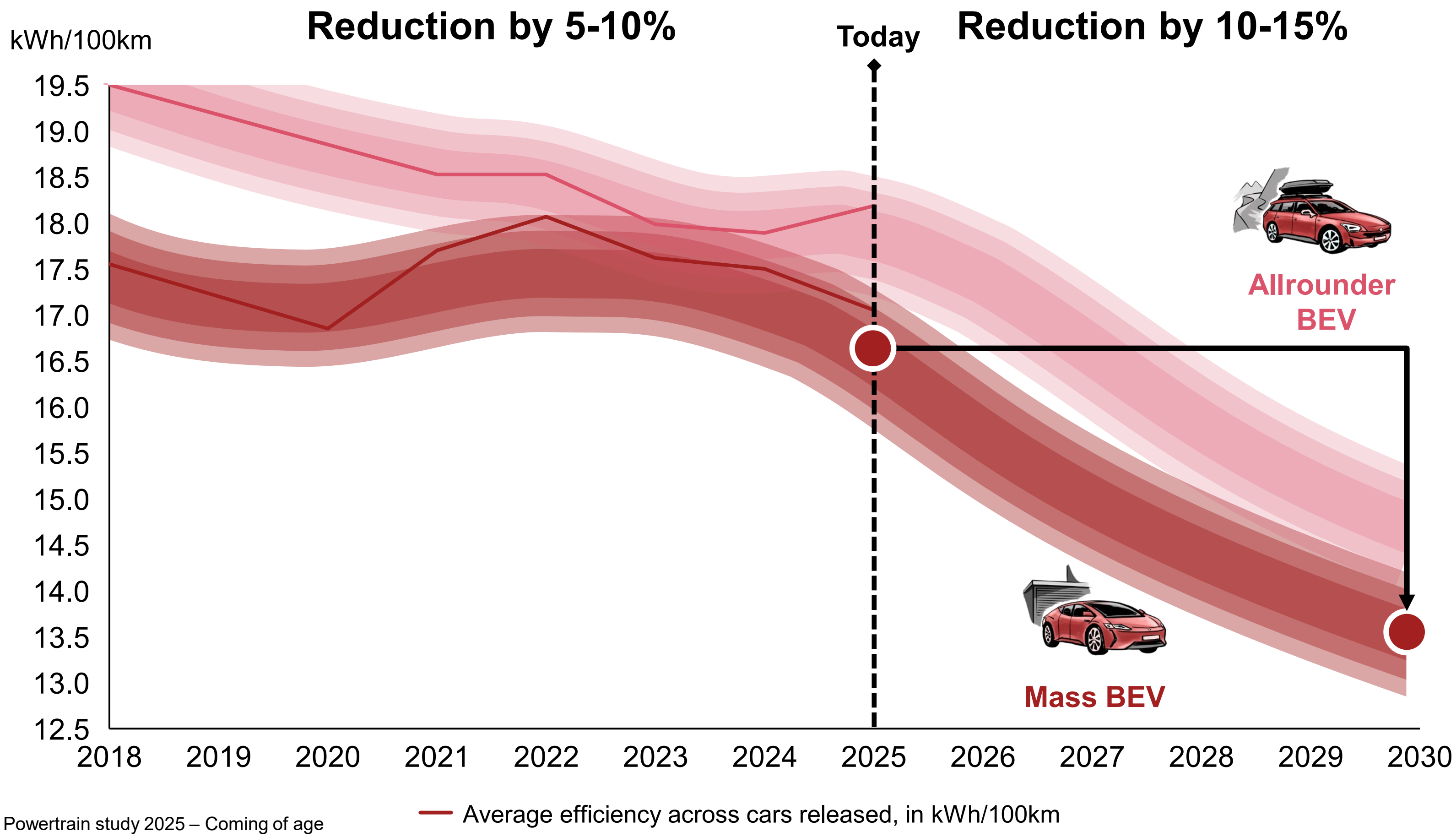
- Material-level innovations have driven recent progress:
  1. **Cathodes**: Cathode development beyond NMC 622 pushed pack energy densities towards 400-450 Wh/l, e.g., through higher nickel content and improved structural stability
  2. **Anodes**: Adding 2-5% silicon enables near-target densities, supported by improved cell-to-pack ratios compared to SSBs
  3. **Solid-state battery**: Despite high cell-level potential of over 1,000 Wh/l, SSBs struggle to match the high cell-to-pack ratio due to additional mechanical requirements

Source: Strategy& analyses

Energy consumption decreased by 5-10 percent in recent years – further drops to 12-14 kWh by 2030 are expected

BEV energy consumption

Real-life energy consumption in core segments



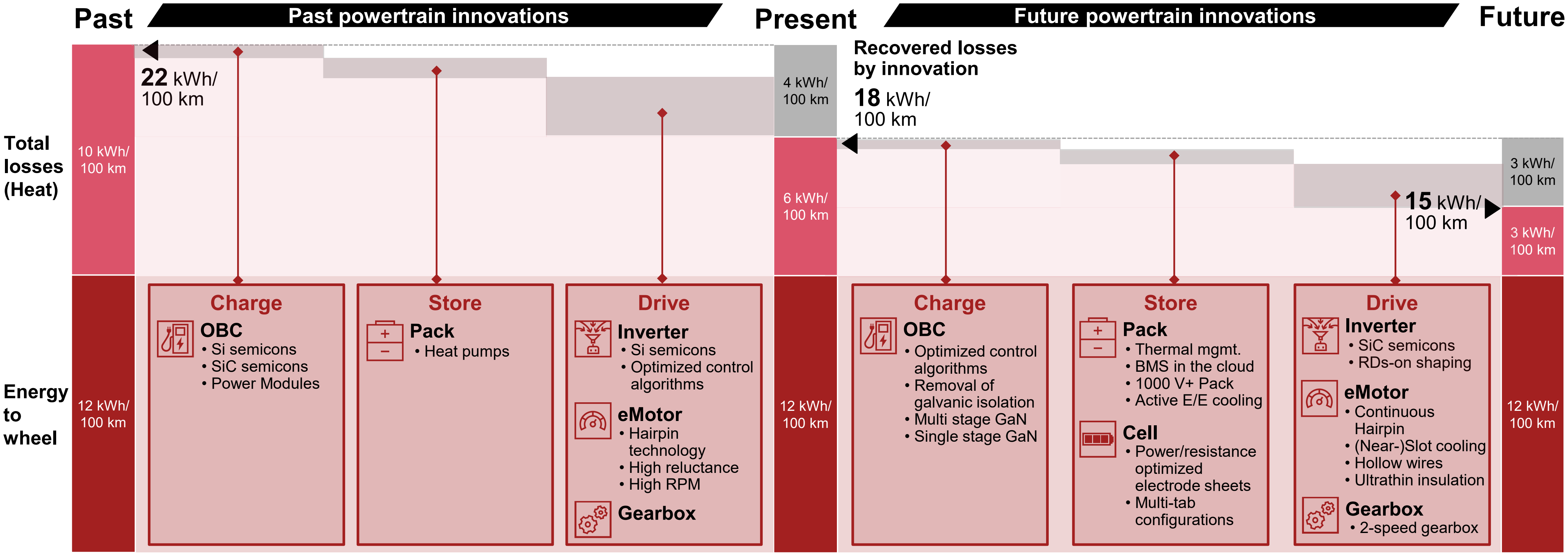
Source: EV-Database "Real Life Consumptions", Strategy& analyses

Comments

- Over **recent years**, energy efficiency **improved by 5-10%** across vehicle segments
- Over the **coming years**, we expect increased efforts to **further reduce** energy consumption by **10-15%** (e.g., by thermal management, aerodynamics)
- **Improved energy efficiency leads to direct customer benefits:**
  - **A** **+50-75 km** range (at constant battery size)
  - **B** **-€500** battery costs (at constant range)

To avoid costly battery pack size to reach range targets, the focus still lies on powertrain efficiency – especially in eMotor and Inverter

Powertrain efficiency roadmap (Exemplary)



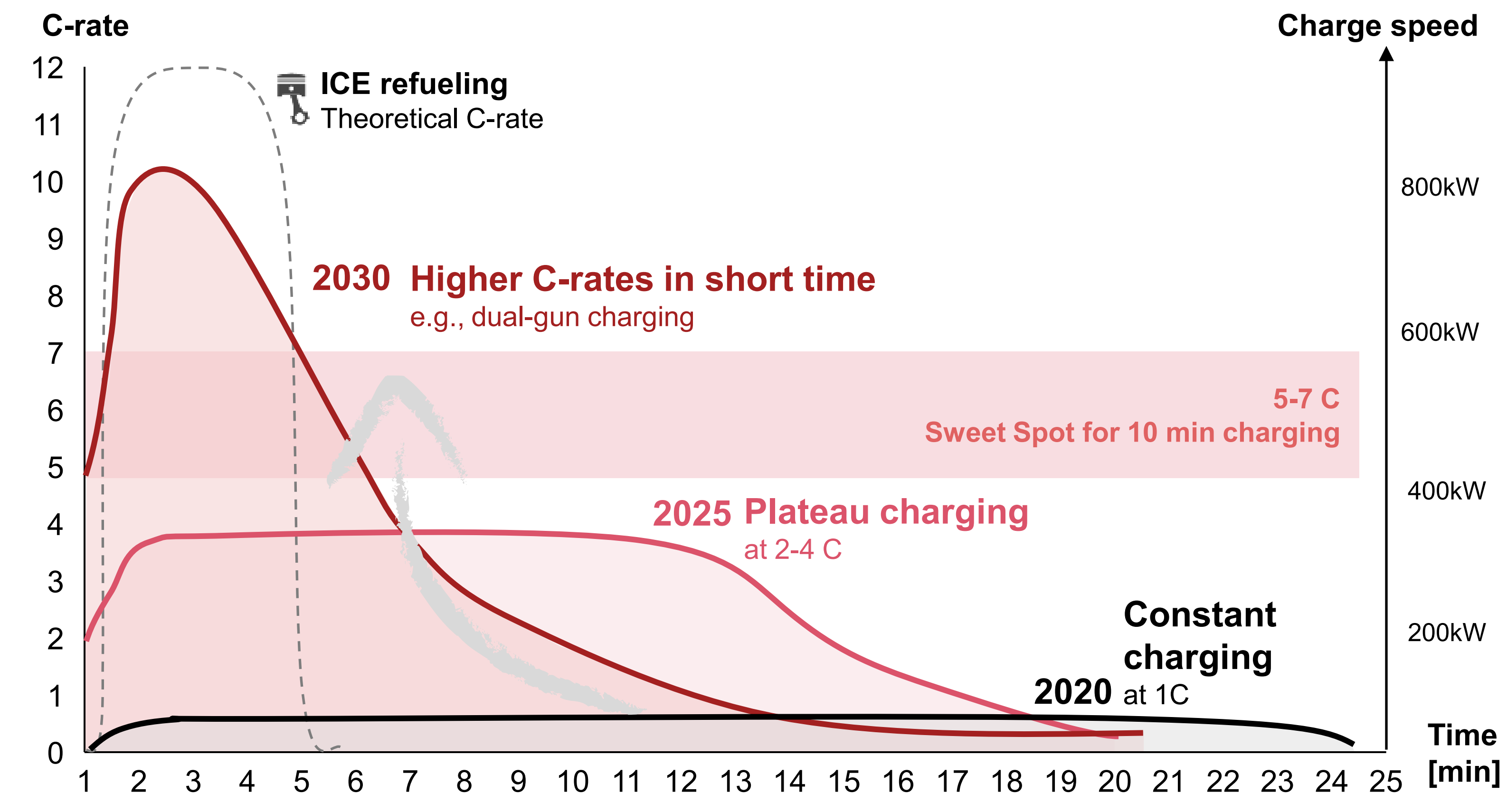
= Energy to wheel [kWh/100 km] = Total losses (Heat) [kWh/100 km] = (To-be) Recovered losses by innovation [kWh/100 km] = (To-be) Recovered losses by individual powertrain component innovation [kWh/100 km]

RPM: Revolutions per minute, GaN: Gallium nitride SiC: Silicon carbide, BMS: Battery management system, OBC: On-board charger
Source: Strategy& analyses

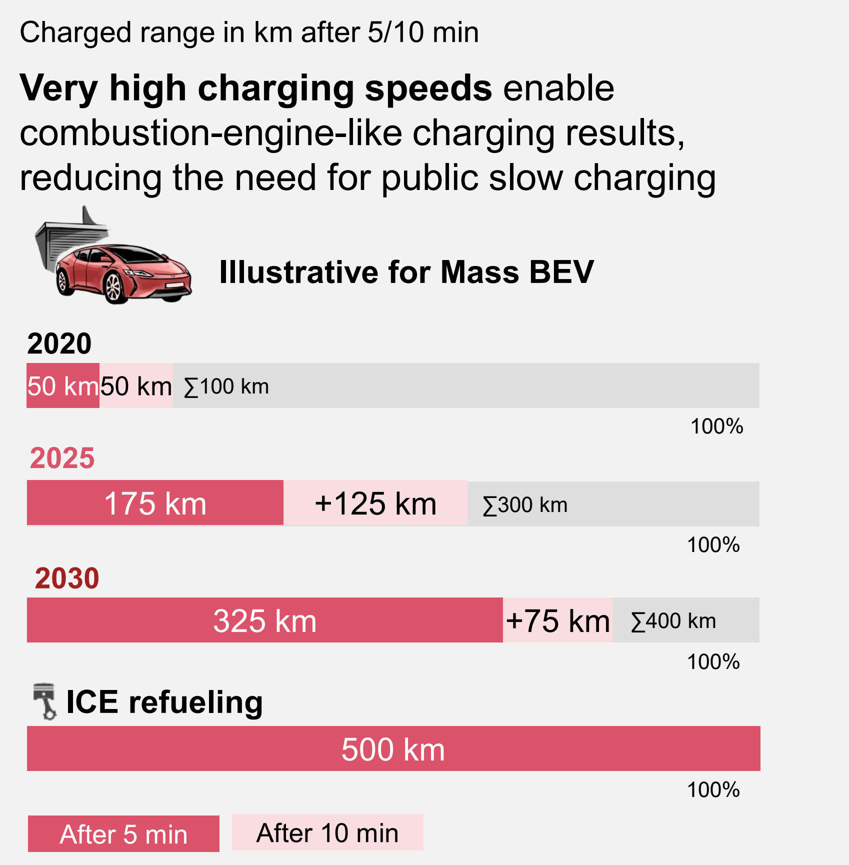
With improvements in charging technologies, BEV gets much closer to ICE refueling speed, with 400km recharged range in 10 minutes by 2030

Charging technological development (2020 vs. 2030)

Charging speed development (C-rate over time)

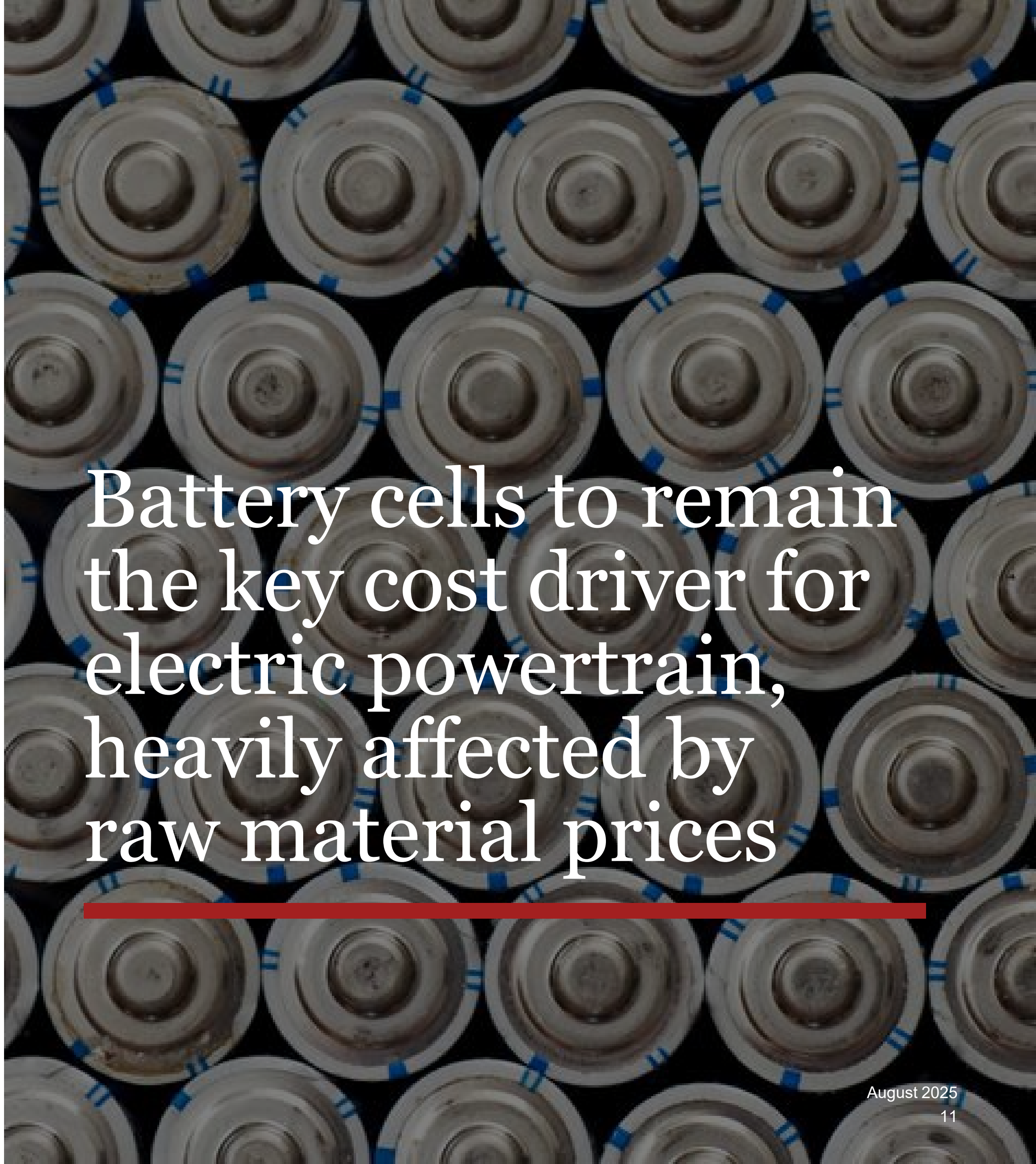


Charging performance



1) For petrol based engine, incl. process times
Source: Strategy& analyses

Table of contents

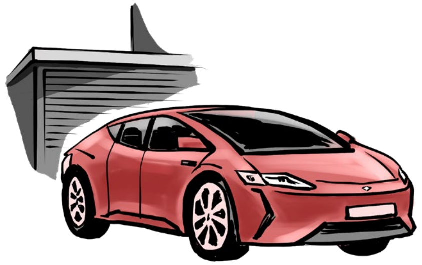


Battery cells to remain the key cost driver for electric powertrain, heavily affected by raw material prices

Product costs are primarily driven by battery and cell costs; components heavily affected by value chain and market ramp-up

Product target costs (2030)

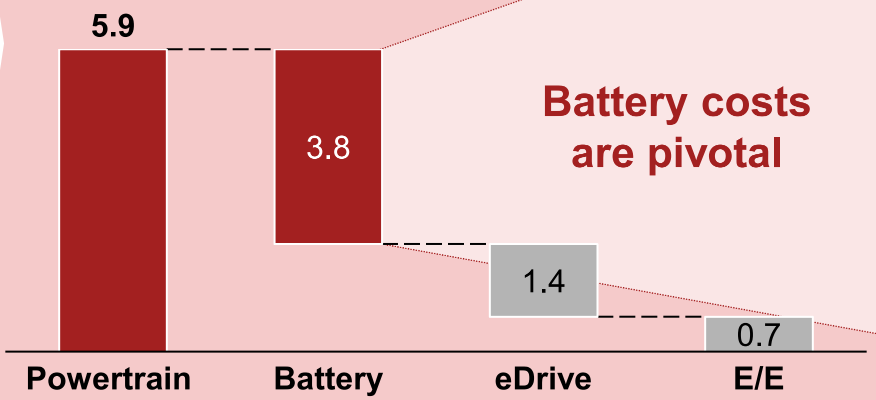
Mass BEV platform



Technology specs	c. 55 kWh 150 kW
Chemistry	Na-Ion
Range	c. 400 km

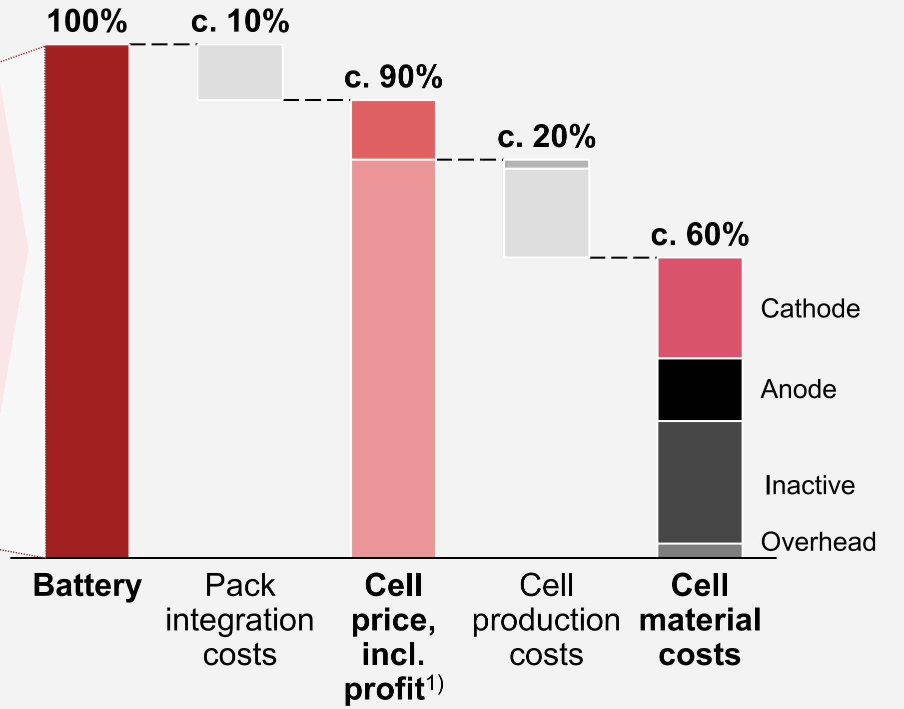
Powertrain cost split (in k€)

c. 60-70% of the powertrain cost comprises the battery



Battery cost split (in %)

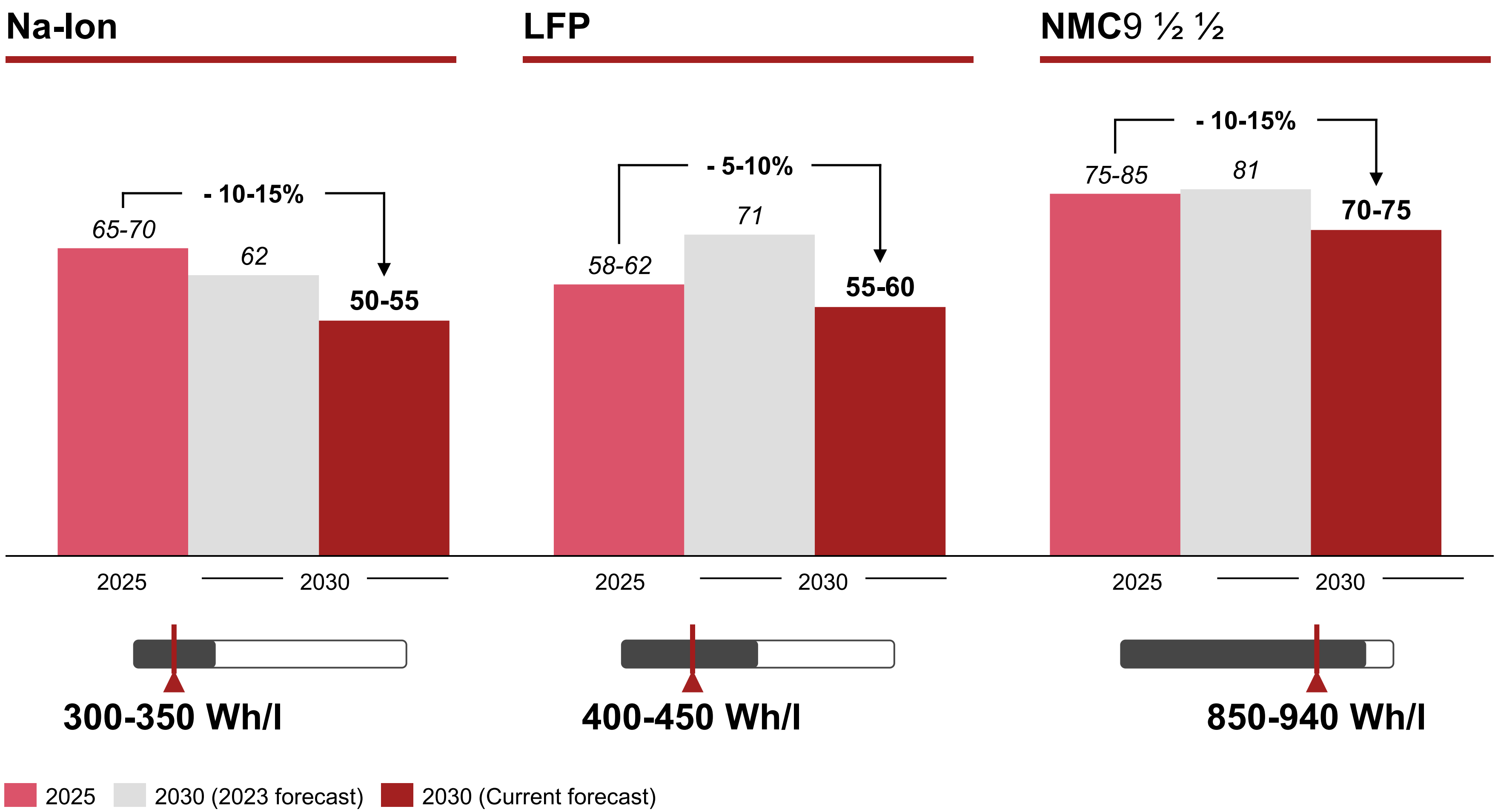
Battery materials constitute c. 60% of **total** battery price



1) Incl. freight and customs from CN to EU
Source: Strategy& Analyses

LFP prices have fallen below forecast – further declines expected by 2030 due to overcapacity-driven competition

Strategy& cell price forecast 2030 (in €/kWh, 2025, ex-works)



Comments

- Cell prices expected to drop 10-15% by 2030 compared to 2025
- LFP prices have fallen significantly, now much lower than NMC and below initial 2023 forecasts, at c. €60/kWh
- Overcapacities drive price competition, aligning prices close to marginal cost
- Reduced raw material prices and CAPEX depreciations contribute to cost reductions

1) Baseline assumption Li2CO3 price €10/kg, Standardized cell format: 300 x 100 x 25 mm, LFP: Lithium Iron Phosphate, NMC: Nickel Manganese Cobalt
Source: Strategy& cell model

Table of contents

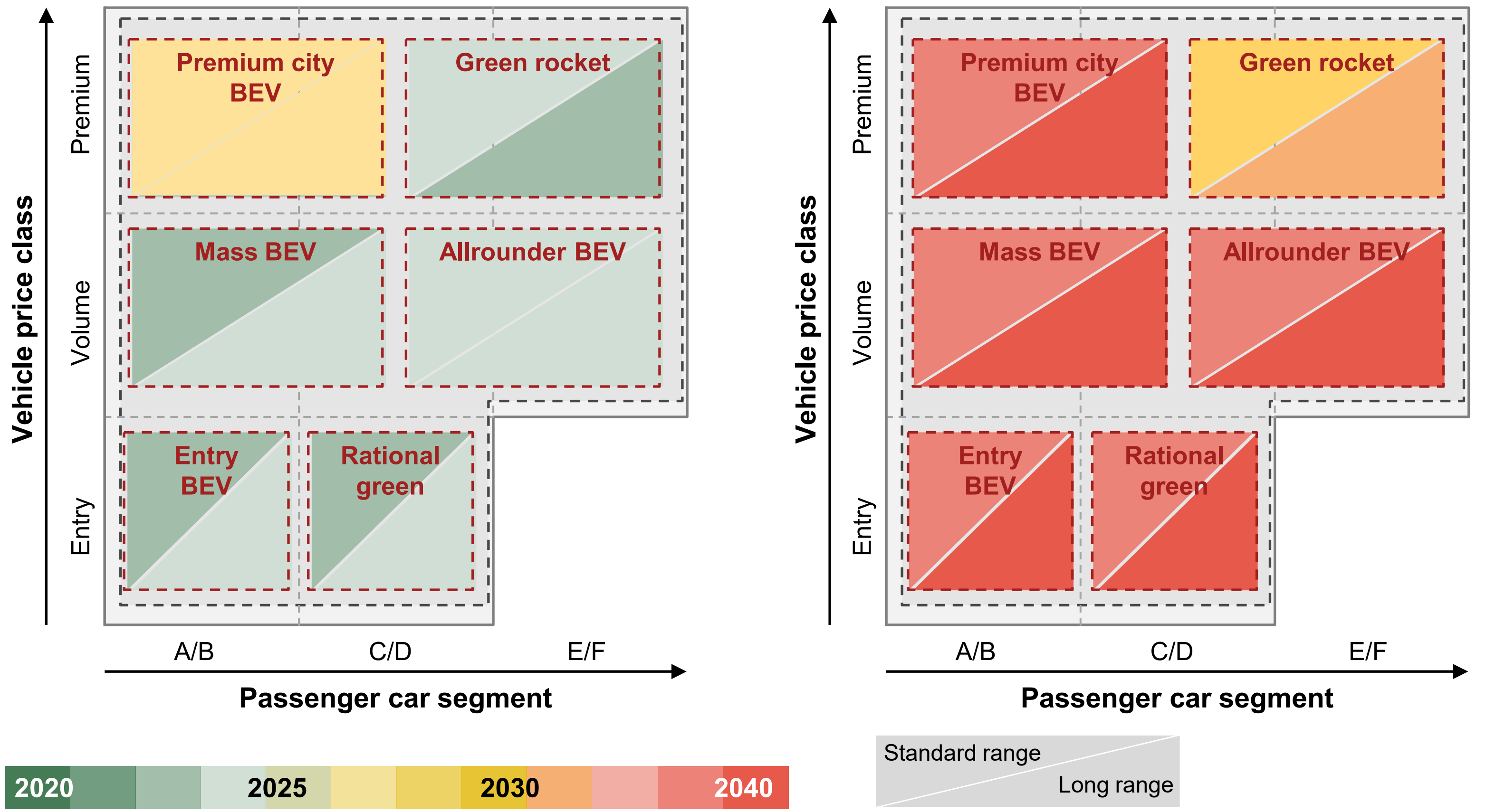
While we expect total cost of ownership parity across segments by 2025, powertrain cost parity will be reached from 2030 onwards

Based on decreasing BEV costs, we expect BEV TCO parity from today to 2030 onwards in all classes, while powertrain costs remain higher

TCO and powertrain cost parity

Total cost of ownership (TCO) parity

Powertrain cost parity



Comments

Total cost of ownership (TCO)

- TCO parity across all segments and ranges expected between 2025 and 2030
- Entry BEVs have reduced battery cost advantage – premium segment BEVs reach TCO parity via high ICE powertrain costs
- Short-range BEVs have lower price but amortize more slowly due to lower annual mileage

Powertrain costs

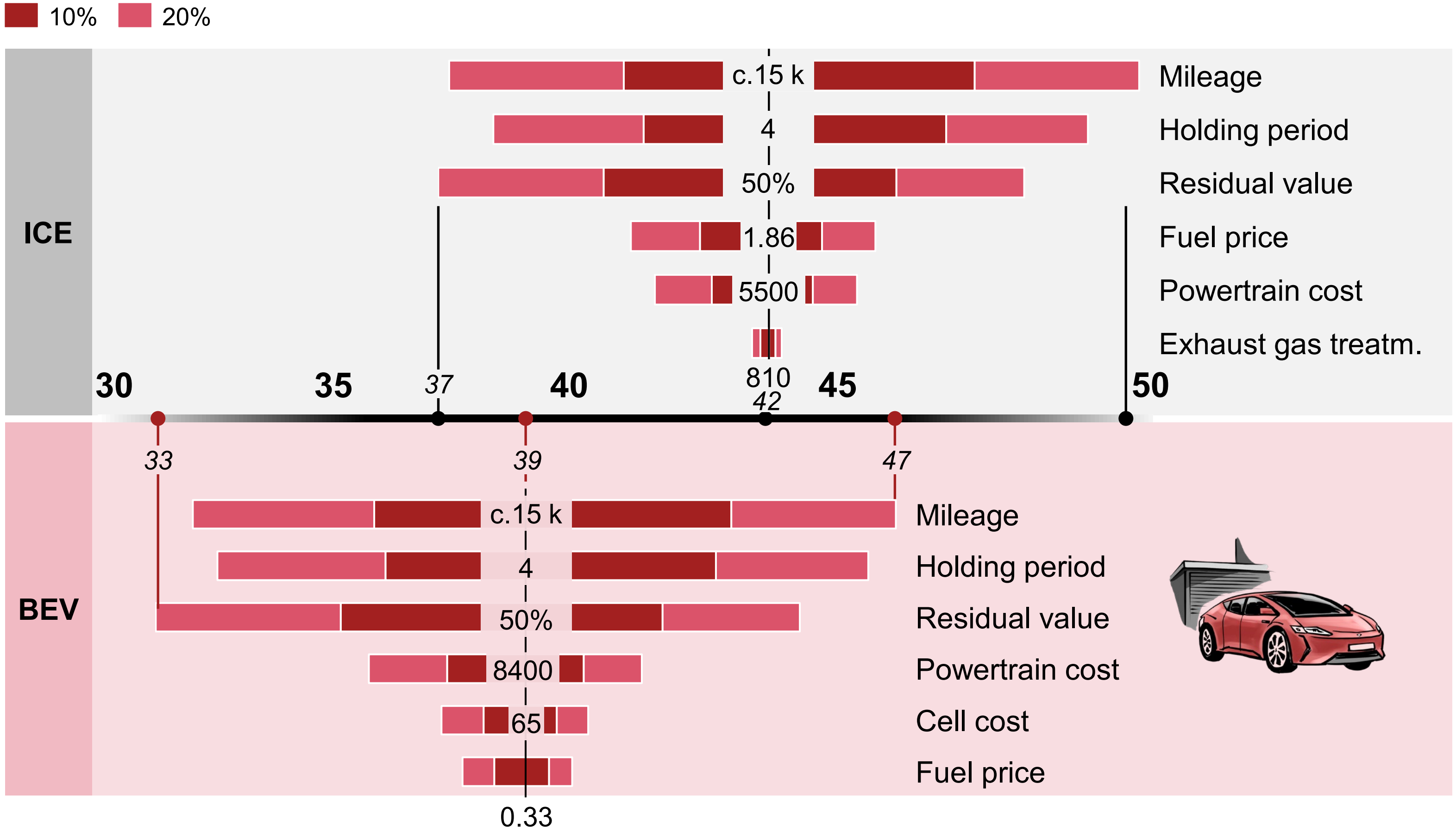
- Cost parity from 2030, led by Green rocket due to cost advantage in high-performance powertrains
- Full parity by c. 2040 as battery costs drop and ICE costs rise (e.g., Euro 7)

Standard range 10k km per annum; Long range 20k km per annum
Source: Strategy& analyses

From a TCO sensitivity perspective, EV powertrain costs are a key driver to obtain a positive business case compared to ICEs

TCO sensitivity

TCO sensitivity comparison (in €-ct/km/y) (Mass BEV 2030 Long range, 2030, EU, Germany)



Key TCO drivers

- **Depreciation parameters** (i.e., mileage, residual value) are primary drivers for TCO
- **Fuel price** almost **equally important** as **powertrain costs**

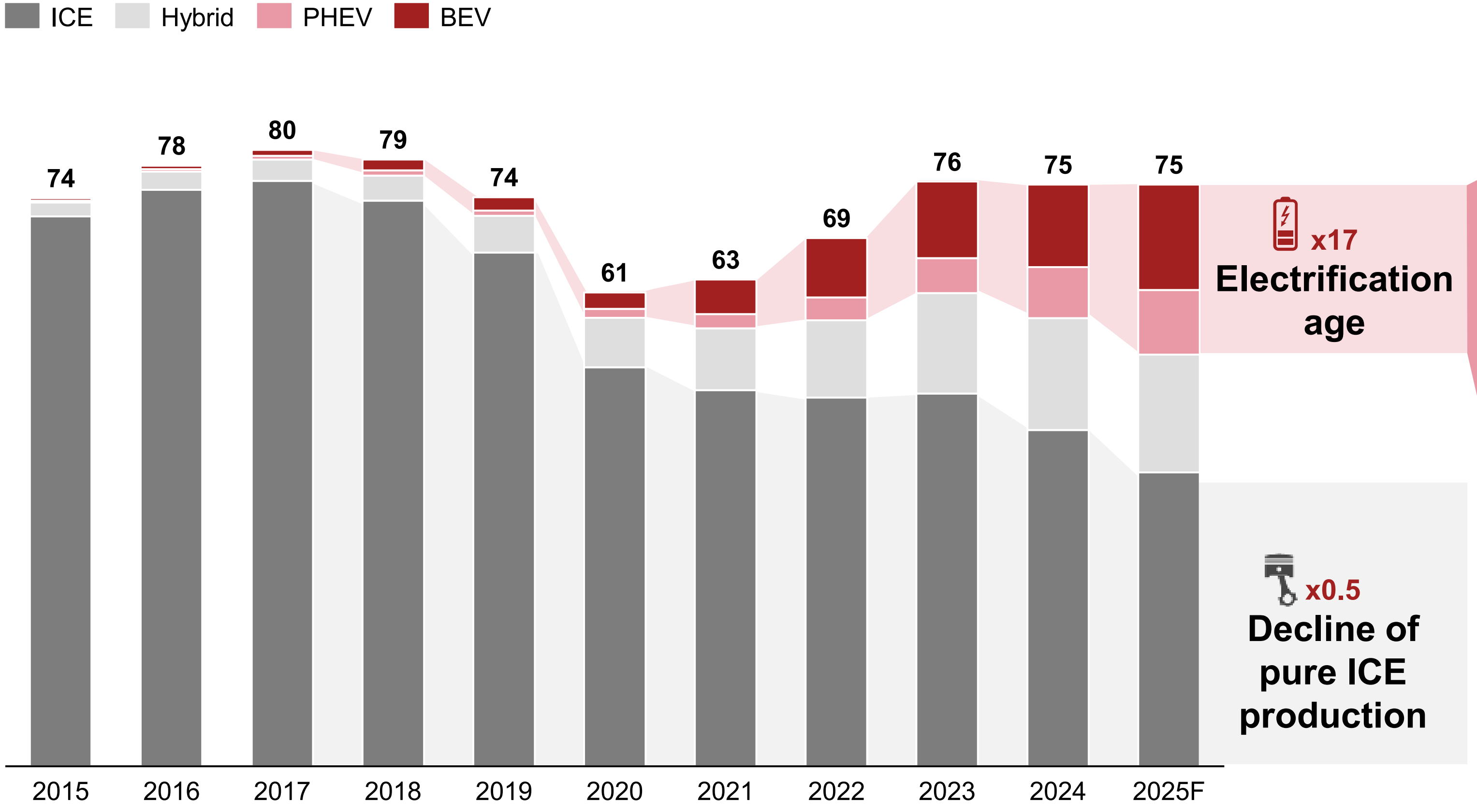
- **Depreciation parameters** (i.e., mileage, residual value) are primary drivers for TCO
- **Powertrain component costs more relevant** than **fuel costs**

Table of contents

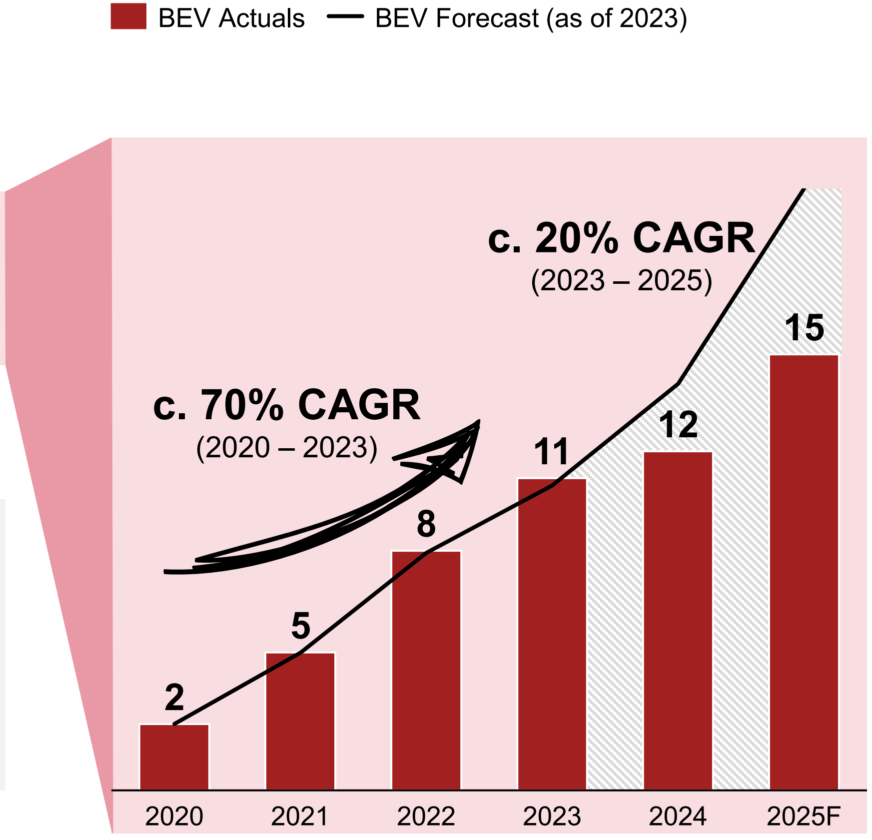
ICE production peaked in 2017, after which the electrification age started – after growth years, headwinds are on the horizon

Current EV market situation

Global powertrain development (in m units, passenger car production volumes)



Global BEV diffusion



Source: Strategy& analyses, PwC Autofacts 2025, IHS Production Forecast 2025

Across the Triad, transformation speeds differ significantly, with China leading; Europe at reduced scale and speed

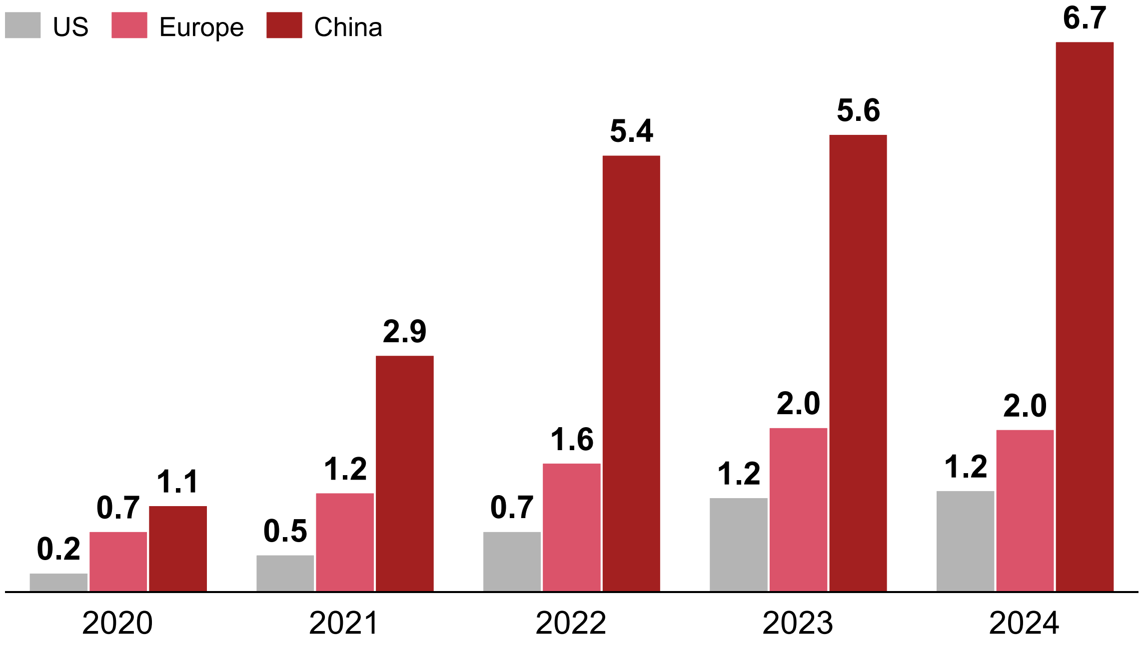
eMobility transformation: Market outlook (as of June 2025)

Regional BEV sales

Regional passenger car BEV sales in m units

China is biggest …

China with higher sales than EU and US (x3-5)

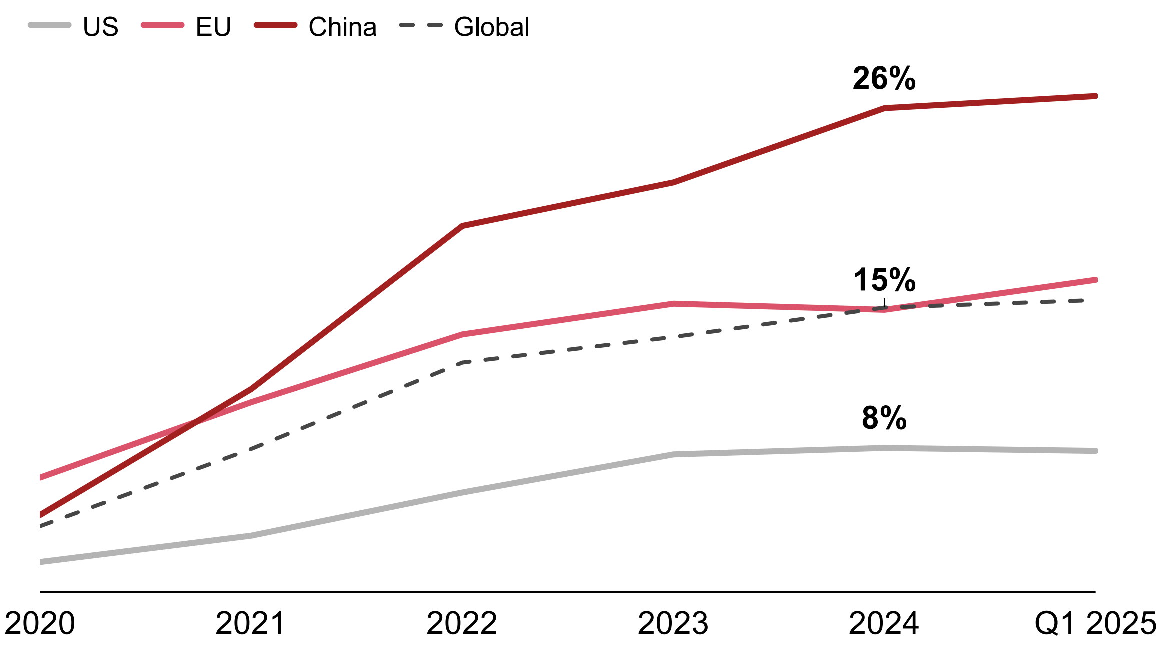


Regional BEV market share

in % of total regional passenger car sales

… and most dynamic EV market

China with higher diffusion than EU and US (x1.7-3)



Source: Strategy& analyses, PwC Autofacts

Looking at BEV diffusion drivers, the "transformation decade" is in full swing –headwinds expected to be overcome

BEV diffusion criteria

Example

	2nd-generation mass model platforms 2025	Decarbonization decade 2030	Quo vadis 2035
Legislation	Reduction in CO_2 targets currently, but further subsidies for additional ramp-up	CO_2 prices to increase gas prices by +10% (2030: €80/t CO2)	ICE ban expected to prevail
TCO and powertrain costs	Scale effects to become effective	Depreciation progression on level with ICE	Scale effects through EU battery value chain
Public perception	Less focus on decarbonization	BEVs as key technology for seamless connectivity and mobility	BEV largely accepted across core segments
Infrastructure/HPC	Sufficient availability of infrastructure available – competitive prices required	Germany as lead market, with one million barrier-free charging stations	Widespread fast charging availability – as fast as refueling

No driver for BEV diffusion | Moderate driver for BEV diffusion | Driver for BEV diffusion

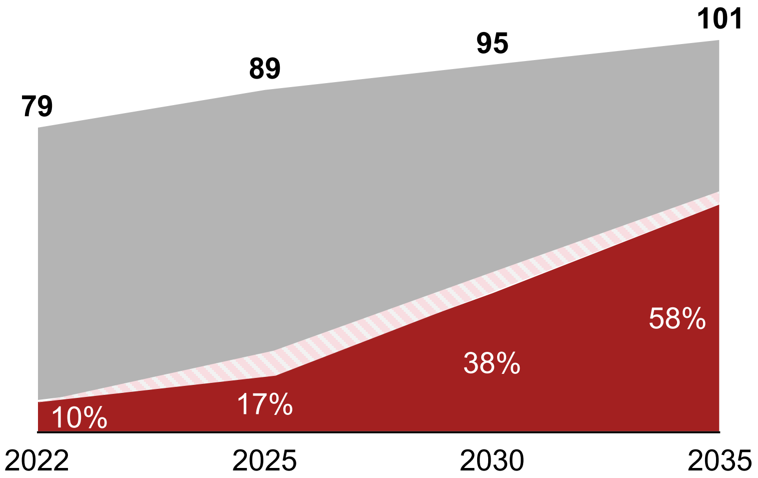
Source: Strategy& analyses

With market pull operating towards 2030, c. 40% of light vehicle sales are likely to have a BEV platform, resulting in 3.0 TWh battery demand

BEV diffusion (Strategy& forecast, as of 2025)

Global BEV diffusion

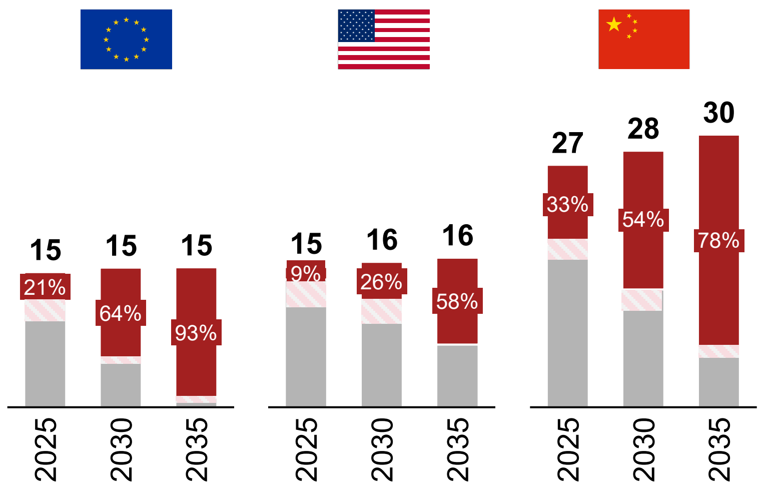
Light vehicle sales In m units



- In 2030, c. 40% of all light vehicles are expected to be based on a BEV platform
- By 2035, BEV share is expected to be nearly 60% globally
- Overall slower transformation speed expected

Regional BEV diffusion

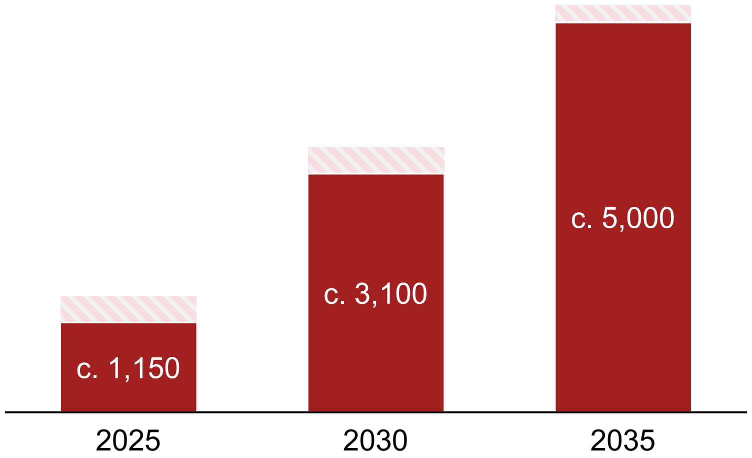
Light vehicle sales in m units



- Across the major three markets, EU and China are expected to be the main drivers of BEV adoption, spurred by regulations, HPC infrastructures and improved economics
- BEV adoption in US expected to accelerate from 2030 onwards

Global battery demand

Battery demand in GWh



- From 2025 to 2035, global battery demand is set to grow almost fivefold, from 1.15 TWh to c. 5.0 TWh
- Market growth driven by vehicle adoption – battery capacities are expected to stay constant from 2030 onwards

Headwinds vs. 2023 Strategy% forecast | Non-BEV | BEV

Source: Strategy& analyses, PwC Autofacts 2025, IHS Production Forecast 2025

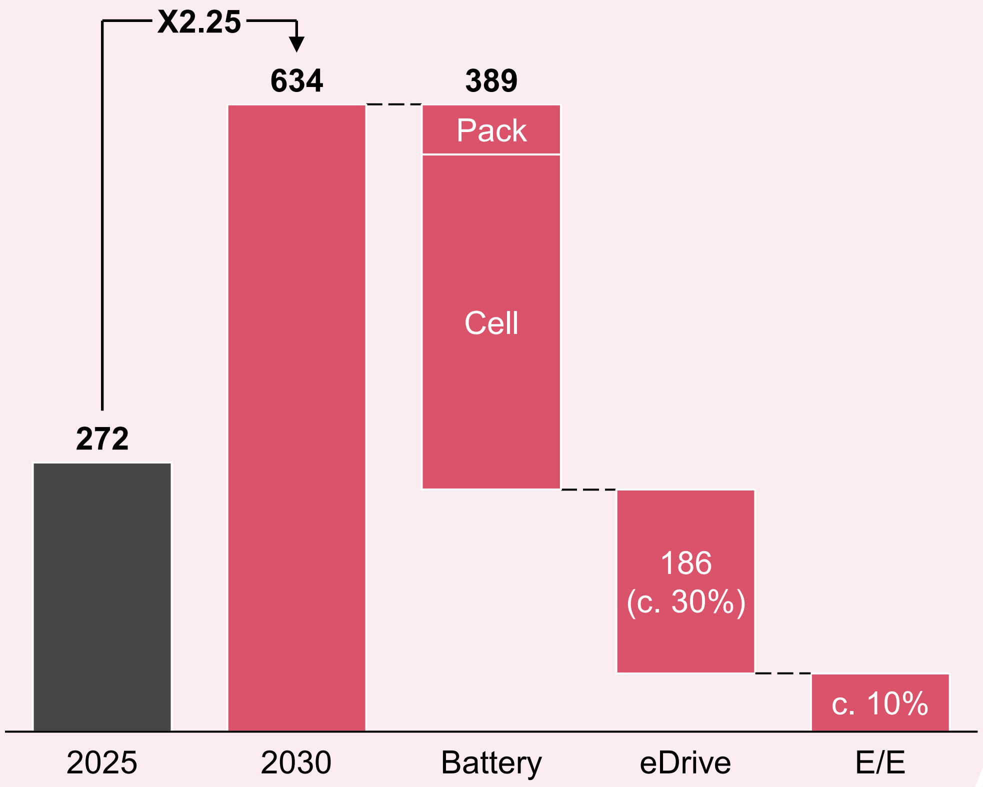
Table of contents

Despite headwinds, the transformative growth continues – to get into a leading position, continued innovations and supply chain build-up are required

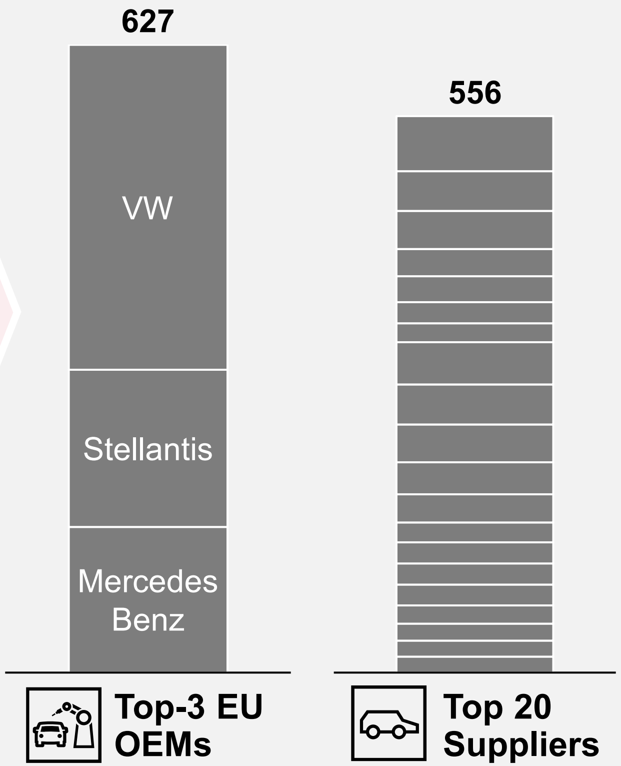
By 2030 we expect over €630 bn ePowertrain revenue – more than the Top-3 EU OEMs and the global Top-20 suppliers

Global ePowertrain revenue

2030 eMobility global annual revenue (in €bn)



2024 reference (revenue, in €bn)



Comments

- **Global ePowertrain revenue** will **more than double** in the next five years, to an **annual revenue** of more than **€600 bn**
- The **annual ePowertrain revenue** surpasses **many major industry players**, emphasizing its overall relevance
- Revenue from battery cell and system comprise c. 60% of global revenues; eDrive with c. 30% revenue share

Source: Strategy& analyses, Bloomberg

Across the entire battery value chain, China holds a dominating position – both EU and USA dependent upon Asia

2030 battery value chain overview (Strategy& forecast)

Battery value chain: Mining and Refining → Active material → Cell production → Battery system → Electric vehicles → Battery recycling

2030 Global battery cell production
(by supplier HQ, in % of GWh[1])

2030 Battery cell trade balance
(in GWh, in €bn based on average cell price)

2030 Global BEV production
(by OEM HQ, in % of total produced units[2])

	2030 Global battery cell production		2030 Battery cell trade balance		2030 Global BEV production		2024 ICE
China	c. 2100 GWh	c. 70%	800 GWh	c. 55 bn€	c. 1300 GWh	c. 45%	16%
Europe	c. 150 GWh	c. 5%	-650 GWh	c. 40 bn€	c. 800 GWh	c. 25%	23%
US	c. 50 GWh	c. 2%	-325 GWh	c. 20bn€	c. 375 GWh	c. 10%	14%
Japan	c. 150 GWh	c. 5%	-200 GWh	c. 13 bn€	~c. 350 GWh	c. 10%	30%
South Korea	c. 450 GWh	c. 15%	275 GWh	c. 20 bn€	~c. 175 GWh	c. 5%	11%
Rest of world	c. 90 GWh	c. 3%	20 GWh	c. 1.5 bn€	~c. 70 GWh	c. <2%	7%

1) Joint ventures between US OEMs and Asian cell suppliers attributed to cell suppliers 2) IHS 2025 Production Data 3) CN EV Post
Source: Strategy& analyses

Keeping up flexibility, momentum and scale in times of headwinds is critical – regaining innovation and operations power decisive for EU

Recommendations for the European Automotive Industry

Product

Scale across platforms
- Flexible, multi-energy platforms required to leverage scale
- Range and chargeability as differentiating customer factors
- Broad product portfolio required
- Drive cost-down initiatives to further improve cost competitiveness

Regain innovator role
- Innovation impact has decreased, but speed remains high
- Closing the performance gap and keeping up with China is essential
- Establish fast update cycles to update new product innovations

Operations

Foster localized cell production
- Localized cell production and supply chain are required
- Gain geopolitical independence, especially in times of growing trade barriers

Close the commercial cell costs gap
- Closely monitor and leverage raw material markets in times of increased demand
- Partnering with Asian players to improve ramp-up and scale production is essential

Market

Stay up to speed
- Diverging transformation speed requires flexibility, especially in US
- China-like scale and speed are required to retain momentum
- EU to catch up to China, via continued investments and potential cooperations

Overcome headwinds
- Headwinds will be overcome – investment in EU and China needed
- US expected to ramp up again – a competitive local product offering is key

strategy&
Part of the PwC network

Strategy& is a global strategy consulting business uniquely positioned to help deliver your best future: one that is built on differentiation from the inside out and tailored exactly to you. As part of PwC, every day we're building the winning systems that are at the heart of growth. We combine our powerful foresight with this tangible know-how, technology, and scale to help you create a better, more transformative strategy from day one.

As the only at-scale strategy business that's part of a global professional services network, we embed our strategy capabilities with frontline teams across PwC to show you where you need to go, the choices you'll need to make to get there, and how to get it right.

The result is an authentic strategy process powerful enough to capture possibility, while pragmatic enough to ensure effective delivery. It's the strategy that gets an organization through the changes of today and drives results that redefine tomorrow. It's the strategy that turns vision into reality. It's strategy, made real.

www.strategyand.pwc.com

Authors

Dr. Jörn Neuhausen
Senior Director E-Mobility
PwC Strategy&
joern.neuhausen@pwc.com

Dr. Philipp Rose
Director E-Mobility
PwC Strategy&
philipp.rose@pwc.com

Jan-Hendrik Bomke
Senior Manager
PwC Strategy&
jan-hendrik.bomke@pwc.com

Dr. Patrick Treichel
Manager
PwC Strategy&
patrick.treichel@pwc.com

Sarah Wennemar
Senior Associate
PwC Strategy&
sarah.wennemar@pwc.com

Dr. Luca Tendera
Senior Associate
PwC Strategy&
luca.tendera@pwc.com

Steven van Arsdale
Manager
PwC Autofacts
Steven.van.Arsdaler@pwc.com

© 2025 PwC. All rights reserved. PwC refers to the PwC network and/or one or more of its member firms, each of which is a separate legal entity. Please see www.pwc.com/structure for further details. Mentions of Strategy& refer to the global team of practical strategists that is integrated within the PwC network of firms. For more about Strategy&, see www.strategyand.pwc.com. No reproduction is permitted in whole or part without written permission of PwC. Disclaimer: This content is for general purposes only, and should not be used as a substitute for consultation with professional advisors.