Q4 2023 – Automotive industry demand forecast

ADVANCED PROPULSION CENTRE UK

This demand forecast covers

Markets	Global; European; UK
Vehicles	Light Duty Vehicles (LDVs) Heavy Goods Vehicles (HGVs) 
Materials	Lithium; Cathode Active Material (CAM); Battery foils; Electrolyte and Separator material

Our process

The data in these demand graphs is based on APC insight gathered from UK OEMs on xEV production; APC and Automotive Council PEMD traction specifications; and powertrain split forecasts from S&P Global IHS Markit. Rho Motion, BloombergNEF (BNEF) and Wood Mackenzie have also guided the demand forecast.

Quarterly updates

Any developments in the sector will change and influence these forecasts. APC will update these on a quarterly basis in line with the impacts of those announcements.

Disclaimer

These forecasts provide an estimate of electrified powertrain demand and are by no means an accurate statement of future markets and industry intentions. The data should be used in good faith and APC UK cannot be held liable for any inaccuracies in the data, views expressed or underlying assumptions.

Q4 2023 – Summary

Summary – Changes to projected demand by region

Q4 2023 compared to Q3 2023

	General notes	• Revision of motor technology split for Europe and UK sees a decrease of permanent magnet motors • LFP demand revised down for both Europe and UK based on slower than expected development of LFP supply chain in Europe	
	**Global demand update**	• Total world battery demand forecast sees a small 22 GWh decrease in 2027 reflecting the general global economic sentiment. This is expected to recover by 2030 with a small increase of 13 GWh compared to Q3 included in the forecast.	page 8
	**European demand update**	• Significant news of various deals for localisation of battery supply chain and a slight increase in the forecast battery demand (7 GWh in 2027 and 39 GWh in 2030). • MoU between Gotion InoBat Batteries and the Slovakian Government to build a gigafactory with an initial 20GWh capacity (SoP Q2 2026). • MoU between CATL and Stellantis for local supply for LFP battery cells for EV production in Europe. No further details on timelines, size or location. • Northvolt announced validation of sodium-ion battery with its research partner Altris. This makes Northvolt one of the first non-Chinese companies to have a sodium-ion production. The sodium-ion cells will initially be used for energy storage rather than EVs.	page 10
	**UK demand update**	• As with the global picture the UK BEV production forecast is reduced in 2027 in favour of lower cost hybrid vehicles largely due to economic headwinds pushing private buyers towards cheaper options. This results in a 3 GWh reduction to the 2027 forecast. • Increasing interest in electrification of HDV and LCV see a slight increase of 1 GWh in the 2030 forecast.	page 11

Summary – Trends insight

Q4 2023

Technology and market dynamics to accelerate BEV adoption	• **Ambition towards electrification for passenger cars across the globe through mandates and legislation by 2035** • **Observation of global slowdown in the sales growth rate of electric vehicles in 2023 due to a combination of economic and systemic industry factors** • **European OEMs investing in reducing cost of BEVs to protect their market share from external competitive threats** • **Systemic technology and market trends that has the potential to accelerate BEV adoption and reduce overall TCO**	pages 12-21

Source: APC analysis

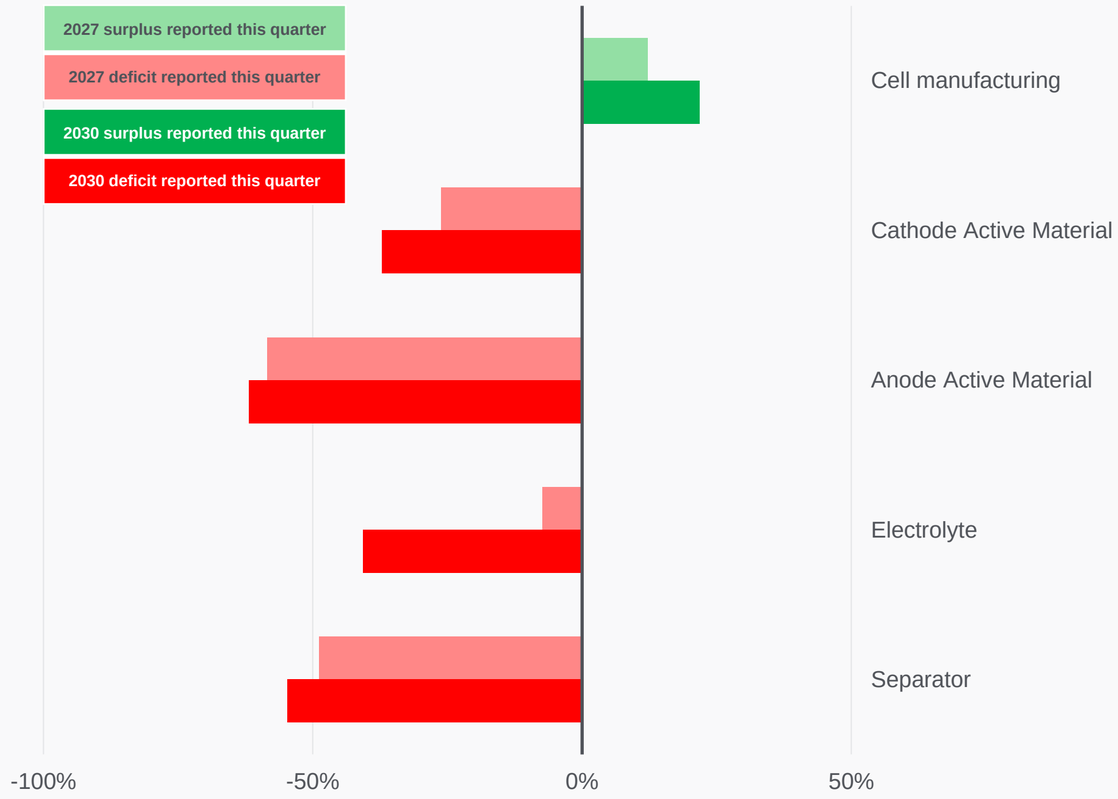
Summary – Supply chain activity

Q4 2023 notes

- The graph refers to Europe's capability to supply battery cells and sub-components that arise from local vehicle production.
- It assumes Europe is a self-sustaining bloc with no imports or exports.
- Capacity demand and incentives are attracting investment to the USA market from Europe.

ADVANCED PROPULSION CENTRE UK

2027 and 2030 European[1] capacity vs demand balances



Status of regional capacity* vs demand balance in 2030	Value** (%)	UK supply chain status
• Capacity plans remain above demand, and as potential cancellations feel less likely the surplus continues to grow. • Capacity for LFxP still lags behind demand, with only 10% of planned capacity likely to be LFP in 2030.	18%	As part of Nissan's announcement of three EVs being produced in Sunderland, the company said it had initiated a feasibility study to explore potential further gigafactory investments in the UK.
• In January, Northvolt secured a USD$5bn loan to be used to expand its cathode and cell manufacturing facilities in Sweden.	**46%**	Required to be made in the region from 2027 for UK cells to qualify as local and to avoid EV tariffs in the EU.
• There are some movement in regards to recycling of graphite, which in the long term is likely to have a positive effect on the supply chain of anode material in the US and Europe. However, in the short to-mid-term the deficiency of anode material is growing.	9%	With the price of natural graphite increasing, the prospect of synthetic graphite is becoming competitive. UK has some of the supply chain e.g. needle coke, it would be prudent to have graphite supply in place by 2026.
• No new major projects announced. However, it is likely that the future European electrolyte supply will be near or match the demand closer the time, as electrolyte facilities will be set up with comparatively short notice (hence the gap between 2027 and 2030).	8%	Value in today's liquid electrolyte is relatively low, but semi-solid and solid-state electrolytes are a key investment consideration.
• Separator materials remains a big growth opportunity for localisation in Europe.	7%	Significant opportunities to localise in UK even though typically manufactured in Eastern Europe.

Source: APC internal analysis of public announcements, BNEF forecasts (December 2023), Wood Mackenzie (December 2023)
1) Europe region includes non-EU countries such as Turkey

*Risk-weighted capacity based on APC internal assessment of announced and under construction projects
**Value in terms of cost contribution to total cell cost based on an NMC811 cell

Q4 2023 – Demand update

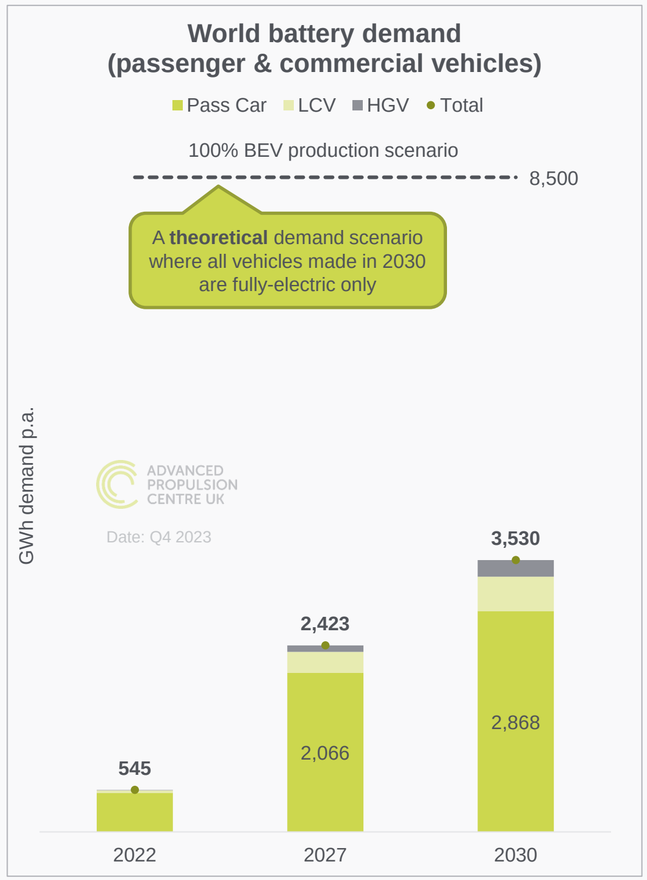
The following section includes battery demand from both Light Duty Vehicles (LDVs) and Heavy Goods Vehicles (HGVs)

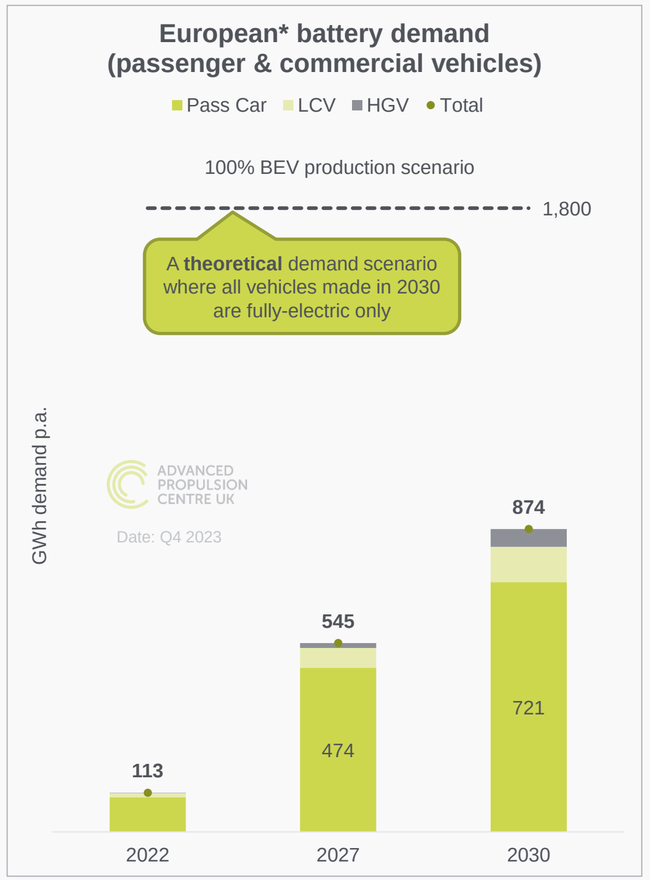
Battery demand forecast

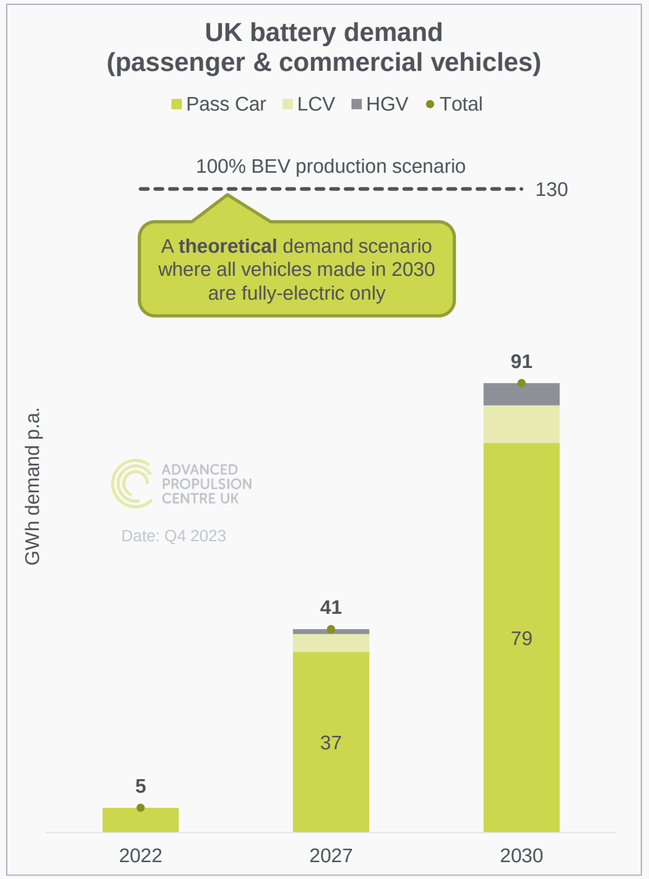
LDVs and HGVs

Q4 2023 notes

- Global battery demand forecast remains strong even though there was a slight decrease in Q4 for demand in 2027.
- Increase in European Passenger Car forecast in Europe both in 2027 and in 2030.
- UK production forecast decreased in 2027 as forecast production volumes are lower compared to Q3.







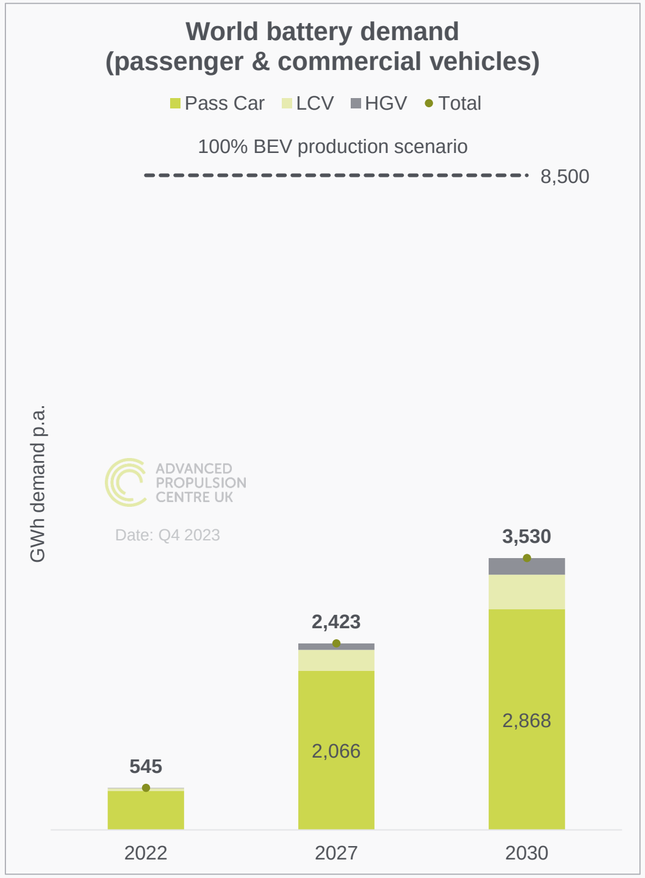
Source: APC Demand Databases using S&P Global AutoTechInsight (Oct 2023), Rho Motion data (Oct 2023), BNEF (Oct 2023), Global Data (Oct 2023)
Note: LCV = Light Commercial Vehicles < 3.5t, buses not included. *European forecast includes non-EU countries such as Turkey

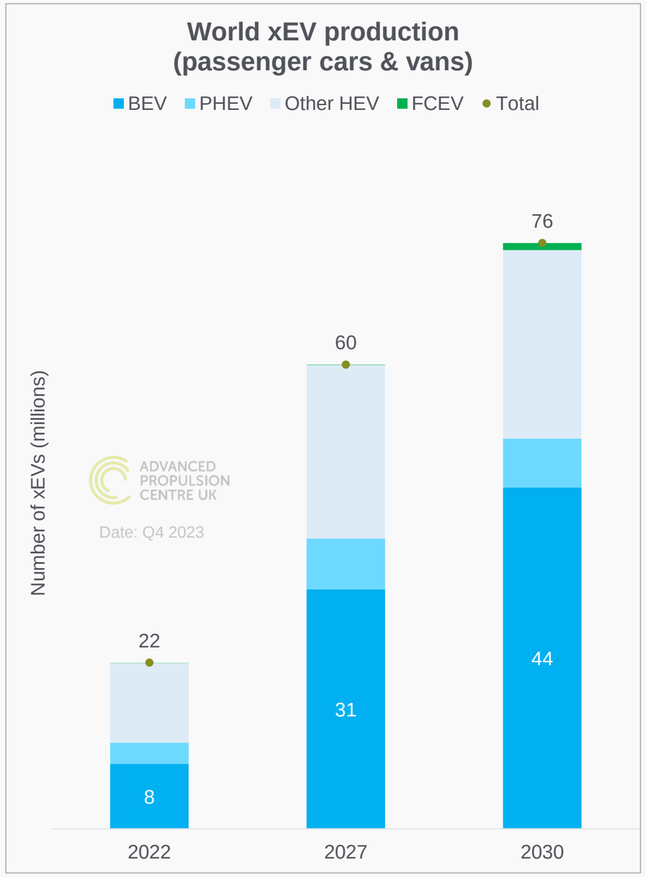
World xEV production

Passenger cars and vans

Q4 2023 notes

- World battery demand forecast fluctuated slightly this quarter compared to last quarter, 2027 decreased (increased hybrid forecast) whereas 2030 increased (increased BEV forecast).
- Total world production forecast remained the same for 2027 but is expected to grow a little more in 2030 than forecast in Q3, notably BEV increased by over 200k.





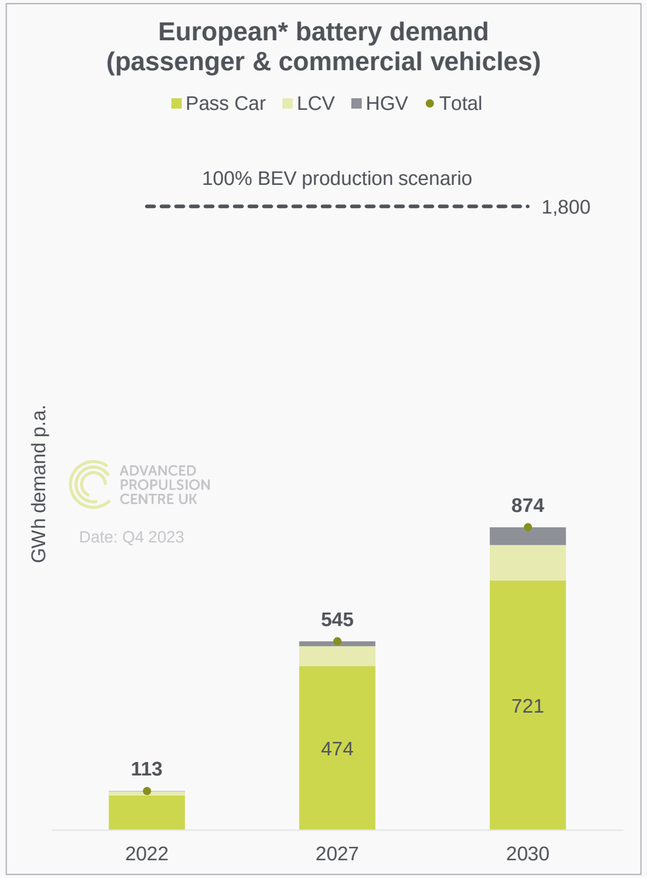
Source: APC Demand Databases using S&P Global AutoTechInsight (Dec 2023), Rho Motion data (2023), BNEF forecasts (2023), Global Data (2023)
Note: LCV = Light Commercial Vehicles < 3.5t, buses not included.

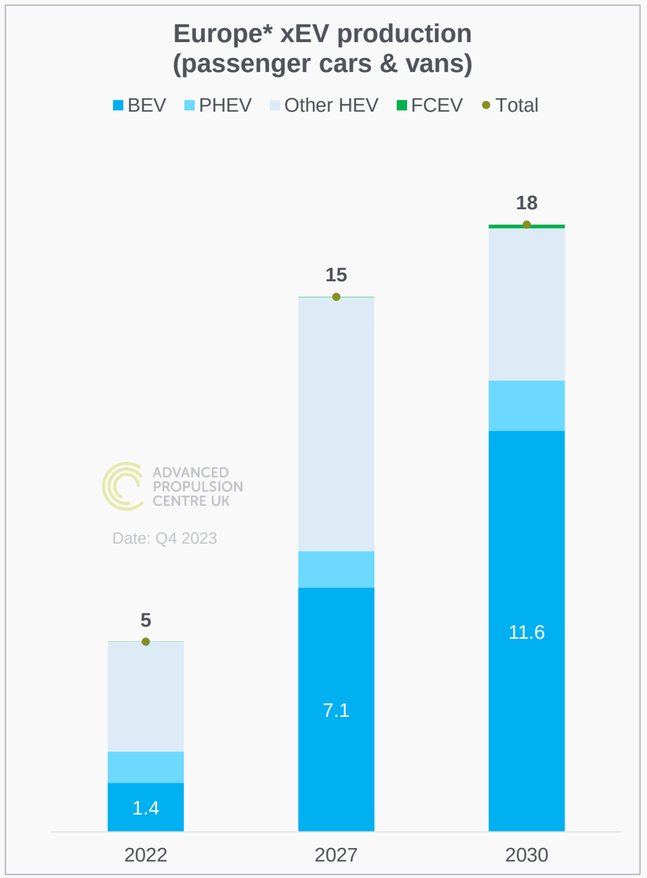
European xEV production

Passenger cars and vans

Q4 2023 notes

- xEV production forecast in 2027 is virtually the same, just under 15.5 million in total. There are some movement between different types of EVs. BEV forecast decreased by ~200k and MHEV forecast increased by ~200k.
- In 2030, 11.6 million fully-electric vehicles forecast to be produced in Europe, over 80k more than predicted in Q3.





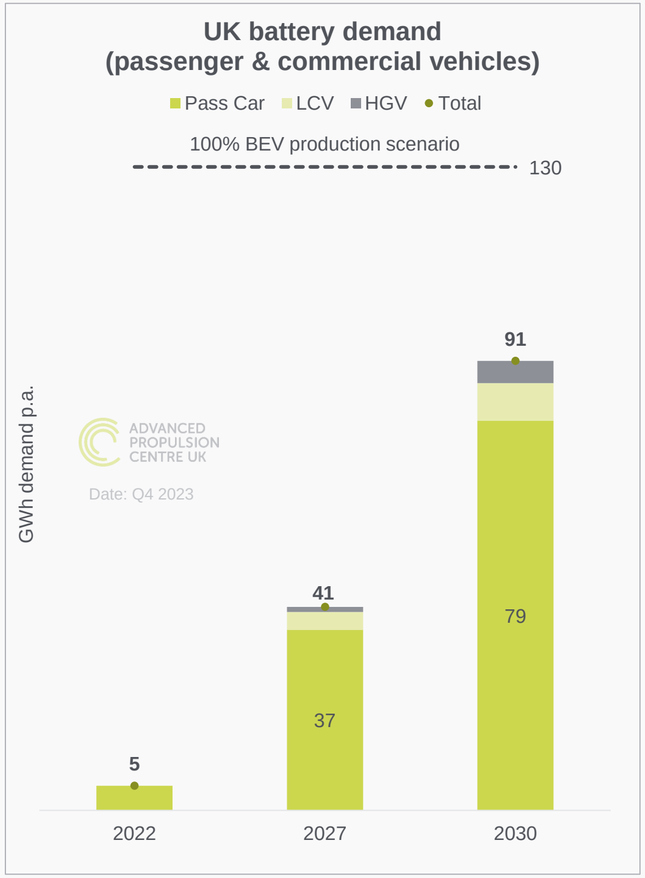
Source: APC Demand Databases using S&P Global AutoTechInsight (Dec 2023), Rho Motion data (2023), BNEF (2023), LMC (2023)
Note: LCV = Light Commercial Vehicles < 3.5t, buses not included. *European forecast includes non-EU countries such as Turkey

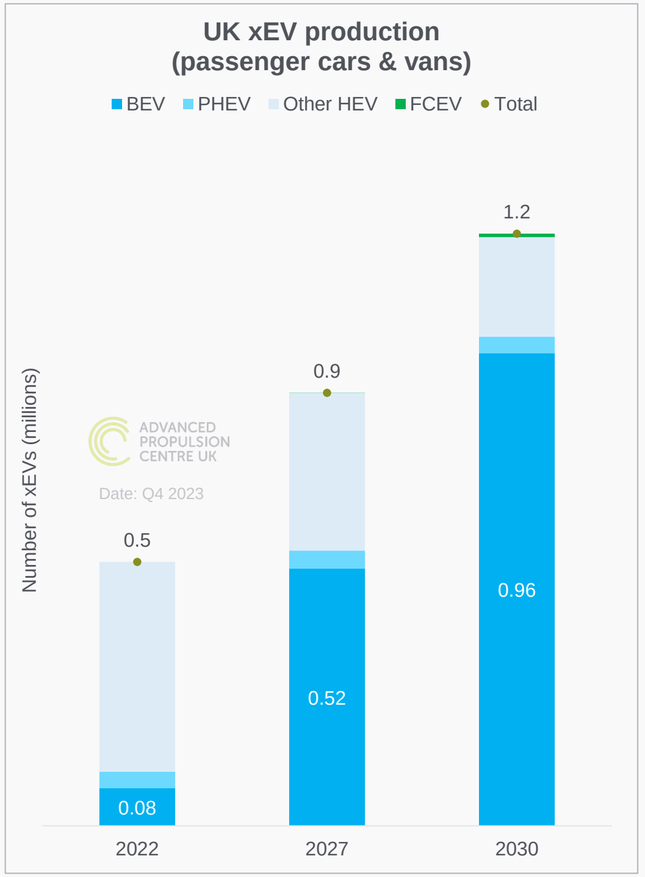
UK xEV production

Passenger cars and vans

Q4 2023 notes

- There is still a positive trajectory of BEV production in the UK, with production expected to be almost 60% of output in 2027.
- Compared to Q3 the production forecast for 2027 is lower, while the forecast for 2030 is a little higher. In 2027 the change is across the board while in 2030 the increase is in hybrid vehicles.





Source: APC Demand Databases using S&P Global AutoTechInsight (Dec 2023), BNEF forecasts (2023)
Note: LCV = Light Commercial Vehicles < 3.5t, buses not included.

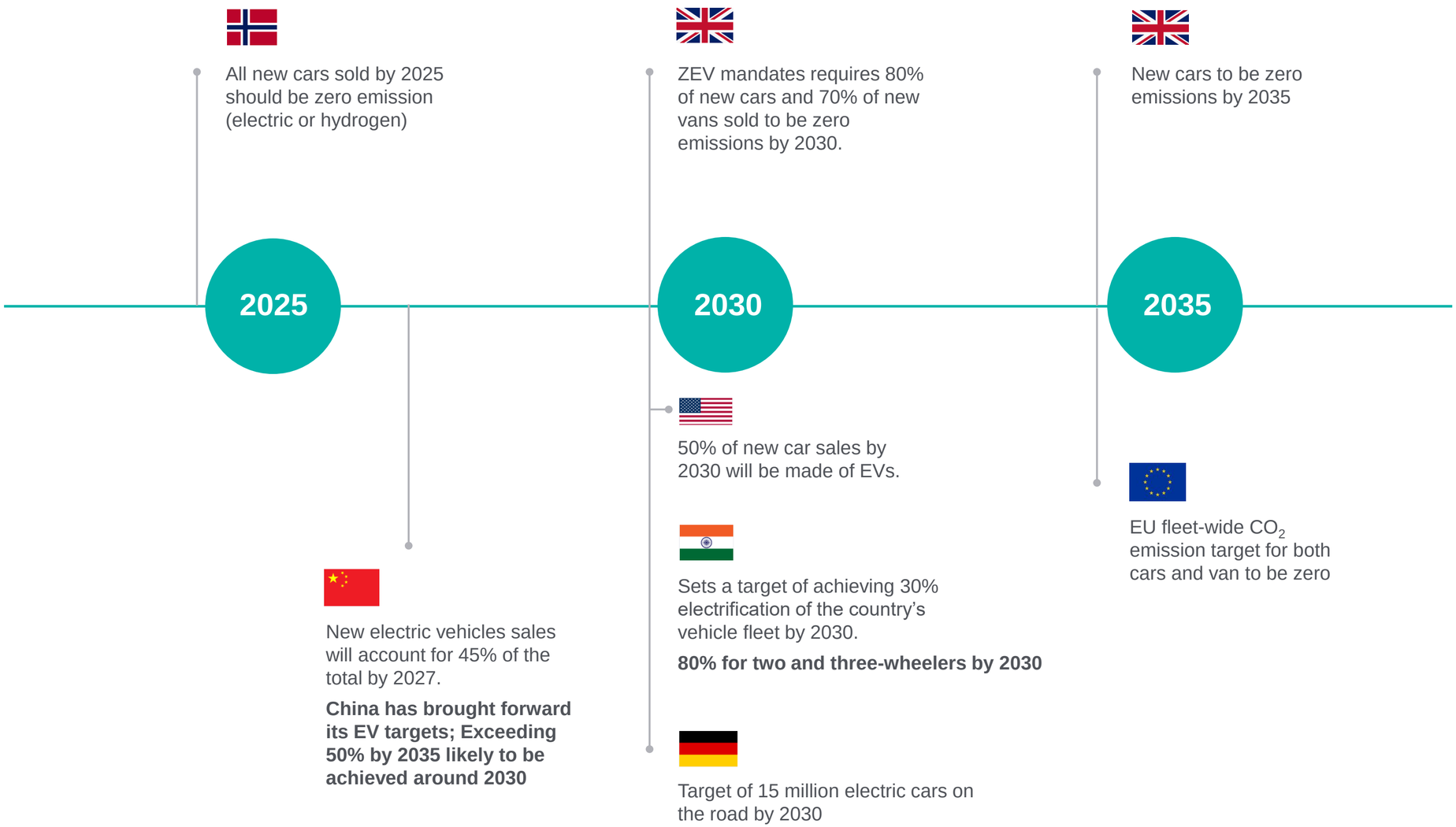
ADVANCED PROPULSION CENTRE UK

Q4 2023 – Trends insight

Technology and market dynamics to accelerate BEV adoption

There is a growing ambition towards electrification for passenger cars across the globe through mandates and legislation by 2035

ADVANCED PROPULSION CENTRE UK



Observation of global slowdown in the sales growth rate of plug-in electric vehicles in 2023 due to a combination of economic and systemic industry factors

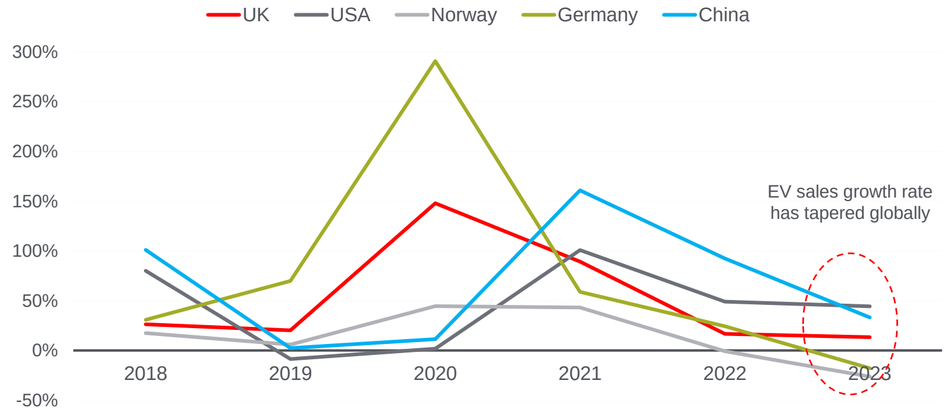
ADVANCED PROPULSION CENTRE UK

Some of the reasons why we are seeing a downturn in EV sales growth rate across the globe:

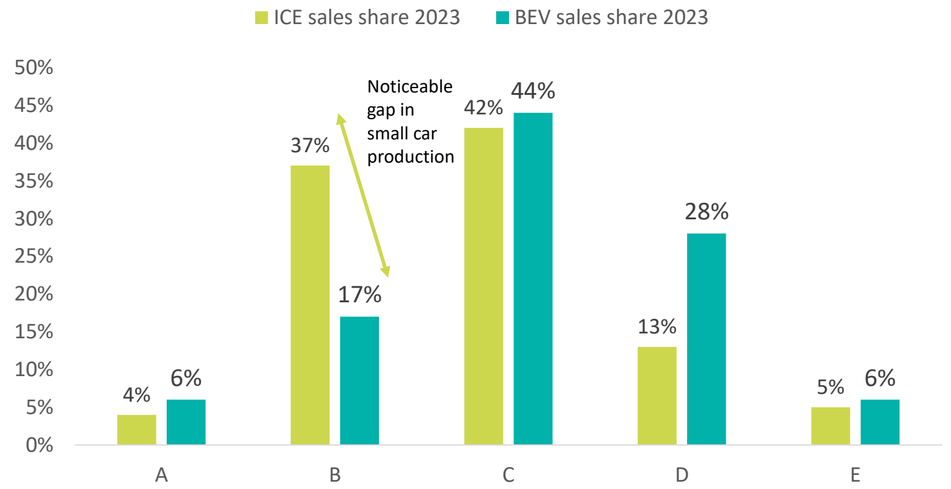
- High interest rates across the globe and drawdown of excess savings from COVID pandemic era has tightened consumers' budget globally
- European nations like Germany, France had started to phase out on BEV incentives
- There is a focus on larger vehicle segments for BEV models in Europe and USA due to higher margins, this has resulted in fewer lower cost/smaller vehicles compared to availability across ICE segments (e.g. segment B)
- The insurance premiums of electric vehicles are higher compared to ICE due to complexity in battery repairs and availability of parts
- Consumers across multiple countries have reported high purchase cost and lack of charging infrastructure as some of the key barriers in acquiring electric vehicles

Segment*	A	B	C	D	E
Existing vehicle model examples					

Plug-in EV sales YoY growth rate in the selected five countries



EU+UK ICE and BEV sales share based on vehicle sales segment



Source: APC analysis from BNEF derived data, Transport & Environment, Kantar, Thatcham research, fleetnews

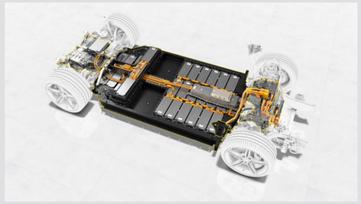
*EU car classification

Systemic technology and market trends that have the potential to accelerate BEV adoption

Trends and developments have the potential to improve the overall TCO of BEVs compared to the current generation of ICE vehicles.

Efficient design and manufacturing processes	Shift to cheaper, efficient design, structures and manufacturing processes that results in lower costs for battery electric vehicles
Lower cost battery chemistries	Strong trend of lower battery pack prices and emergence of low-cost cathode alternatives for lithium-ion batteries through technology and innovation
Dedicated platform	Dedicated BEV platforms adopted by OEMs that will have an impact on the overall costs and offering to consumers
Integrated BMS	Integrated battery health management leveraging AI technologies and machine learning techniques to reduce insurance premiums and increase resale value of BEV
Charging infrastructure	Increasing investment into charging infrastructure across globe to remove the bottleneck on EV charging constraints for consumers

Shift to designs, structures and manufacturing processes that result in lower costs for battery electric vehicles

Themes on focus	Description	Positive benefits for the industry	Some of the challenges with the innovation
Structural development of batteries 	Research and development in advanced battery structures can result in the increase of gravimetric and volumetric densities. Technology concepts such as cell to pack and cell to chassis has the potential to increase structural integrity of the battery electric vehicles	✓ Better material and weight distribution across the length of the vehicle. Improves overall efficiency of the system ✓ Increased structural integrity for the electric vehicle during crashes ✓ Technologies like cell to pack eliminates the need for modules and allows to have fewer components, reducing manufacturing costs	○ There are still safety challenges like thermal runway issues with the lack of modules between cells in cell to pack technology ○ Less technology maturity resulting in increased costs in manufacturing and maintenance
Integrated high pressure die casting 	Integrated high pressure casting, also know by names megacasting or gigacasting, is made by filling molten or semi molten metal like aluminium into the cavity of diecasting die at a very high speed and high pressure	✓ Reduces the need to manufacture large number of components ✓ Increases scale of efficiency, simplified production line and results in drastic reduction of manufacturing costs	○ Upfront need for investment on the mega press equipment ○ Increased complexity in the repair of the vehicles that is damaged in crash/accident
800-volt architecture systems 	OEMS are increasingly switching to 800v systems architecture to power the electronics, drive units and powertrain of modern electric vehicles	✓ Faster charging capabilities resulting in rapid charging time ✓ Reduced need for thick cables and copper materials in the system due to the flow of less current in the system ✓ Ability to make compact and small batteries due to the efficiency gained from the weight reduction	○ Requires rework of vehicle architecture and dedicated investment into the electronics components ○ Need for charging stations equipped with higher voltage ranges

Source: SBD automotive,S&P Global Mobility

Images: Toyota media site, Porsche newsroom, Henkel

Strong trend of lower battery pack prices and emergence of low-cost cathode alternatives for lithium-ion batteries through technology and innovation

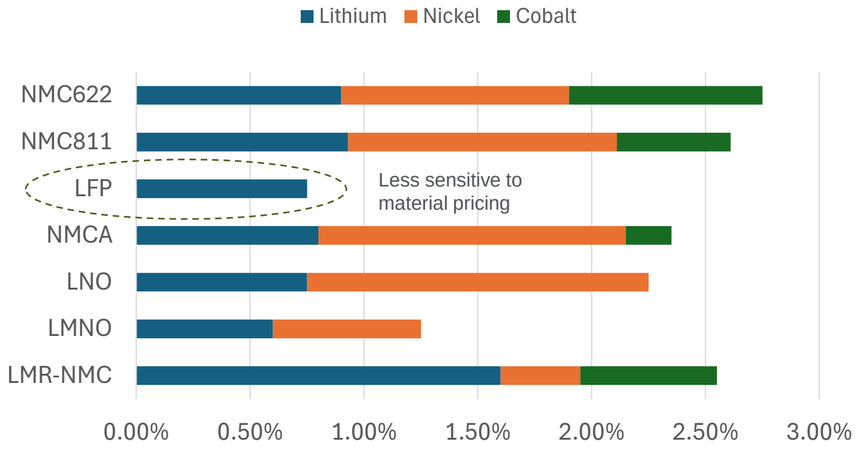
There is a broad agreement in the direction of the cost of batteries <$100/kWh achievable by 2030

Battery costs $/kWh	2020		2025		2030	
	Pack	Cell	Pack	Cell	Pack	Cell
BNEF	140	104	85	63	59	39
US Department of Energy	143	107	-	-	80	60
Automotive council UK	125	85	97	70	77	58
Ford	165	123	100	75	80	60
Renault	150	113	100	75	80	60
VW	133	100	-	-	67	50

Though lithium-ion battery packs are influenced and affected by the price of raw materials, advancements in technologies and expansion of battery manufacturing capacity will lead to a decline in battery price per kWh. There is broad agreement that < $100/kWh is achievable by 2030 and could drop below $80/kWh. The assumptions are based on the following:

- Developments in new battery technologies like silicon anodes and LFMP cathodes
- Better efficiencies through cell to pack and cell to chassis technologies
- Improvements to manufacturing technology for cathode production

Change in battery pack price per 10% change in commodity price for various battery chemistries



LFP is a cost-effective alternative to NMC. LFP is less sensitive to fluctuating material pricing and contains fewer critical materials compared to NMC, which is dependent on price sensitive materials, like nickel and cobalt.

The figure above shows the susceptibility of different class of batteries for change in commodity price. LFP is least affected, among common lithium-ion battery types, due to lack of exposure to price sensitive minerals, like nickel and cobalt.

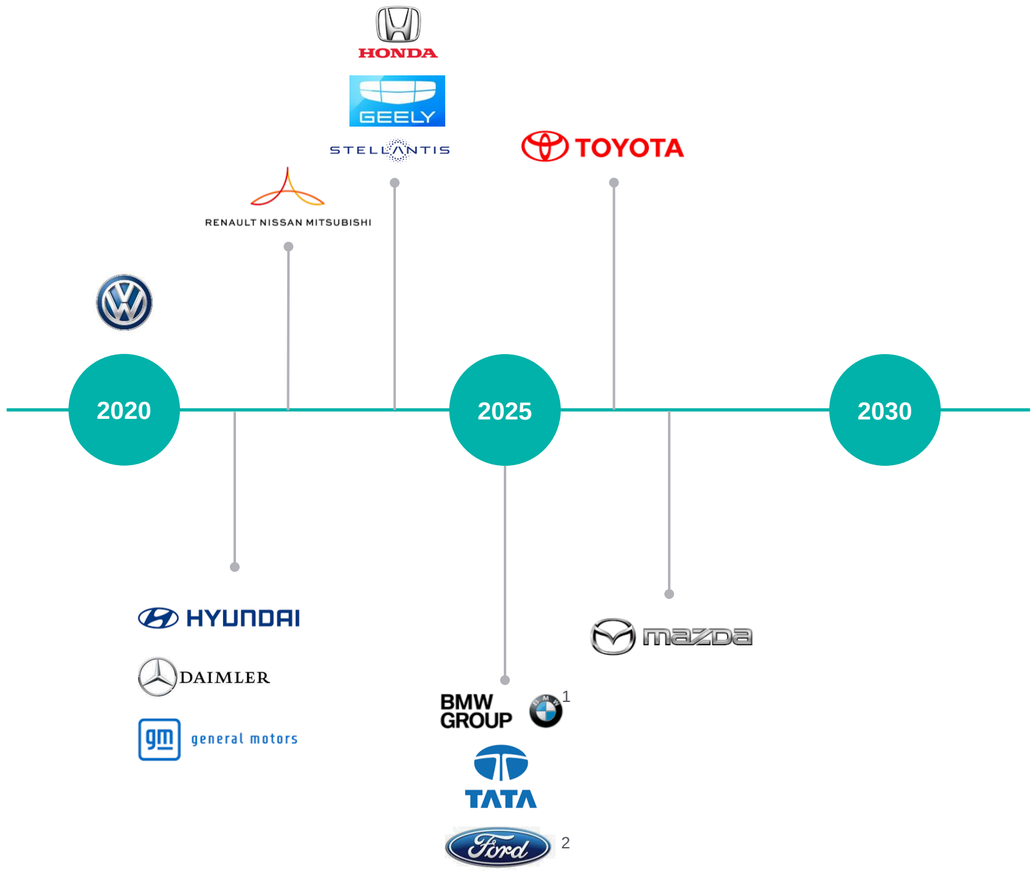
According to APC analysis, if large premium SUVs are optimised to achieve the highest range possible, then LFP is likely to provide the lowest ‘cost per mile’ by 2030*.

Source: APC Battery insight report:2025 and beyond 2022, IEA, The Faraday Institution Developments in Lithium-Ion Battery Cathodes

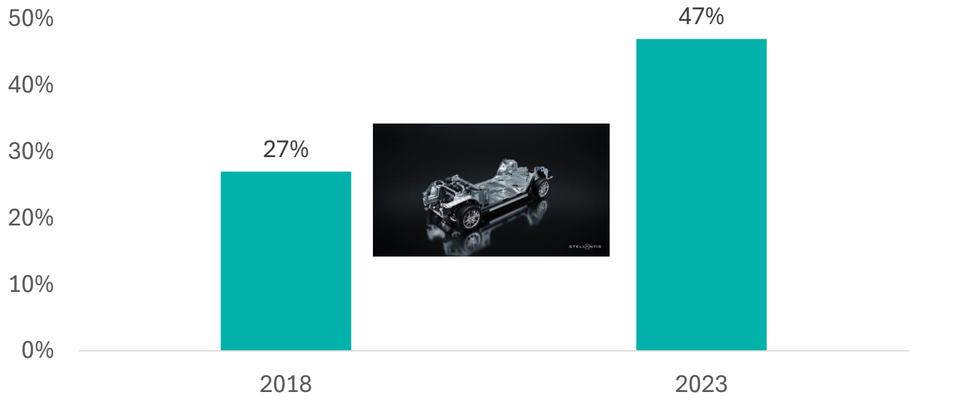
Dedicated BEV platforms will have a positive impact on the reduction of BEV's overall cost, through scale and efficiency

OEM manufacturers are increasingly aware of the potential advantages and cost savings gained by transitioning away from legacy ICE to dedicated BEV platforms. By deploying dedicated BEV platforms, OEMs can launch multitude of models through simplified production and assembly line helping to gain large scale efficiencies and cost savings.

Launching timelines of dedicated BEV platforms* by OEMs



% of global BEV sales from dedicated platforms



Switching to dedicated BEV platforms combined with the declining battery prices can lead to 40 % decrease in BEV costs by 2030

Advantages of having dedicated EV platforms:

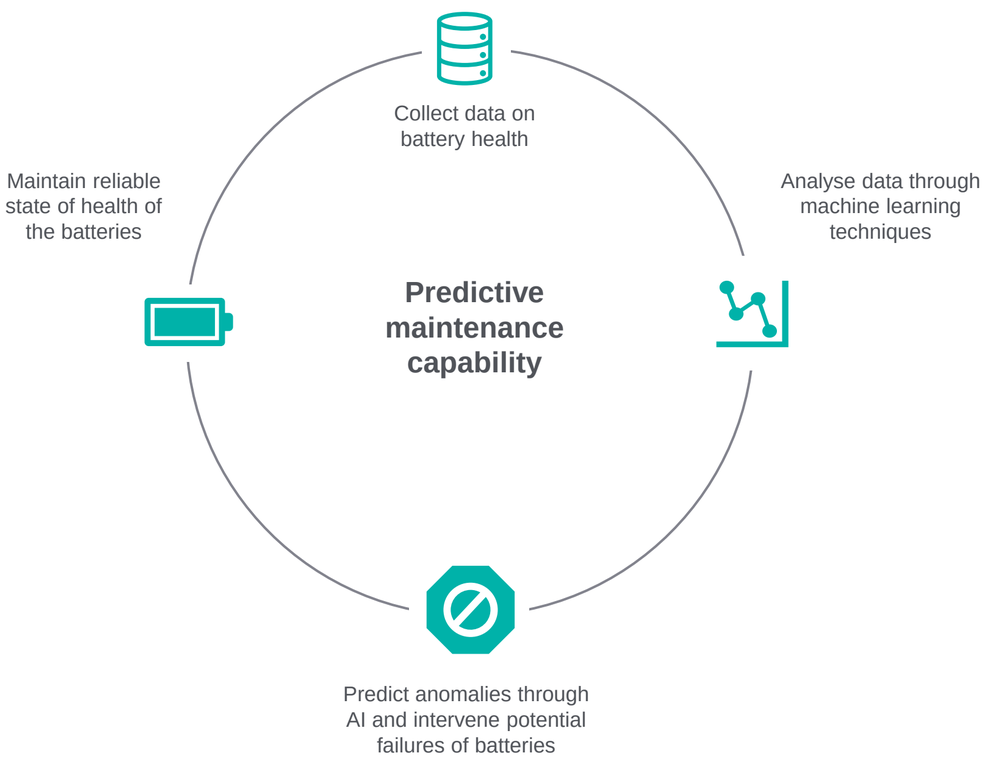
- Can accommodate dedicated battery packs leading to higher kWh and range
- Dedicated EV platform allows more floor space as there is no need for engine compartments, allowing more compact cars
- Integrated design structures by using support from cell to pack and cell to vehicles can be used as a structural support and eliminate excess materials
- Ability to centralise power electronics and electrical drive units to support over the air connectivity and 4G/5G services

Source: BNEF Legacy automakers report *Dedicated BEV platforms are ground up platforms with exclusive focus to electric vehicles. 1 BMW group - Neue Klasse platform 2 Ford - GE2 platform images: Stellantis STLA platform

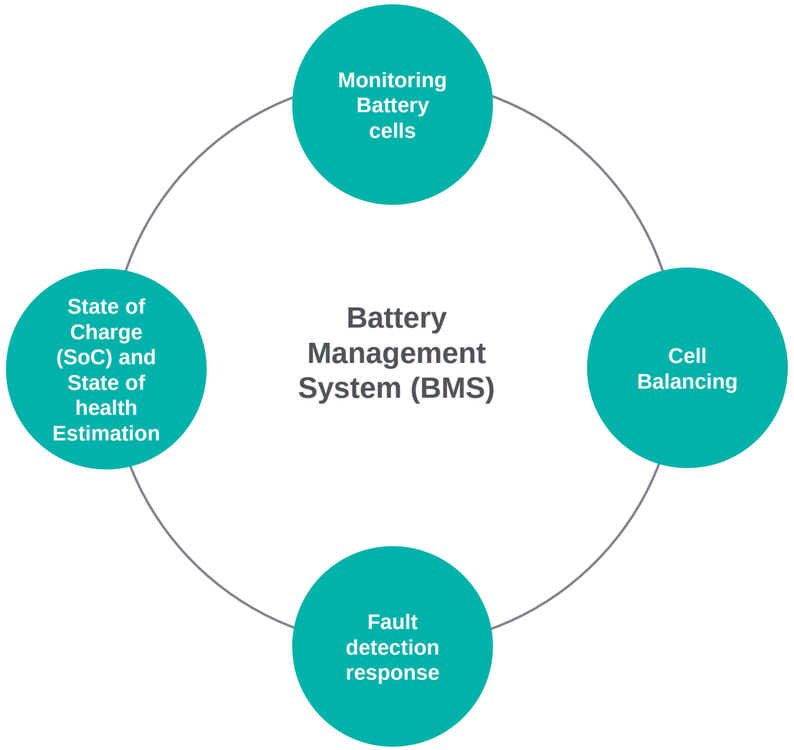
Integrated Battery Health Management (IBHM) will reduce insurance premiums and increase BEV resale value by providing confidence on battery health

Battery management system (BMS) is a critical component in managing health and performance of batteries. Leveraging the capabilities of AI and wireless cloud connectivity, will help to predict and maintain the health of the battery cells and packs from catastrophic failure and structural degradation.

Strategic level monitoring of battery health



Tactical level monitoring of battery cells



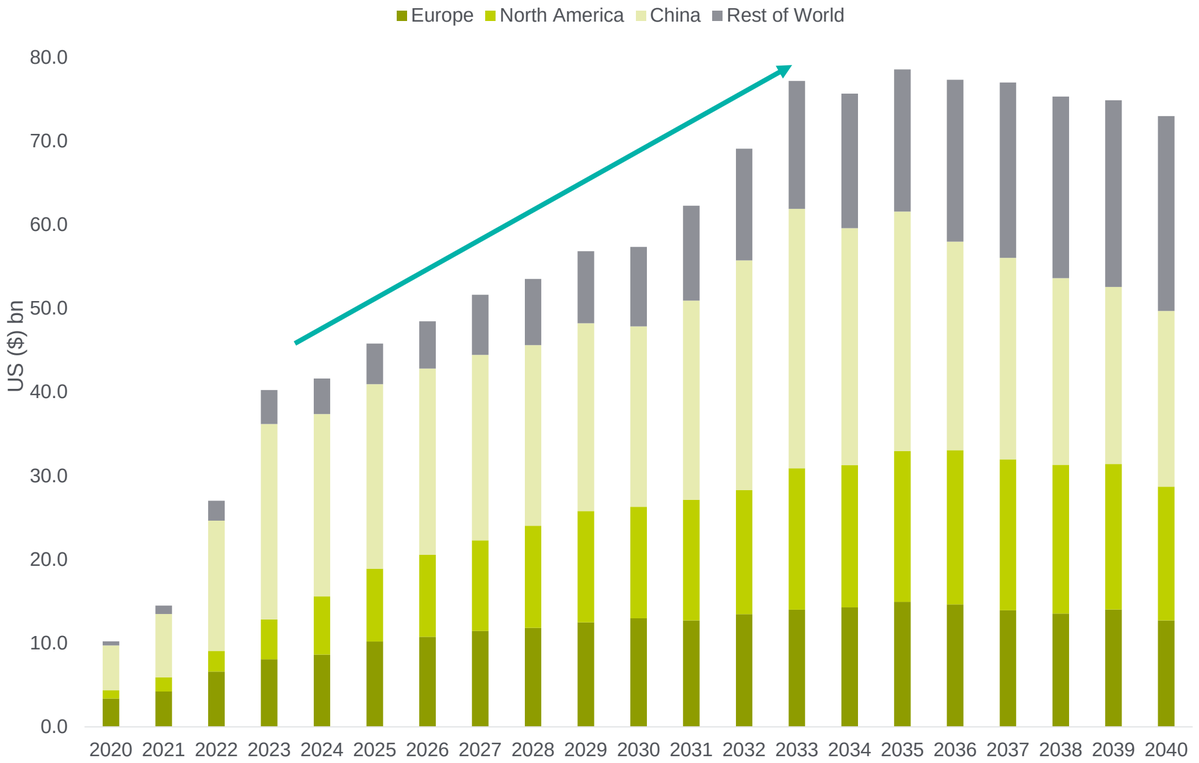
Advantages of combining predictive maintenance and BMS

- Reduces unplanned downtime on BEV fleets from non-scheduled repairs and catastrophic failures
- Improved battery performance and increased reliability on future battery health
- Provides better information and rationale for insurers on the accurate cost of the insurance premiums
- Increases the resale value of the battery electric vehicles as the confidence in battery health data increases

Sustained investment on rolling out of charging infrastructure will remove the bottleneck on EV adoption

Charging infrastructure has been highlighted as one of the important barriers preventing consumers across globe to adopt EV. Annual investment in all types of charging globally increases to over $50 billion by 2027. There are positive signs across globe through regulations and grant funding to accelerate charging infrastructure for increasing EV adoption.

Annual BEV charging investment across globe to hit $57 billion by 2030



Source: BNEF Economic transition scenario, UK GOV, EU Council and Kantar

Some key developments across UK and Europe on EV charging infrastructure

UK

Government has been investing on increasing the availability of public charging points through deployment of various investment funds and grants. In Dec 2023, the government launched the £70 million rapid charging fund pilot that will facilitate industry's rollout of ultra-rapid chargepoints at motorway service areas.

The government is delivering £381 million to local councils through Local Electric Vehicle (LEVI) fund. Local councils can choose where is best to install chargepoints in their area.

Europe

As part of the EU's alternative fuel infrastructure regulation, more EV charging stations will be deployed in Europe. Some key highlights from the proposal:

- From 2025 onwards, fast recharging stations of at least 150 kW for cars and vans need to be installed every 60 km along the EU's main transport corridors (TEN-T network)
- Recharging stations for heavy-duty vehicles with a minimum output of 350kW need to be deployed every 60 km along the TEN-T network.

European OEMs are leveraging technological advances and developing economies of scale to enable lower cost BEV models

Launch of lower cost models based on dedicated BEV platforms using lower cost chemistry like LFP and perhaps sodium ion are being accelerated in Europe by the perceived threat to market share of lower cost imports.

Car makers	Announcement
Stellantis	Announced to cut EV costs and launch affordable electric cars
Renault	Renault aims to offer EVs at prices comparable to traditional internal combustion engine vehicles in 2026
Volkswagen	Volkswagen are launching the ID 2 in 2025 an all-electric vehicle costing less than €25000
Citroen	Citroen are launching the e-C3 costing less than £23,000 in 2024 with a smaller battery version costing less than £17,500 coming in 2025
Nissan	Nissan aims to have cost parity between EVs and ICE vehicle by 2030

Renault Twingo


Citroen e-C3

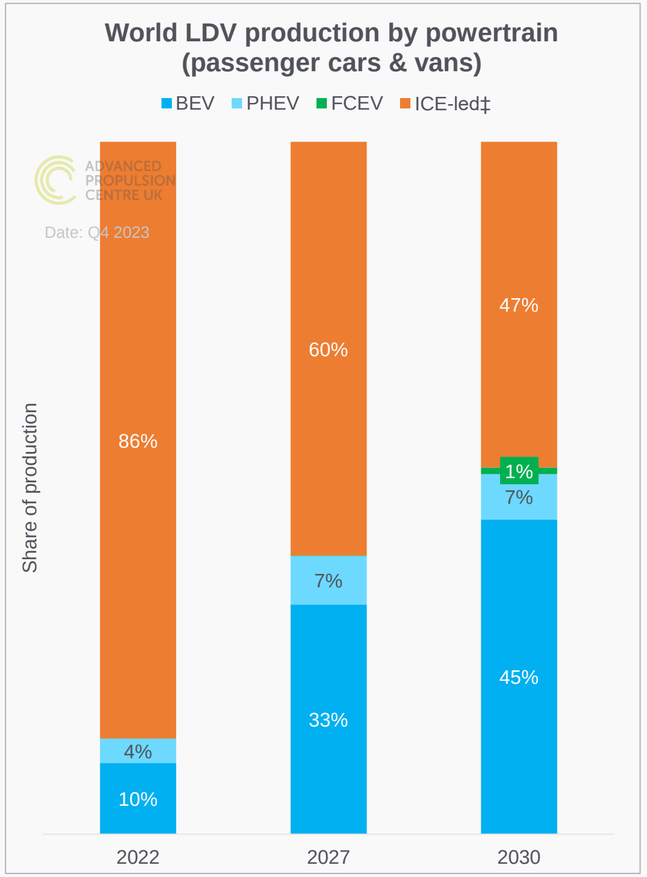

Volkswagen ID2

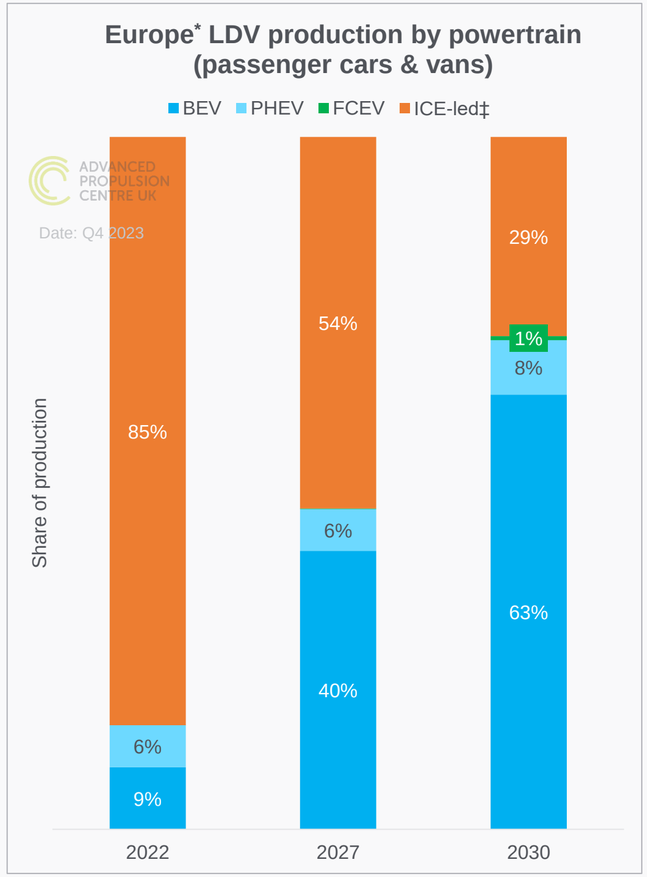
Q4 2023 – Electrified components data

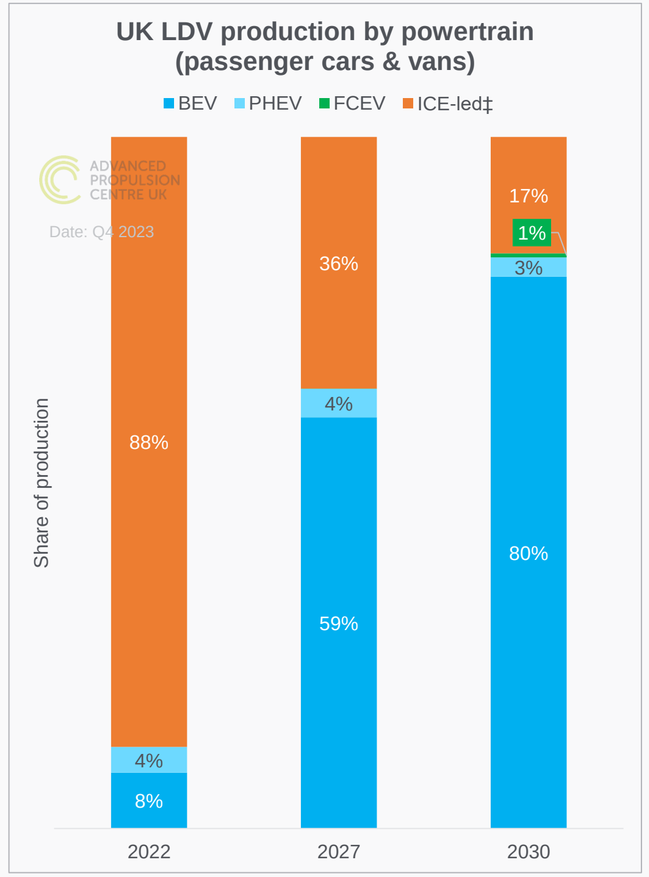
Forecasts for LDV production by powertrain

Q4 2023 notes

- World production forecast remained virtually unchained.
- The forecast for BEVs in Europe continues to grow but there is still some way to go to pass 2/3 of total production.
- Despite lower BEV production forecast this quarter, the UK forecast still far exceed European and global percentage splits.





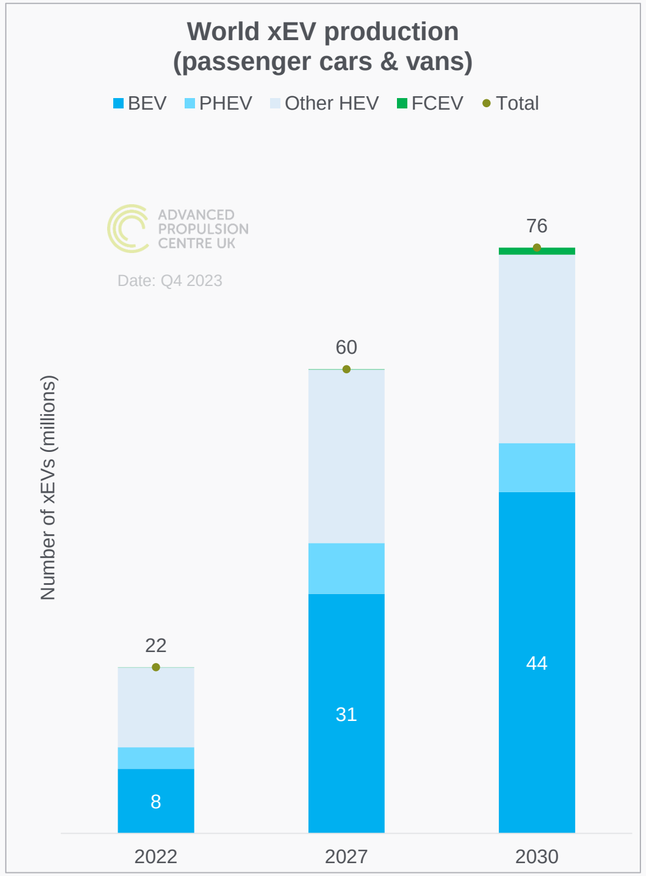


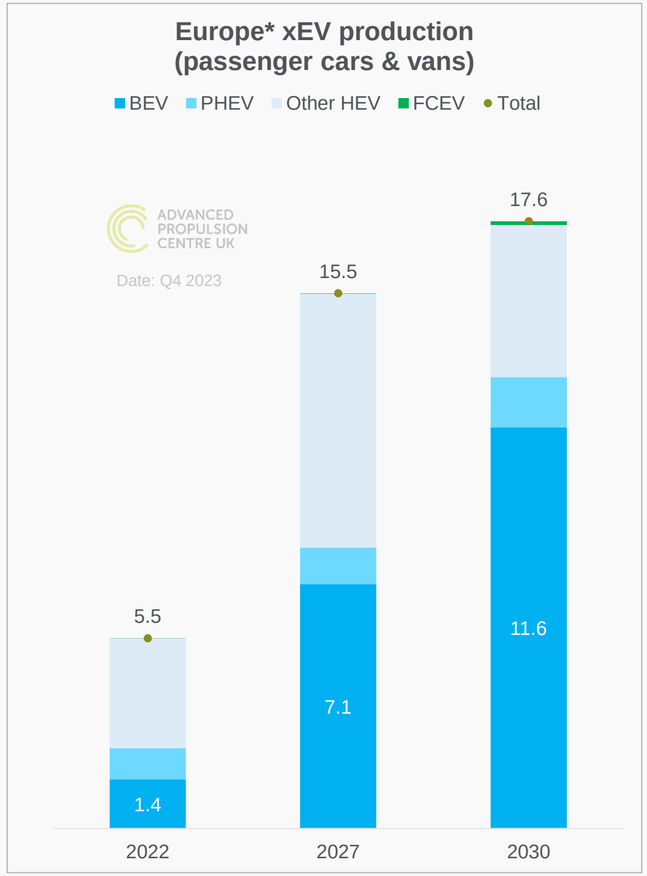
Source: APC Demand Databases using S&P Global AutoTechInsight (Dec 2023), BNEF forecasts (2023)
Note: Passenger cars & Light Commercial Vehicles < 3.5t only, *European forecast includes non-EU countries such as Turkey, ‡Includes non-plug-in HEVs & ICE

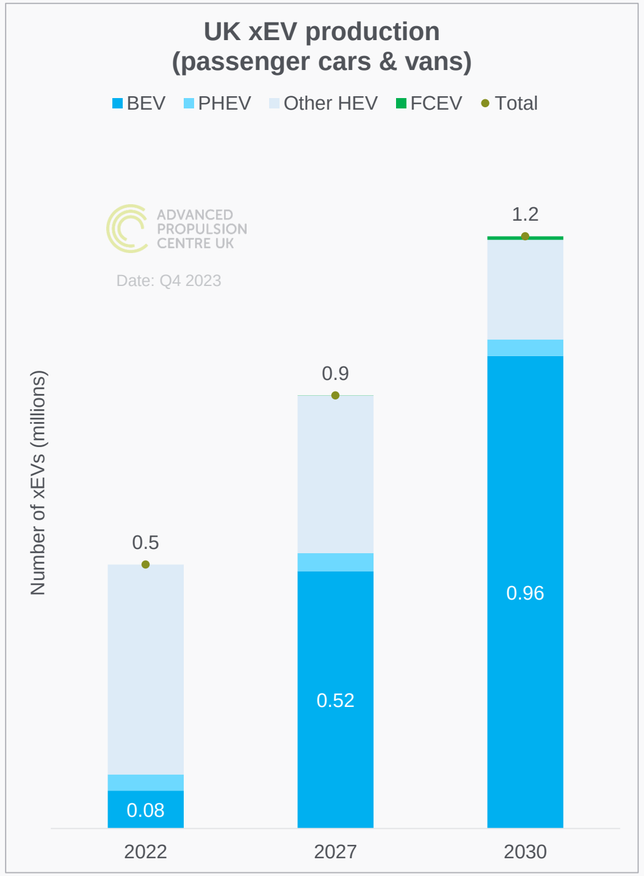
Forecasts for light duty xEV production

Q4 2023 notes

- Total Global World production did increase in Q4 by 376,000 units, equal to 0.50% in 2030.
- Plug-in hybrid and full hybrid continue to grow in European in 2027, but only moderate growth in 2030.
- Slight reduction is forecast for production in the UK ~50k BEV in 2027.





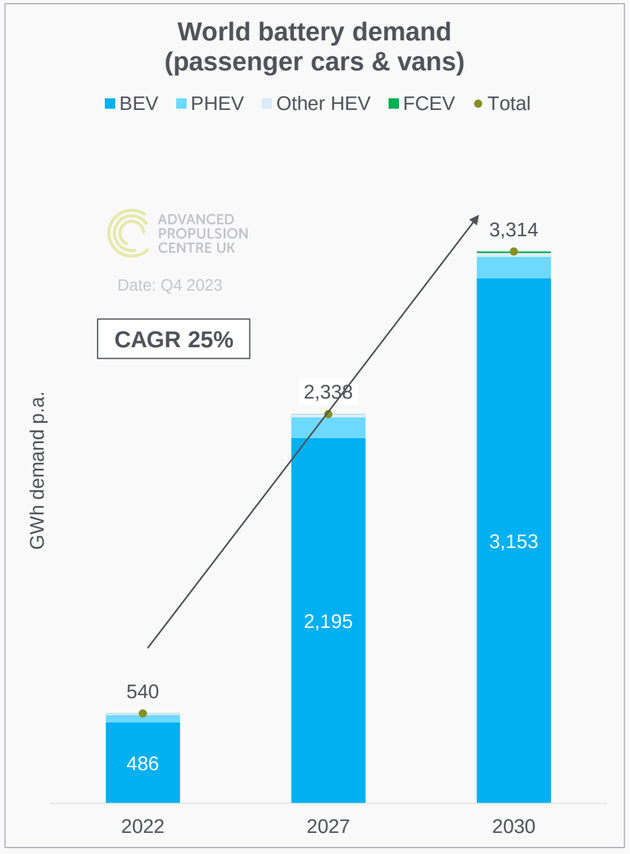


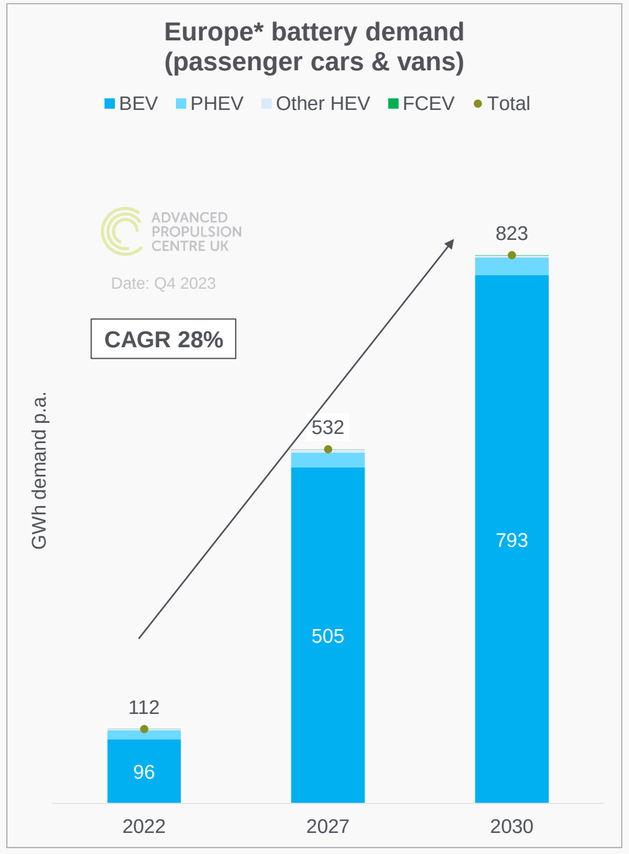
Source: APC Demand Databases using S&P Global AutoTechInsight (Dec 2023), BNEF forecasts (2023)
Note: Passenger cars & Light Commercial Vehicles < 3.5t only, *European forecast includes non-EU countries such as Turkey

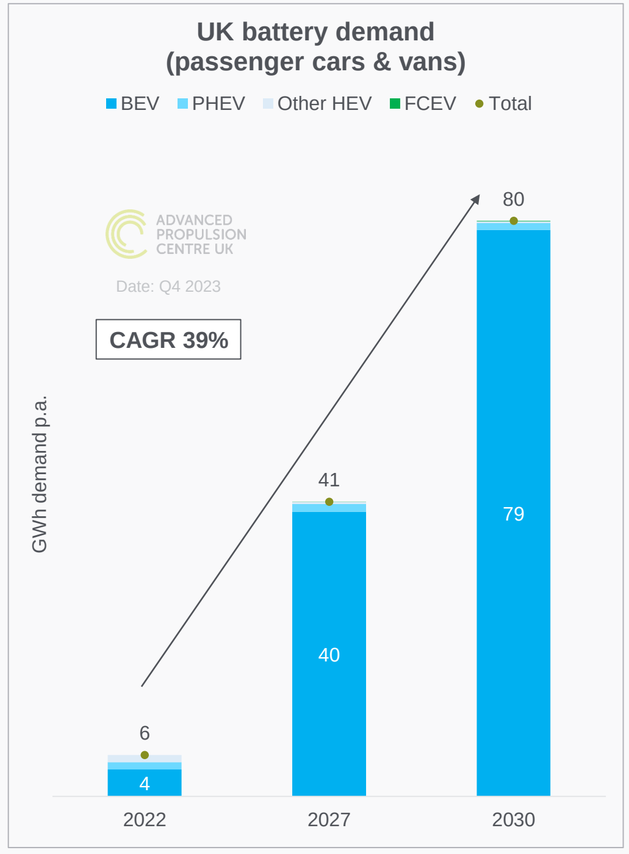
World battery demand for LDVs

Q4 2023 notes

- World battery demand forecast decreased in 2027 and 2030 compared to Q3, mainly for BEVs.
- The European battery demand forecast increased slightly in 2027 and 2030 compared to Q3.
- UK BEV demand forecast decreased in 2027 compared to Q3.





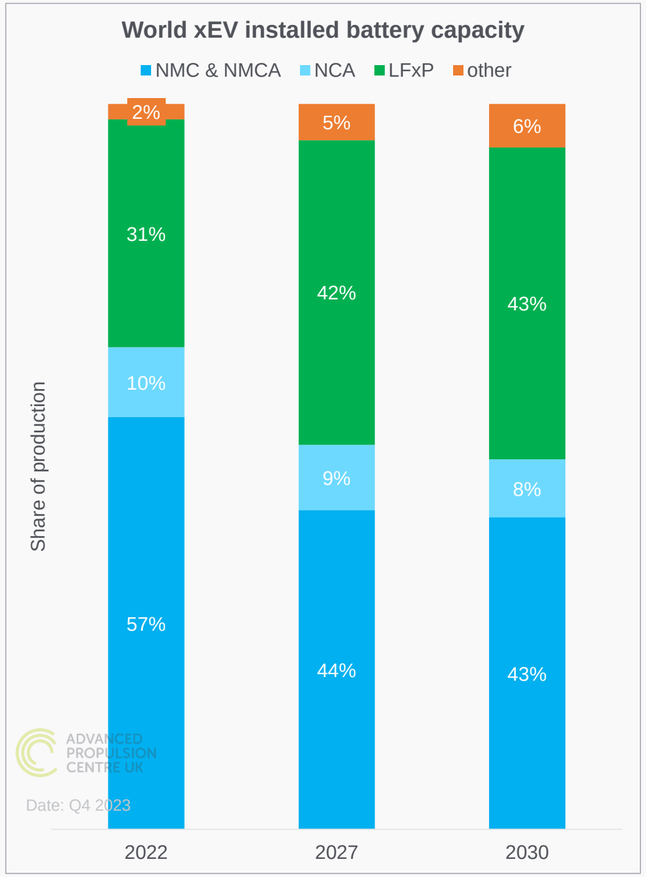


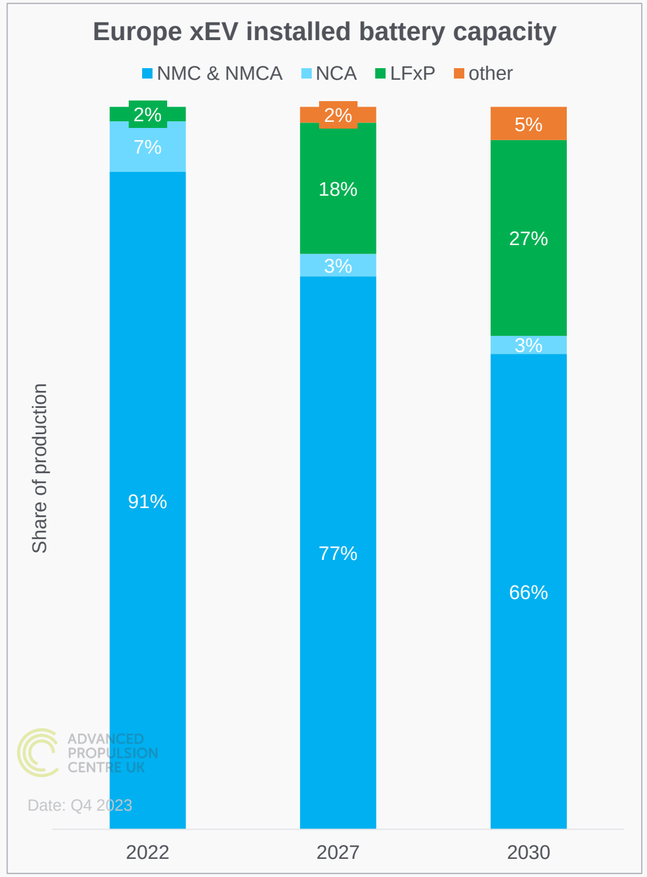
Source: APC Demand Databases using S&P Global AutoTechInsight (Dec 2023), BNEF forecasts (2023)
Note: Passenger cars & Light Commercial Vehicles < 3.5t only, *European forecast includes non-EU countries such as Turkey

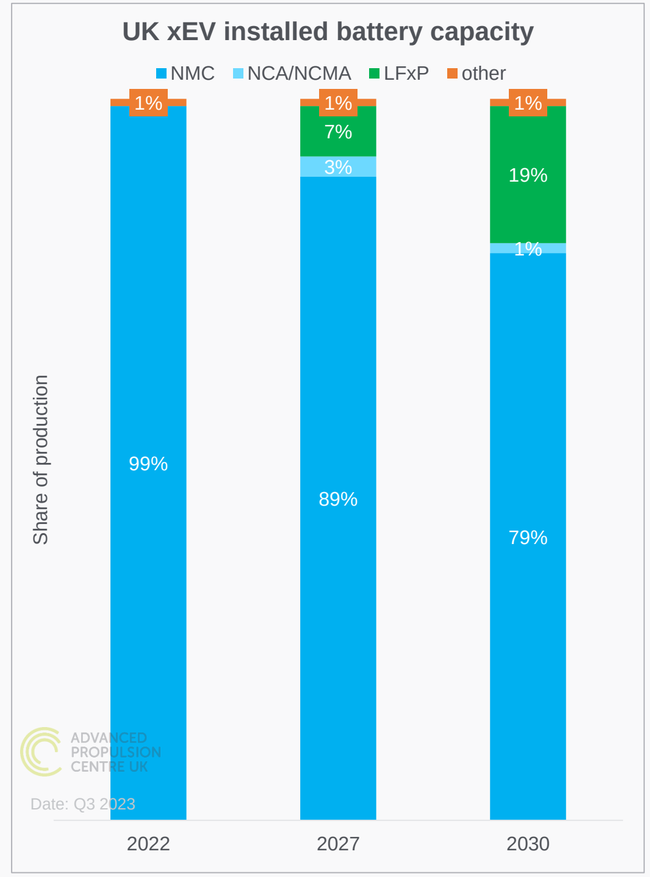
Forecasts for automotive battery production by chemistry

Q4 2023 notes

- LFxP demand forecast has been [further] reduced for UK and Europe. This is driven by slow investment in the LFP supply chain in the region.
- Demand signals from OEMs remain high with more OEMs indicating a desire to use LFxP, however, the supply chain investment is continuing to lag behind demand and is likely to hinder uptake.





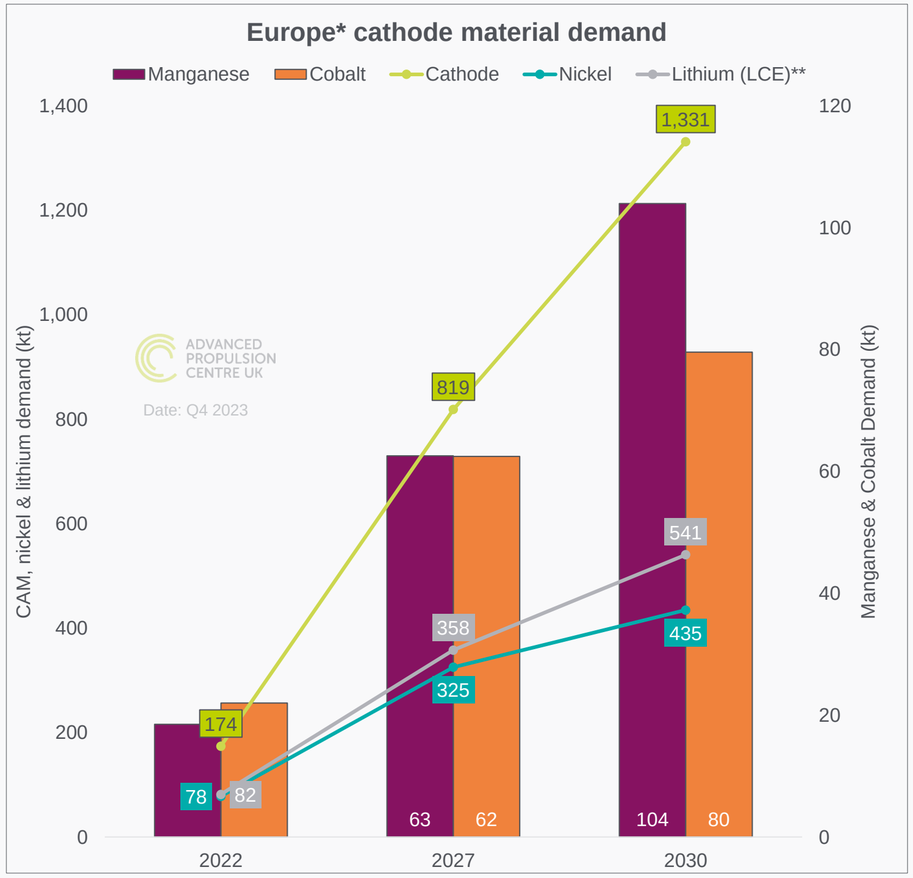


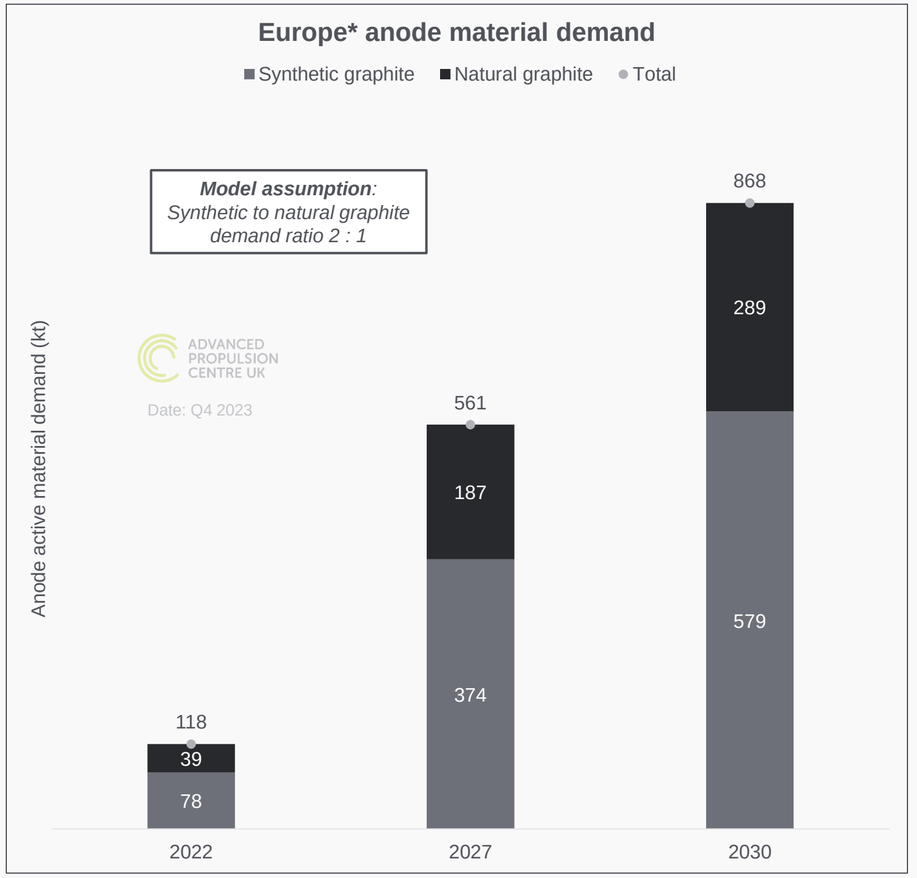
Source: APC Demand Databases using S&P Global AutoTechInsight (Dec 2023), BNEF forecasts (2023)
Note: Passenger cars & Light Commercial Vehicles < 3.5t only, *European forecast includes non-EU countries such as Turkey, ‡Includes non-plug-in HEVs & ICE

European Cathode Active Material (CAM) demand

Q4 2023 notes

- Increase in forecast cathode material demand in 2030 following the increased battery demand. However changing chemistry split forecast impacts individual material.
- European anode material increased slightly in 2027 and is expected to increase even more in 2030 (by almost 4%).



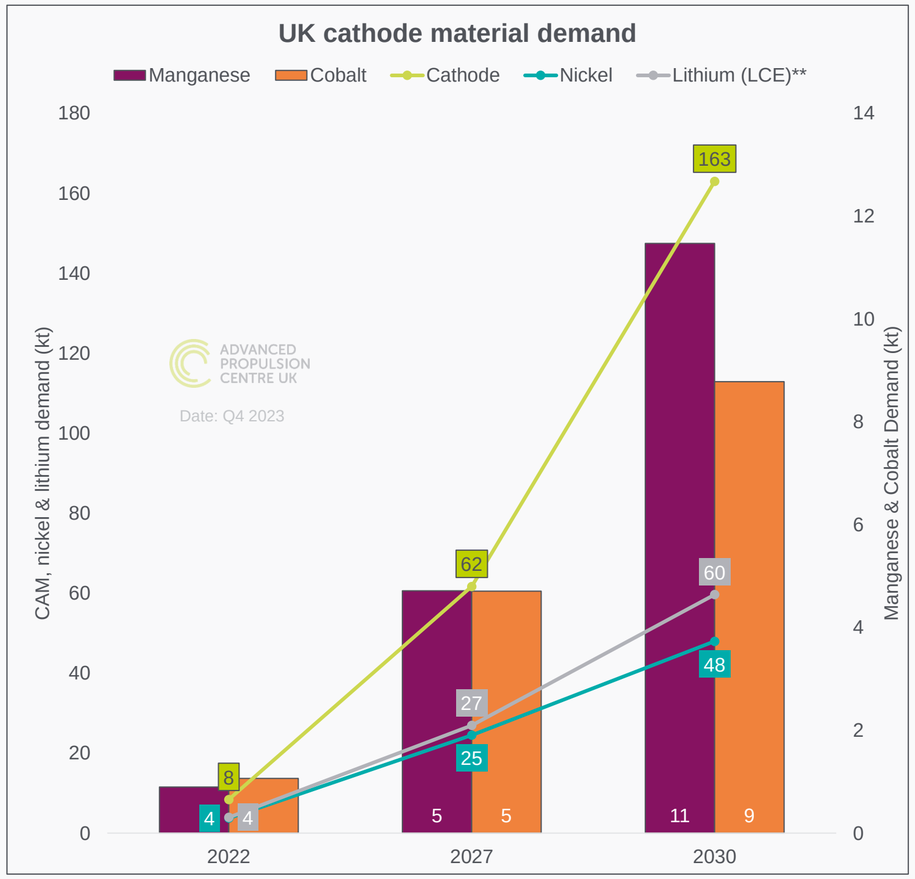


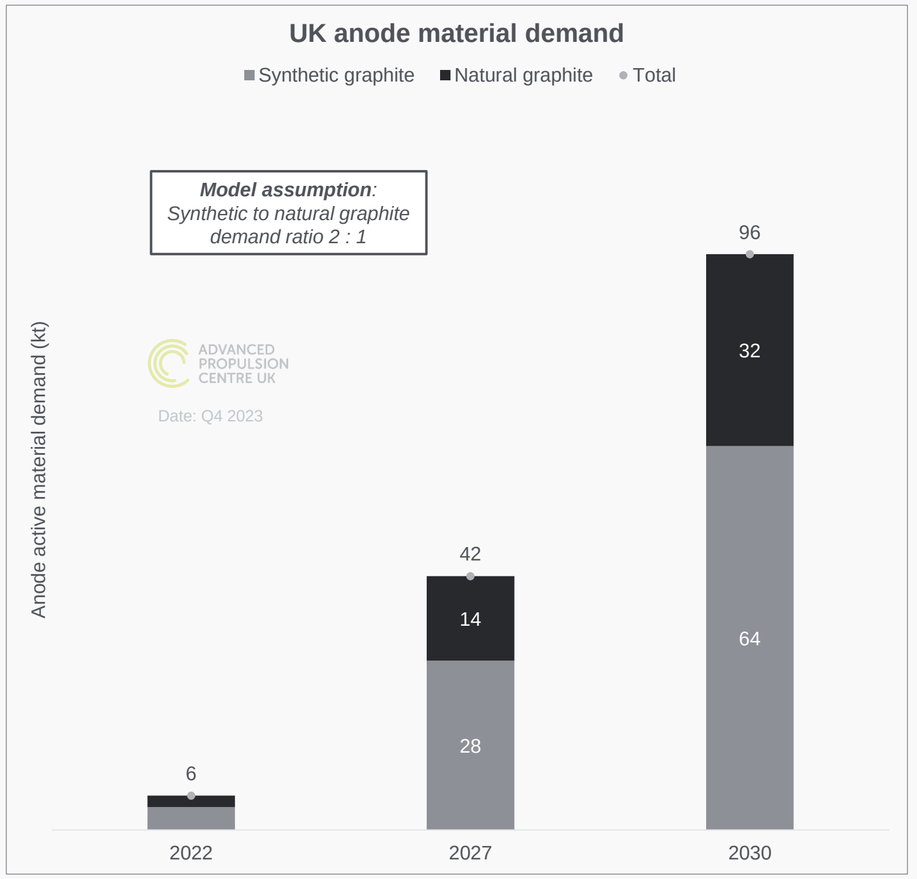
Source: APC Demand Databases using S&P Global AutoTechInsight (Dec 2023), Rho Motion data (2023), BNEF forecasts (2023)
Note: Passenger cars & Light Commercial Vehicles < 3.5t only, *European forecast includes non-EU countries such as Turkey, **Contained Li metal would be 5.3x lower

UK Cathode Active Material (CAM) demand

Q4 2023 notes

- Decreases in material demand seen for 2027 mirroring the forecast decrease in battery GWh demand



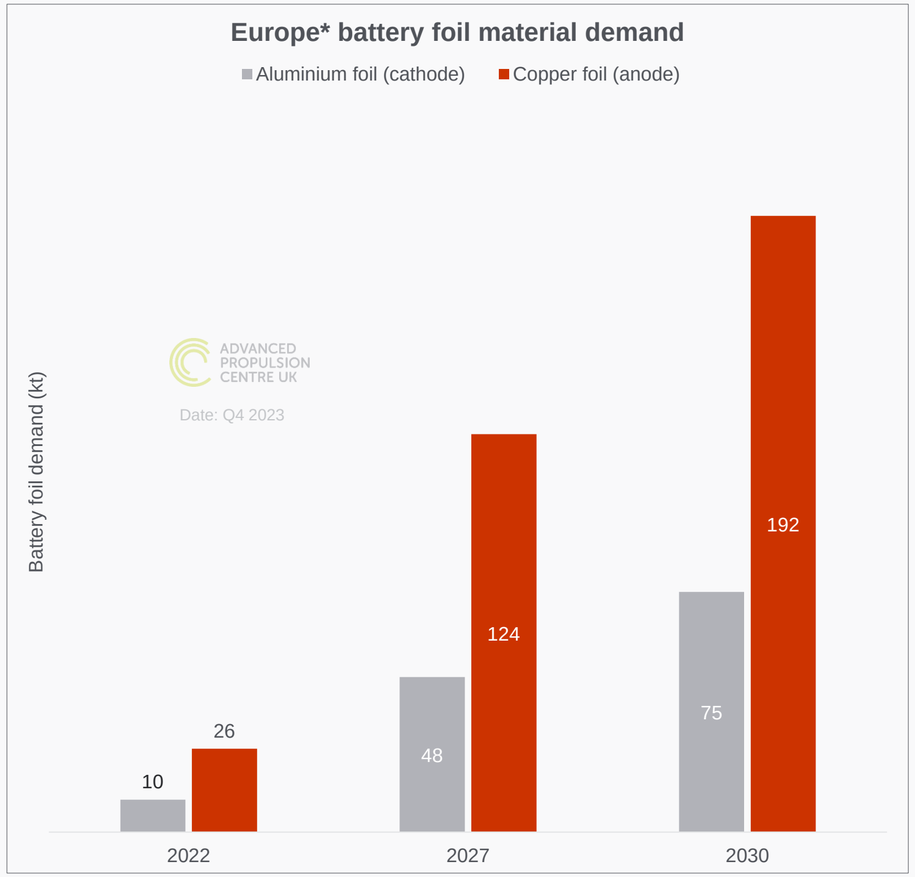


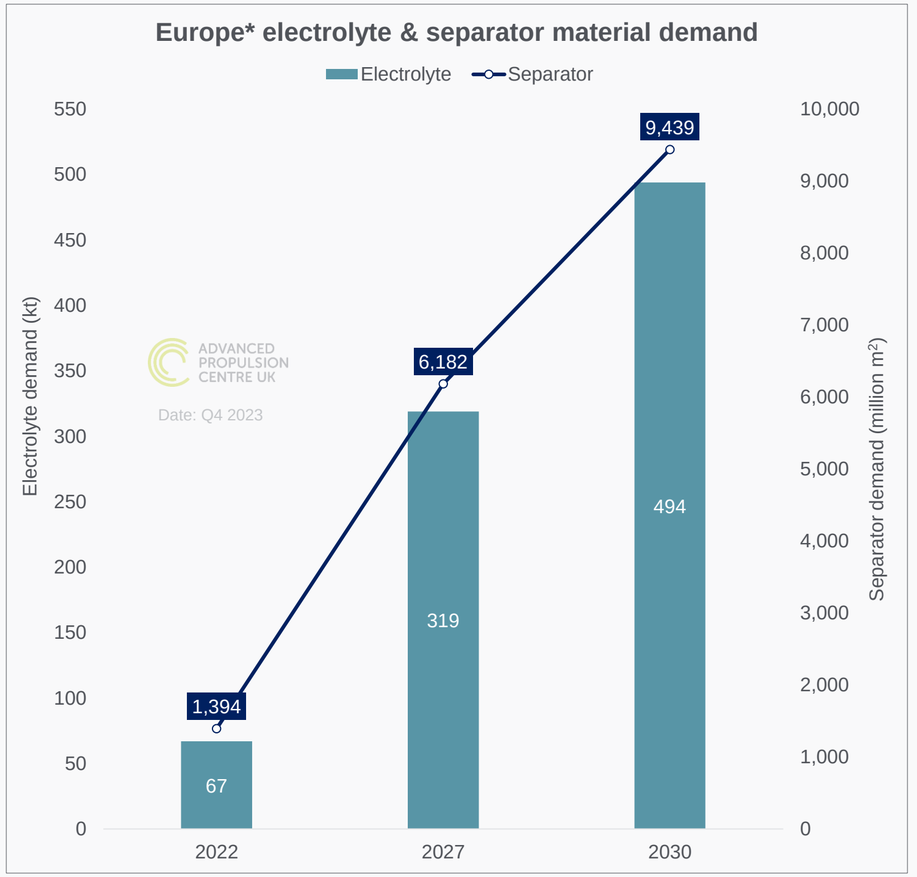
Source: APC Demand Databases using S&P Global AutoTechInsight (Oct 2023), Rho Motion data (2023)
Note: Passenger cars & Light Commercial Vehicles < 3.5t only, **Contained Li metal would be 5.3x lower

European demand for battery foils, electrolyte and separator material

Q4 2023 notes

- Forecast marginal changes in battery foil material demand in Q4 compared to Q3.
- Forecast decrease in separators and electrolyte in 2027 but increase in 2030 in Q4 compared to Q3.



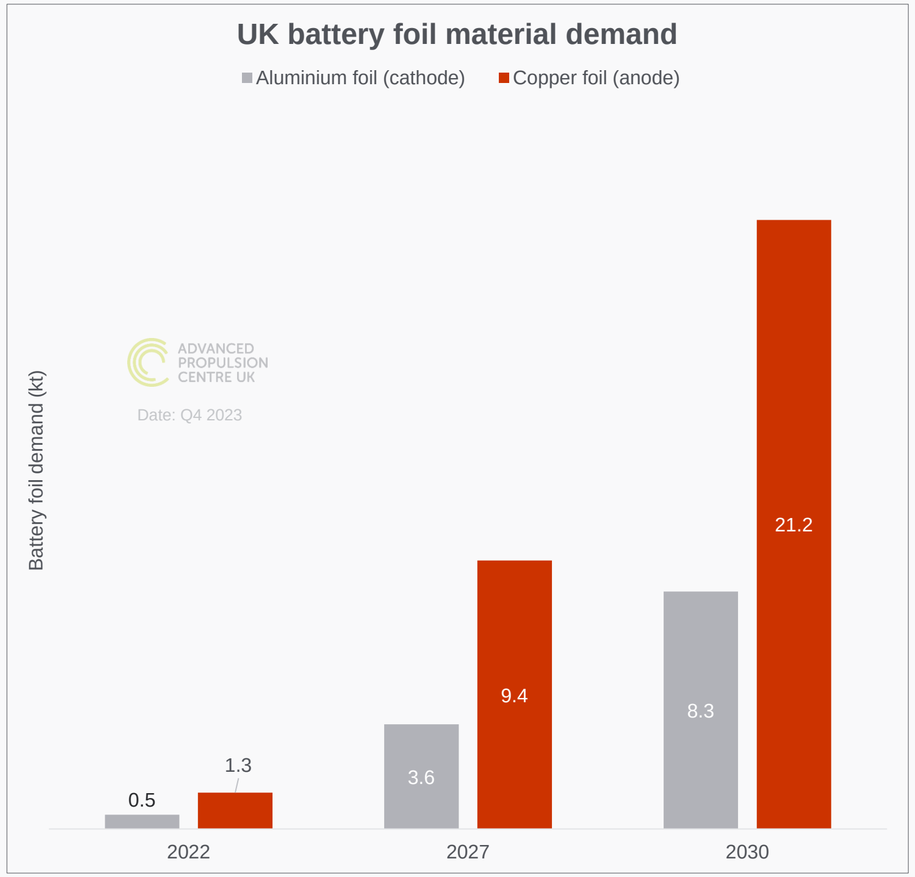


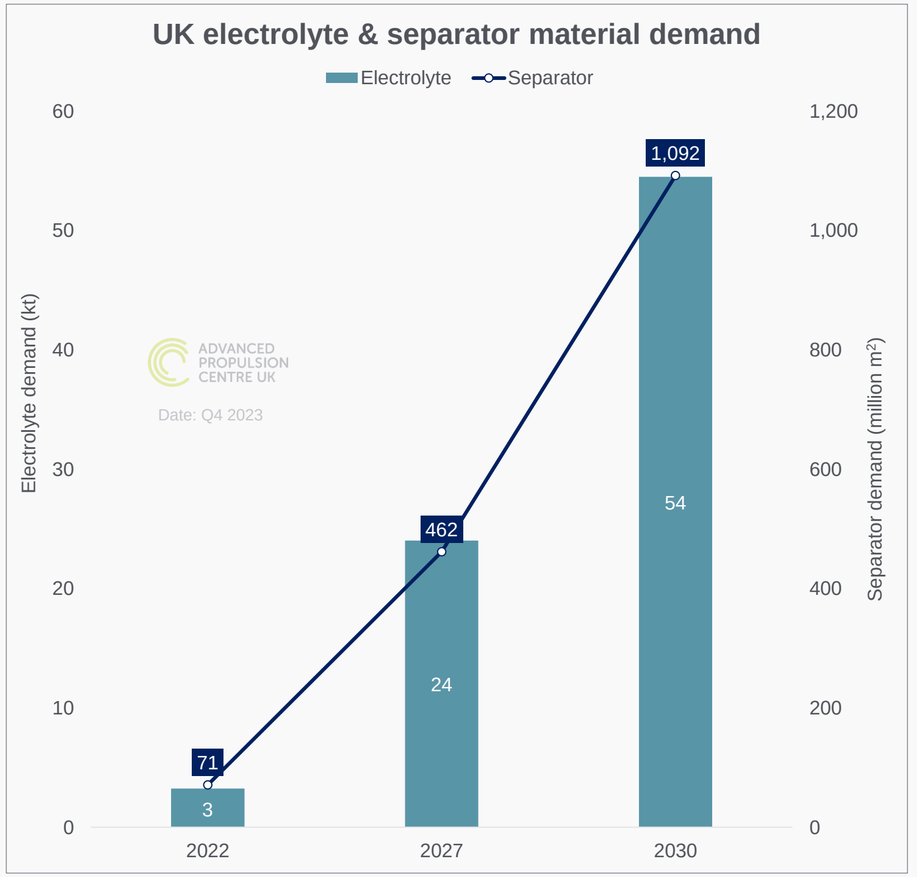
Source: APC Demand Databases using S&P Global AutoTechInsight (Dec 2023), Rho Motion data (2023), BNEF forecasts (2023)
Note: Passenger cars & Light Commercial Vehicles < 3.5t only, *European forecast includes non-EU countries such as Turkey

UK demand for battery foils, electrolyte and separator material

Q4 2023 notes

- Decrease in demand for foils in 2027 due to decreased battery demand.
- Small increase in 2030 due forecast increase of battery demand.



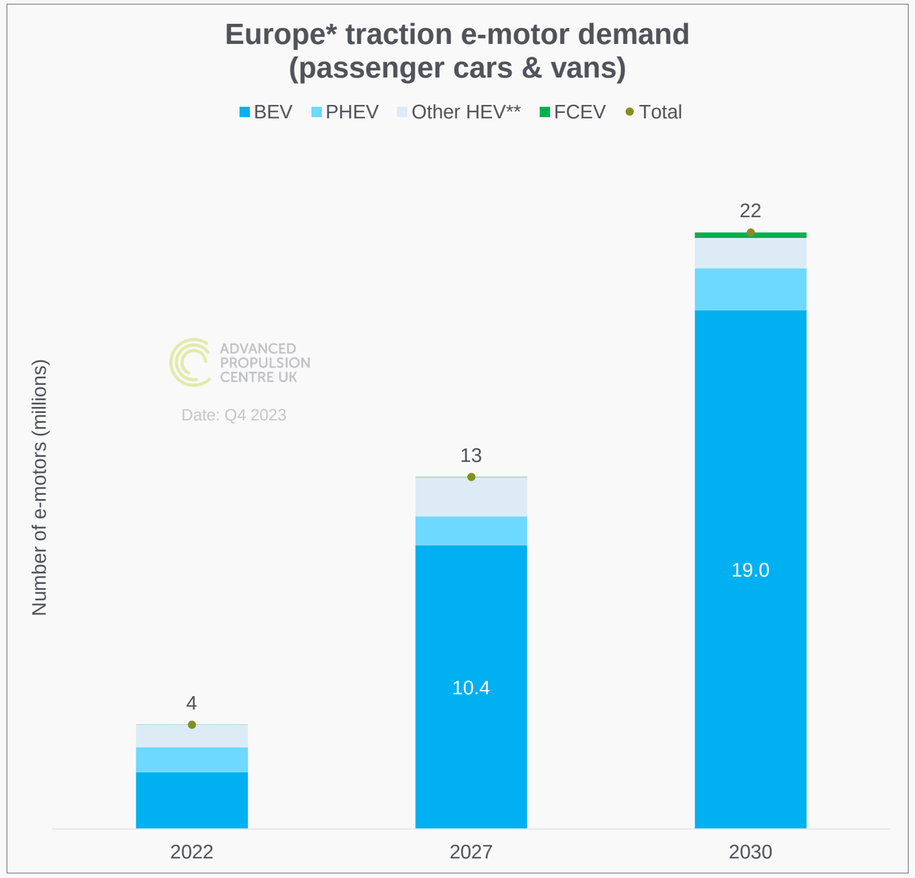


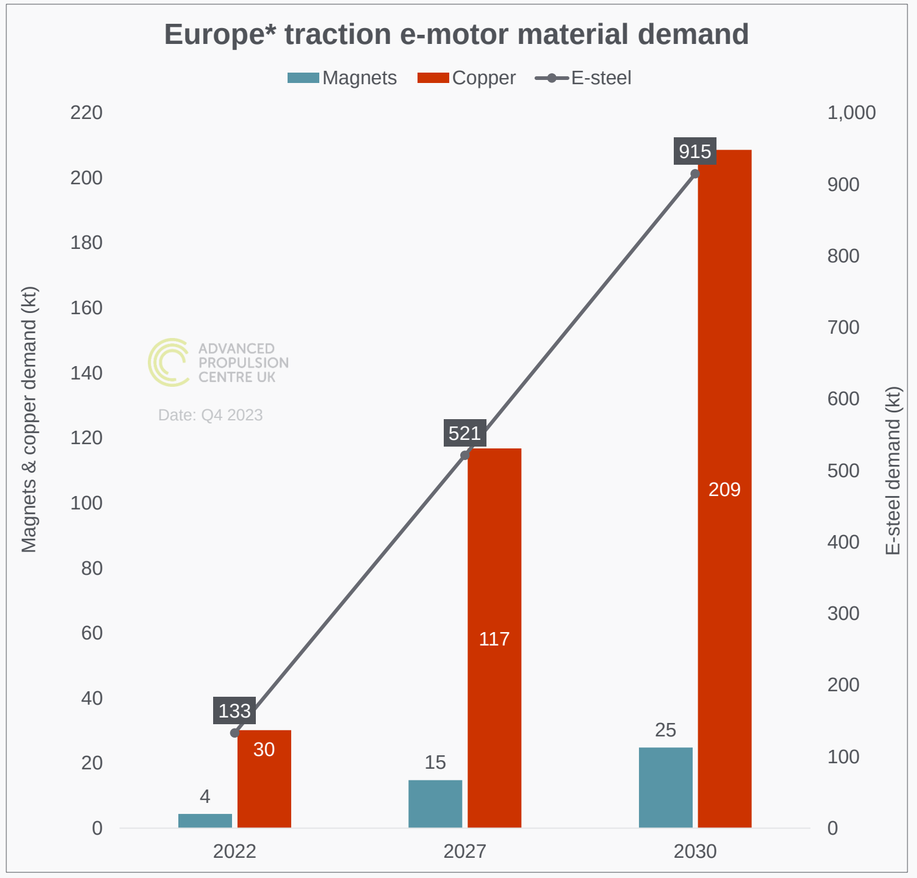
Source: APC Demand Databases using S&P Global AutoTechInsight (Dec 2023), Rho Motion data (2023)
Note: Passenger cars & Light Commercial Vehicles < 3.5t only

European demand for traction electric motors

Q4 2023 notes

- The small decrease in forecast for battery electric vehicles in 2027 has a corresponding decrease in 2030 e-motor and material demand.
- The increase in forecast for battery electric vehicles in 2030 has a corresponding increase in 2030 e-motor and material demand.
- The e-motor material demand reflects a decrease in PMSM motors.



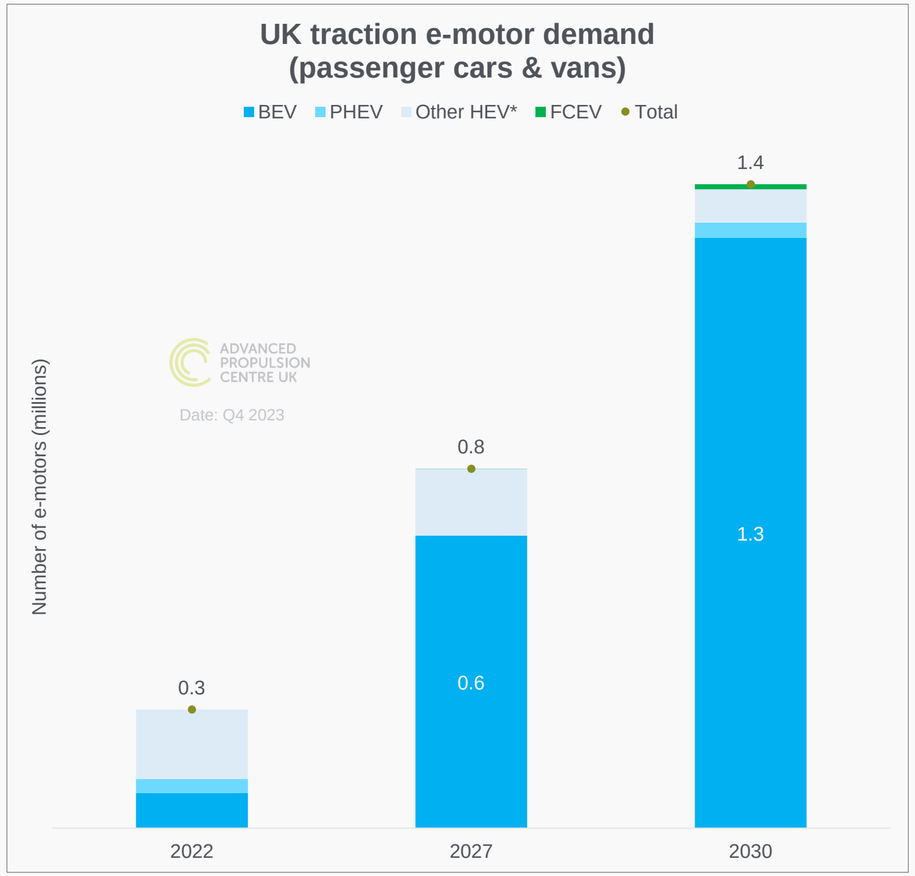


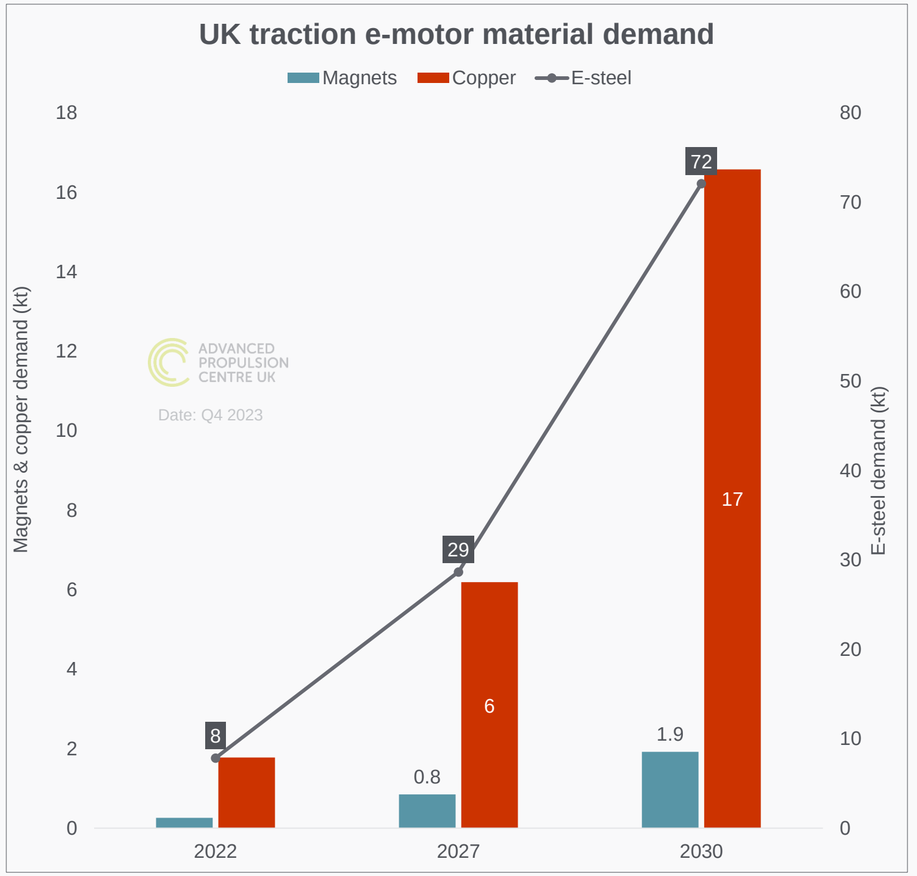
Source: APC Demand Databases using S&P Global AutoTechInsight (Dec 2023)
Note: Passenger cars & Light Commercial Vehicles < 3.5t only, *European forecast includes non-EU countries such as Turkey, **Excluding mild hybrid electric motors

UK demand for traction electric motors

Q4 2023 notes

- Small increases in total motor demand, even in 2027, despite the decrease in BEV numbers reflecting the split of vehicles being produced in the UK.
- Forecast magnet demand is reduced compared to Q3 due to revision in motor technology split.





Source: APC Demand Databases using internal insights and S&P Global AutoTechInsight (Dec 2023)
Note: Passenger cars & Light Commercial Vehicles < 3.5t only, *Excluding mild hybrid electric motors

Glossary

APC	Advanced Propulsion Centre UK
BEV	Battery Electric Vehicle
BMS	Battery Management System
CAM	Cathode Active Material
CMIC	Critical Minerals Intelligence Centre
DLE	Direct Lithium Extraction
FCEV	Fuel Cell Electric Vehicle
HGV	Heavy Good Vehicle
LCE	Lithium Carbonate Equivalent
LCV	Light Commercial Vehicle
LFxP	Lithium iron phosphate (LFP) lithium-ion cathode which can include manganese (LFMP)
NCA	Nickel Cobalt and Aluminium lithium-ion cathode
NMC	Nickel Manganese Cobalt lithium-ion cathode
NMCA	Nickel Manganese Cobalt and Aluminium lithium-ion cathode
OEM	Original Equipment Manufacturer
Other-HEV	Non-plug-in hybrid vehicles including full and mild hybrids that combine and internal combustion engine and a battery to deliver power
Pass Car	Passenger car
PHEV	Plug-in hybrid electric vehicle combining an internal combustion engine and an electric powertrain
PMSM	Permanent magnet synchronous motor
TCO	Total Cost of Ownership
xEV	Electrified vehicle including BEV, PHEV, HEV, FCEV
ZEV	Zero Emission Vehicle

ADVANCED PROPULSION CENTRE UK

This Q4 automotive demand forecast is provided by the Technology Trends team at the APC.

Q4 spans 1 January 2024 to 31 March 2024.

If you have any questions or would like more detail on any of the graphs or data email: info@apcuk.co.uk

March 2024