Automotive quarterly report

Q1 2024

Demand forecast

June 2024

ADVANCED PROPULSION CENTRE UK

Accelerating Progress

Q1 2024 – Automotive industry demand forecast

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This demand forecast covers

Markets	Global; European; UK
Vehicles	Light Duty Vehicles (LDVs) Heavy Duty Vehicles (HDVs) 
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.

Q1 2024 – Summary

Summary – Changes to projected demand by region

Q1 2024 compared to Q4 2023

	General notes	• Added 2035 to forecast and changed baseline year to 2023. • Added total production, including ICE-only, to LDV production forecast.	
	**Global demand update**	• Global automotive battery demand to exceed 5 TWh by 2035. • Half of global vehicle production expected to be BEV by 2035. • Steady growth in production volume forecast, including ICE vehicles, with over 100 million cars and vans produced per annum by 2035.	Page 8
	**European demand update**	• European automotive battery demand is forecast to exceed 1 TWh by 2035, accounting for 20% of global demand. This is despite modest growth in total production volumes. • Demand growth comes from a change in the vehicles produced with a move to 75% BEV production in 2035. • Localising the production of cathode and anode material still looks challenging.	page 9
	**UK demand update**	• BEV production in UK is expected to top 1 million p.a. between 2030 and 2035, creating a demand for over 100 GWh of automotive batteries. • New models are expected to be introduced by major manufacturers before the end of the decade bringing total production to approx. 1.2 million. New models or new OEMs need to be attracted to the UK for the UK automotive industry to grow beyond this.	page 10

Summary – Supply chain activity

Q1 2024 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.

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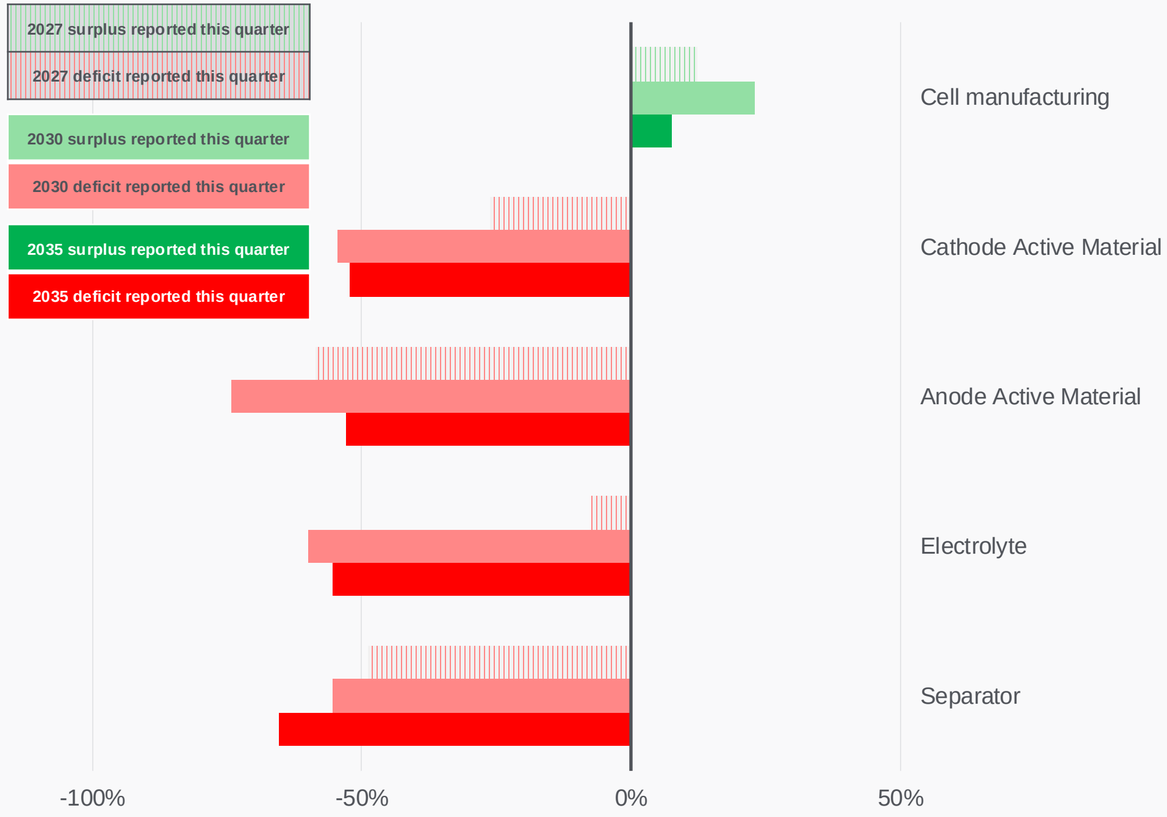
2027, 2030 and 2035 European[1] capacity vs demand balances



Status of regional capacity* vs demand balance in 2035	Value** (%)	UK supply chain status
• Northvolt has broken ground on Northvolt-Drei. The facility is expected to start production in 2026 targeting a capacity of 60 GWh. • If all announced capacity is realised Europe would be considerably overcapacity in the near term.	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.
• BASF has postponed plans for a cathode plant in Finland indefinitely. • CAM is increasingly looking like a risk regarding local content requirements.	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.
• China produces 95% of the world's anode material. The USA, through the Inflation Reduction Act, is investing in developing local supply but in Europe there has been little activity.	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 2027.
• Electrolyte manufacturing can be deployed relatively quickly therefore further announcements are expected in the coming years that will meet the demand.	8%	Value in today's liquid electrolyte is relatively low, but semi-solid and solid-state electrolytes are a key investment consideration.
• Like electrolyte, separators are relatively low value and quick to establish production. However, capacity in Europe is low and looks like to remain low.	7%	Significant opportunities to localise in UK.

Source: APC internal analysis of public announcements, BNEF forecasts (May 2024), Wood Mackenzie (May 2024)
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

Q1 2024 – Demand update

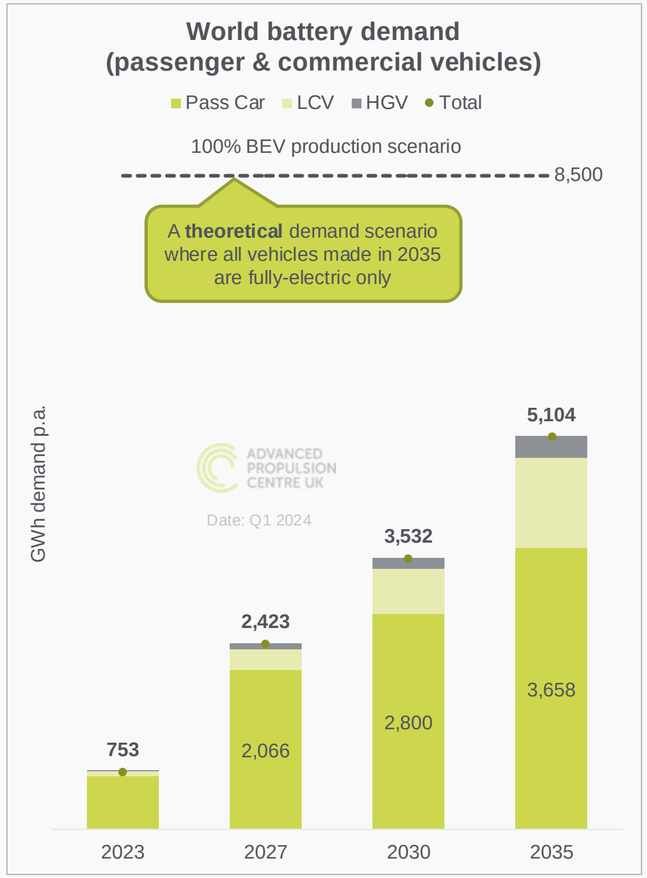
The following section includes battery demand from both Light Duty Vehicles (LDVs) and Heavy Duty Vehicles (HDVs)

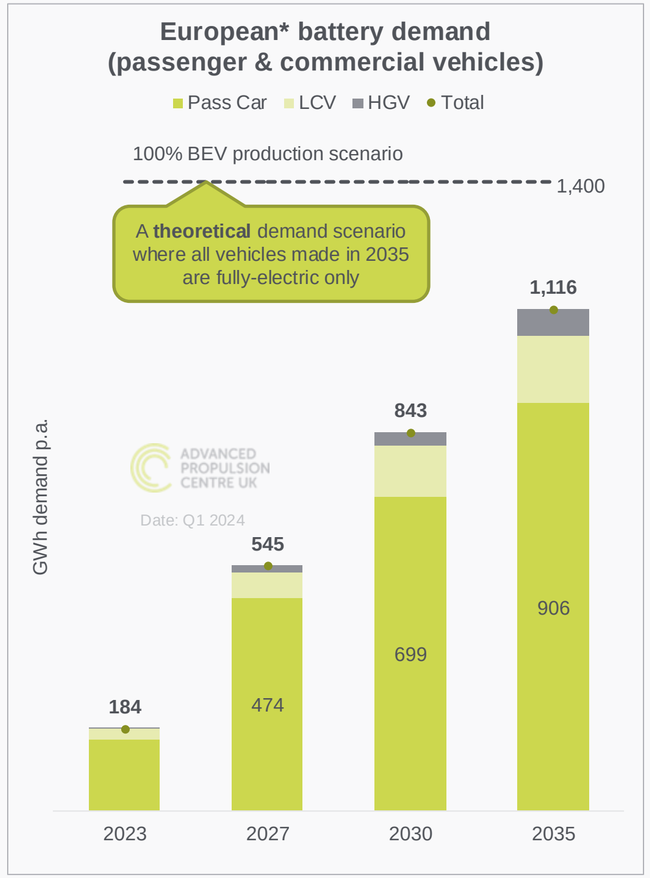
Battery demand forecast

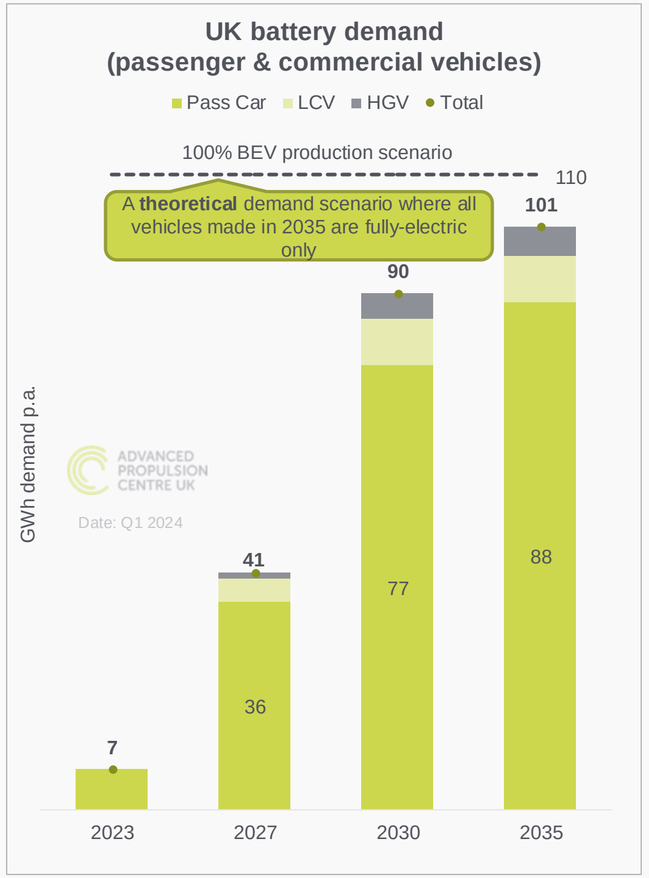
LDVs and HDVs

Q1 2024 notes

- Global automotive battery demand is forecast to surpass 5 TWh by 2035 with Europe accounting for 1 TWh of that demand.
- UK is leading the way to fully electric production with 95% of production expected to be BEV by 2035.







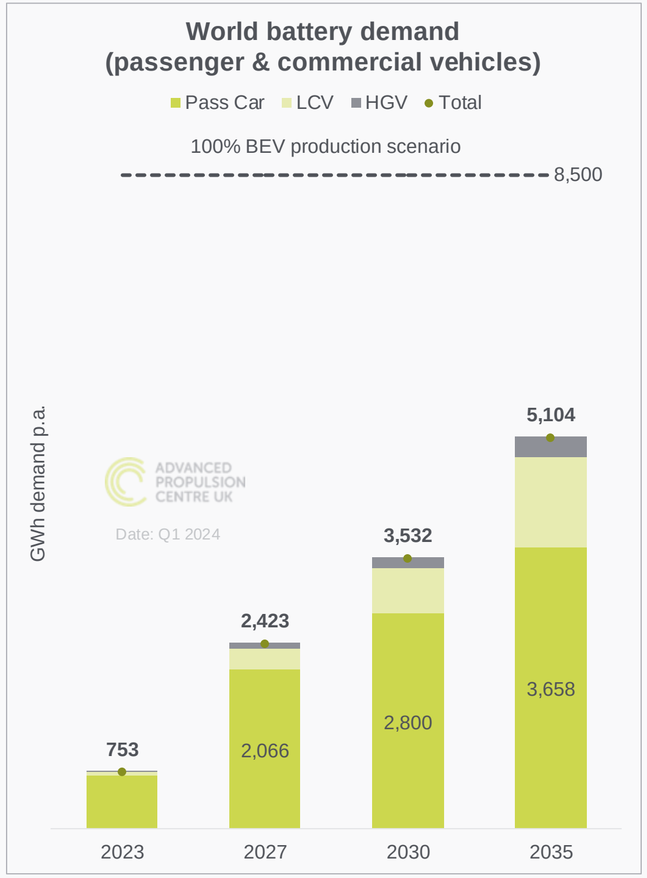
Source: APC Demand Databases using S&P Global AutoTechInsight (May 2024), Rho Motion data (May 2024), BNEF (May 2024), Global Data (May 2024)
Note: LCV = Light Commercial Vehicles < 3.5t, buses not included. *European forecast includes non-EU countries such as Turkey.

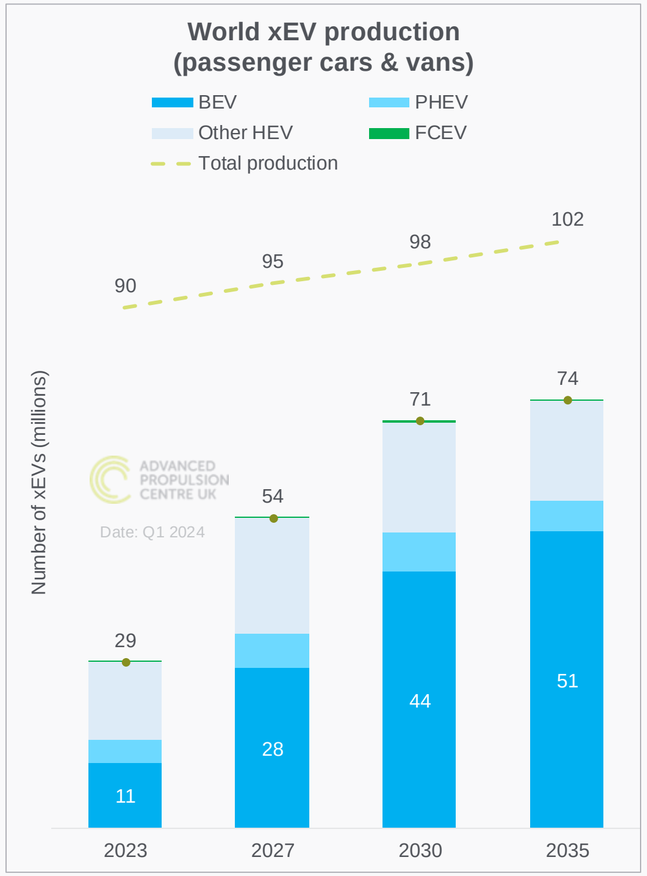
World xEV production

Passenger cars and vans

Q1 2024 notes

- World automotive battery demand to exceed 5 TWh by 2035 with 50% of LDV production expected to be BEVs.
- Total world production, including ICE, is forecast to grow by over 10 million by 2035, to a total of over 100 million LDV vehicles.





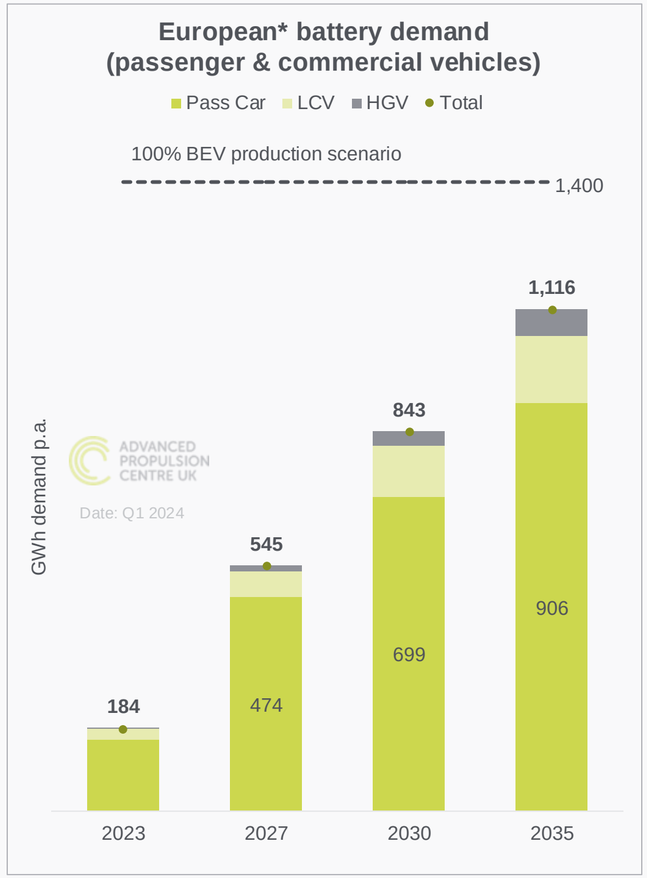
Source: APC Demand Databases using S&P Global AutoTechInsight (May 2024), Rho Motion data (2024), BNEF forecasts (2024), Global Data (2024)
Note: LCV = Light Commercial Vehicles < 3.5t, buses not included.
Total production includes ICE-only vehicles.

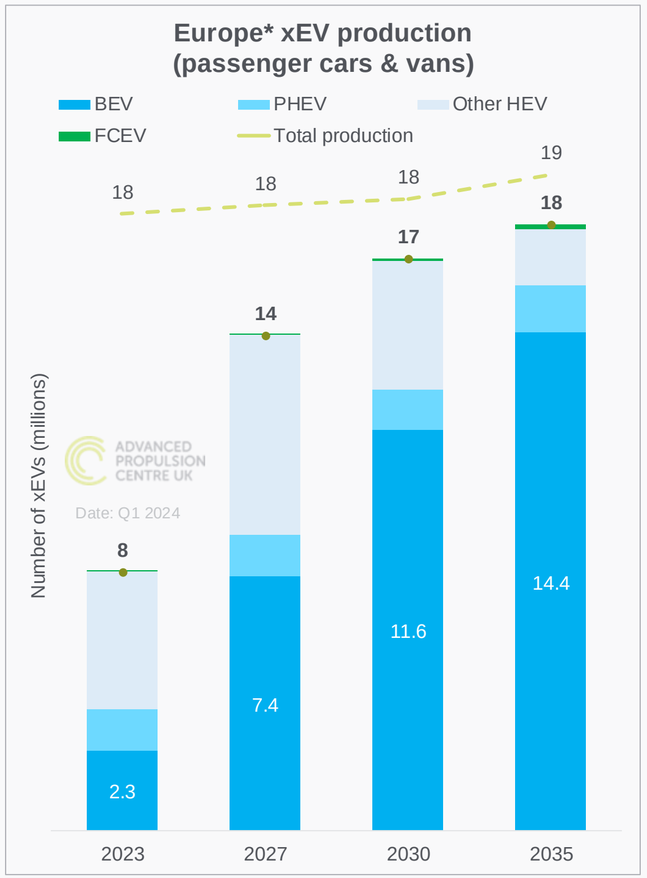
European xEV production

Passenger cars and vans

Q1 2024 notes

- A total of over 1 TWh of automotive batteries will be required by 2035.
- Growth in BEV production is expected to come from a change in vehicle split rather than growth in production totals.
- Despite expected bans on sales of non-zero-emission vehicles, significant ICE-based production is still expected for an export market which accounts for 64% of European production.





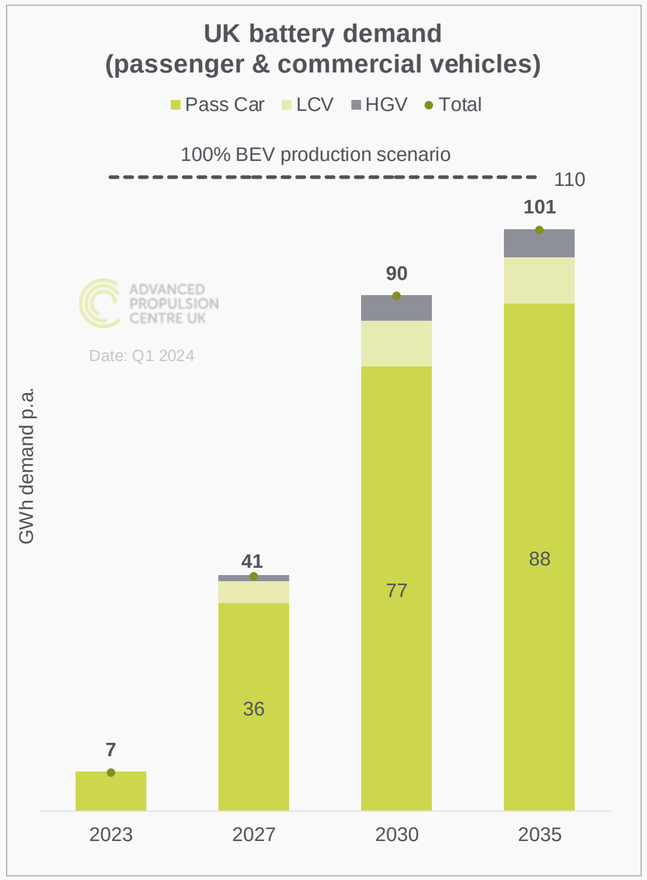
Source: APC Demand Databases using S&P Global AutoTechInsight (May 2023), Rho Motion data (2024), BNEF (2024), GlobalData (2024), ACEA (2024)
Note: LCV = Light Commercial Vehicles < 3.5t, buses not included. *European forecast includes non-EU countries such as Turkey.
Total production includes ICE-only vehicles

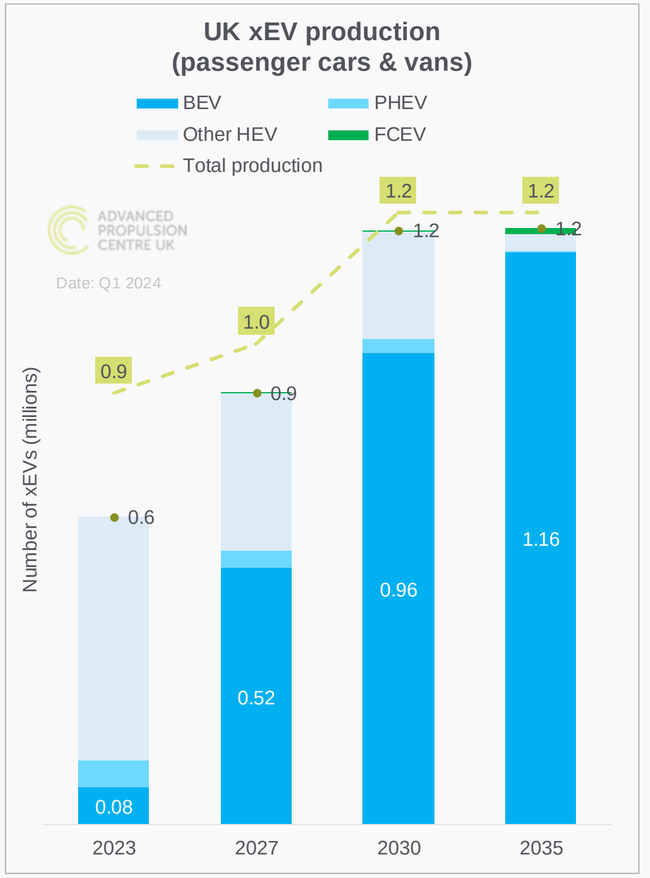
UK xEV production

Passenger cars and vans

Q1 2024 notes

- BEV production in UK is expected to top 1 million between 2030 and 2035.
- New models are expected to be introduced by major manufacturers before the end of the decade, bringing total production to approx. 1.2 million.





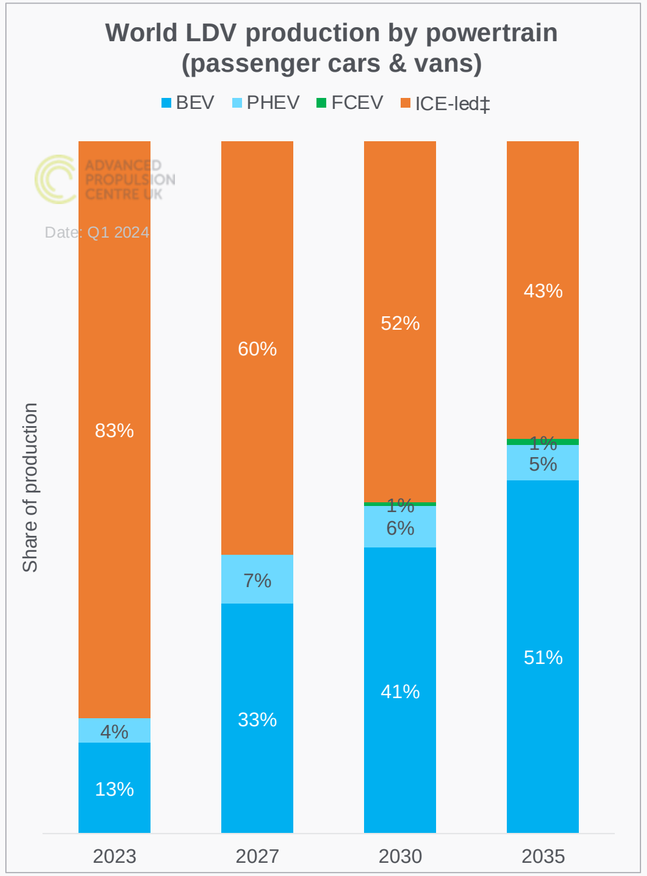
Source: APC Demand Databases using S&P Global AutoTechInsight (May 2024), BNEF forecasts (2024)
Note: LCV = Light Commercial Vehicles < 3.5t, buses not included.
Total production includes ICE-only vehicles.

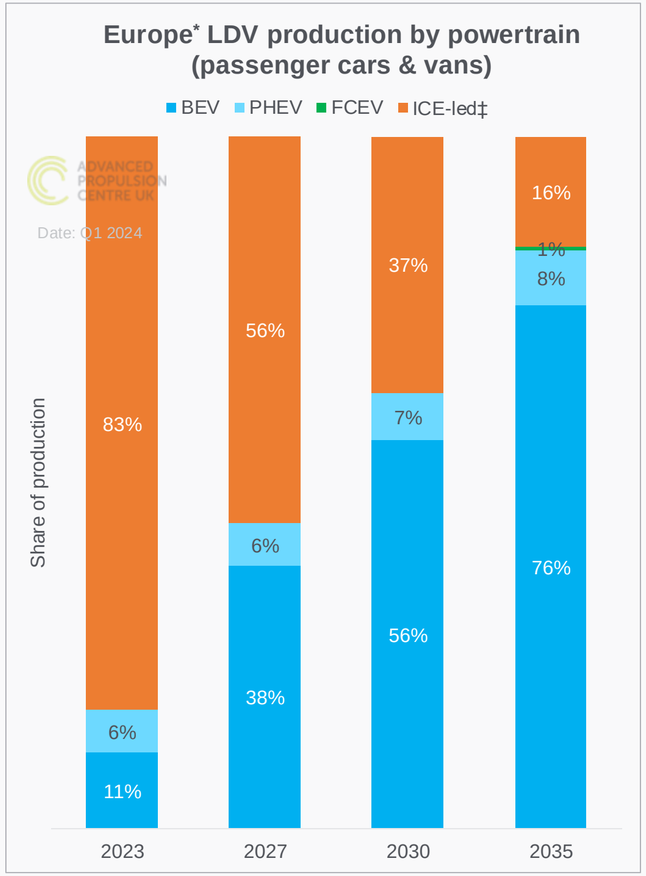
Q1 2024 – Electrified components data

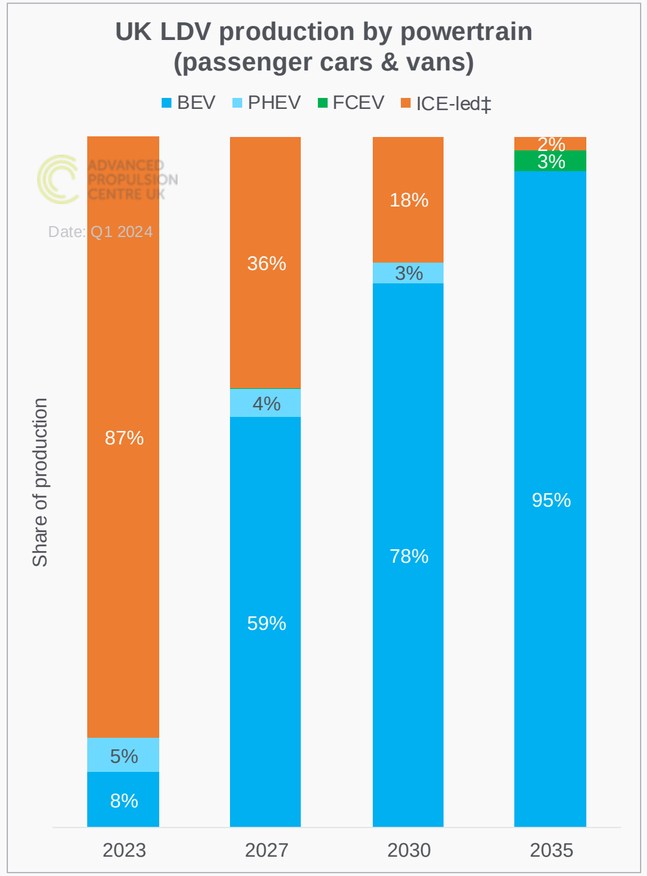
Forecasts for LDV production by powertrain

Q1 2024 notes

- World BEV production is expected to surpass 50% of global production by 2035, with both ICE-led and PHEVs declining.
- The forecast for BEVs in Europe continues to grow and is expected to reach 2/3rds capacity by 2035.
- BEV production in the UK is expected to reach 95% capacity by 2035, with a small percentage of non-zero-emission vehicles being produced for export.





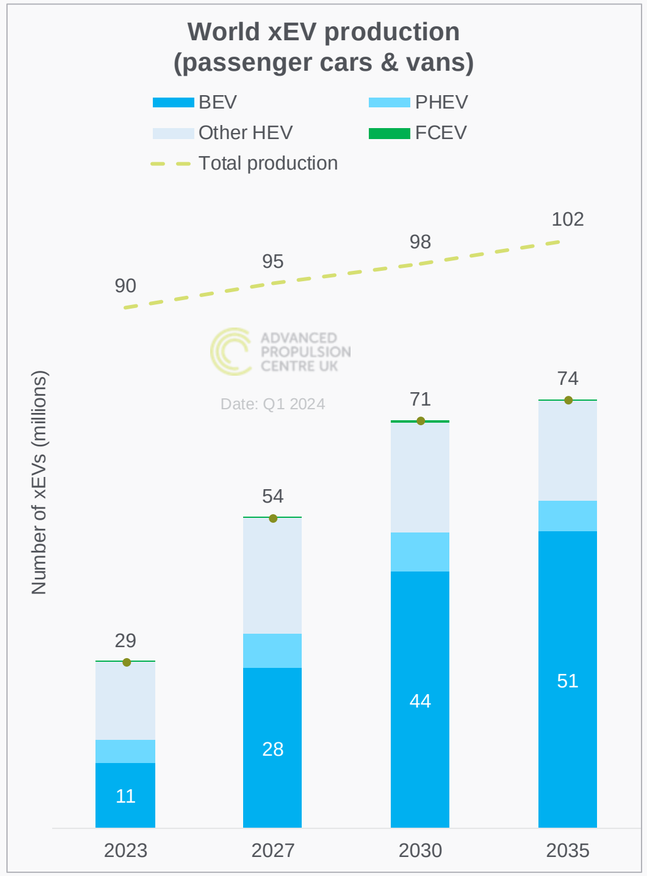


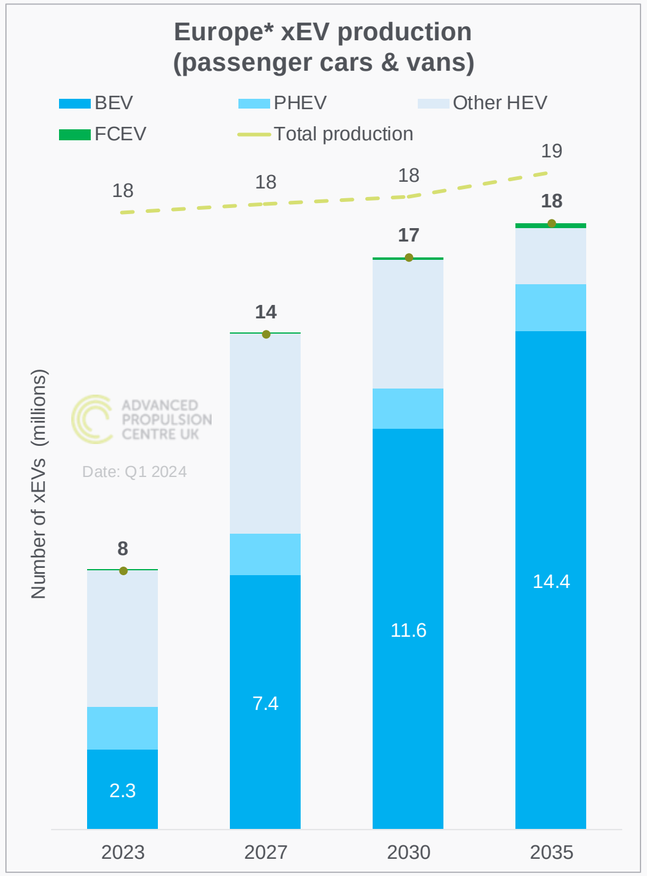
Source: APC Demand Databases using S&P Global AutoTechInsight (May 2024), BNEF forecasts (2024), RhoMotion (2024)
Note: Passenger cars & Light Commercial Vehicles < 3.5t only, *European forecast includes non-EU countries such as Turkey, ‡Includes non-plug-in HEVs & ICE.

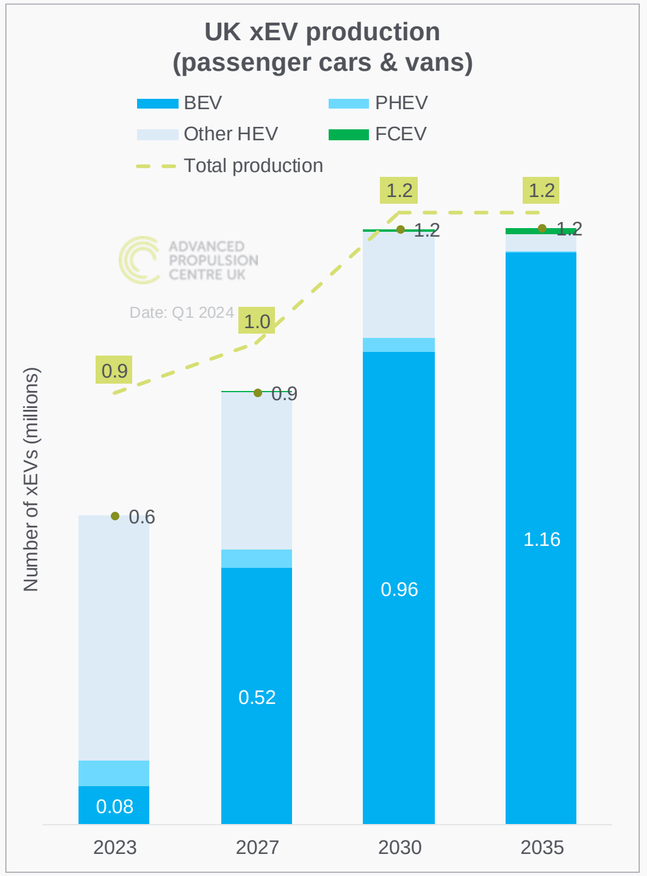
Forecasts for light duty xEV production

Q1 2024 notes

- Total global production is expected to show some growth, while production in Europe and the UK is forecast to show some recovery and then plateau at a new level.
- Plug-in hybrids continue to show strong forecast growth in Europe with uncertainty over the definitions of net-zero fuels. At the same time, the UK is leading the way to a fully zero-emission vehicle production scenario, reaching 95% BEV production by 2035.





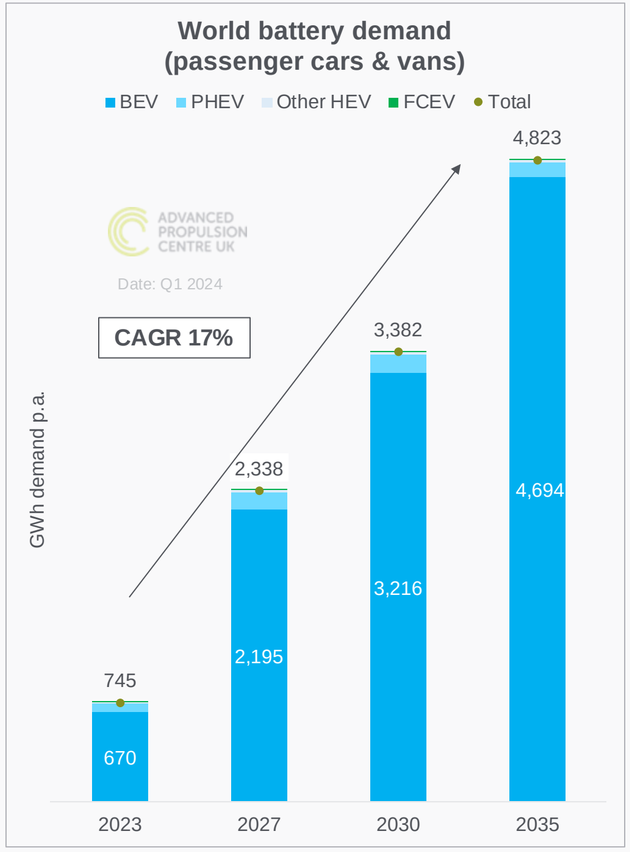


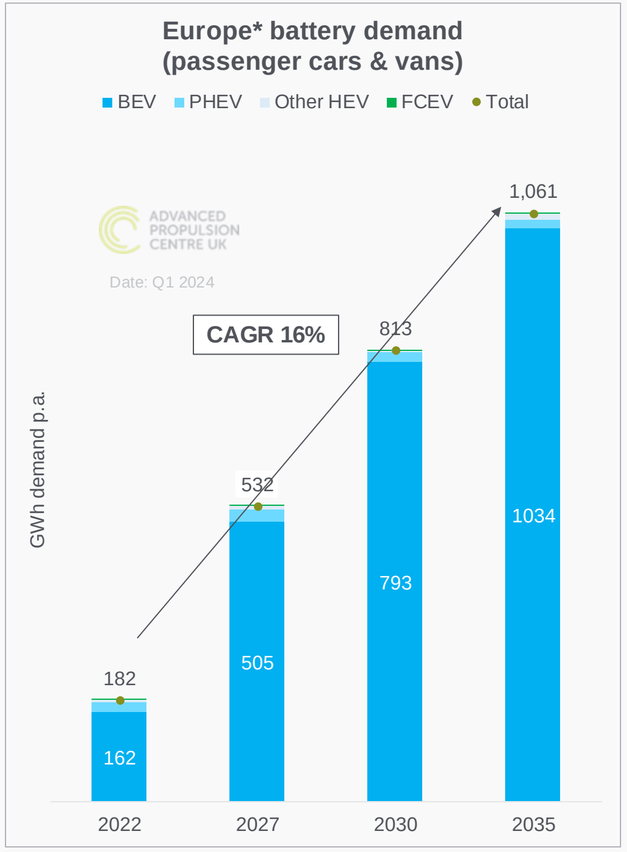
Source: APC Demand Databases using S&P Global AutoTechInsight (May 2024), BNEF forecasts (2024)
Note: Passenger cars & Light Commercial Vehicles < 3.5t only, *European forecast includes non-EU countries such as Turkey.

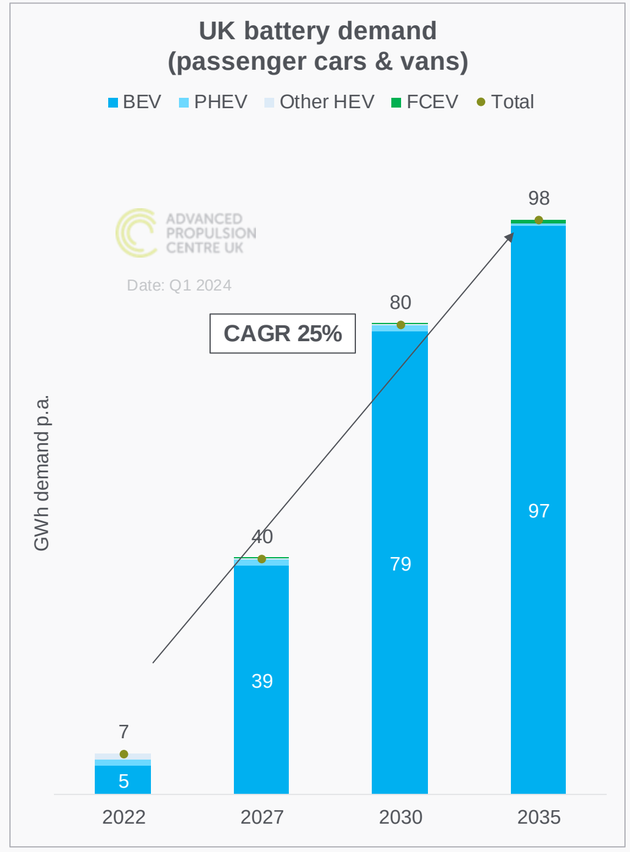
World battery demand for LDVs

Q1 2024 notes

- Adding in 2035 with a longer range CAGR compared to 2023 demand reports.
- UK is leading the way with xEV vehicle production showing strong growth in battery demand despite limited growth in vehicle production after 2030.







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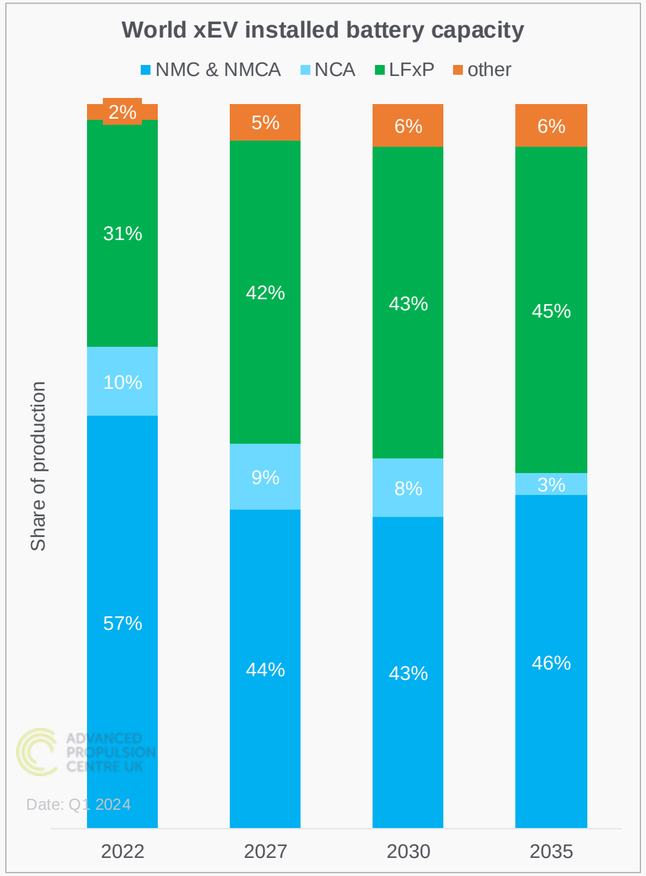
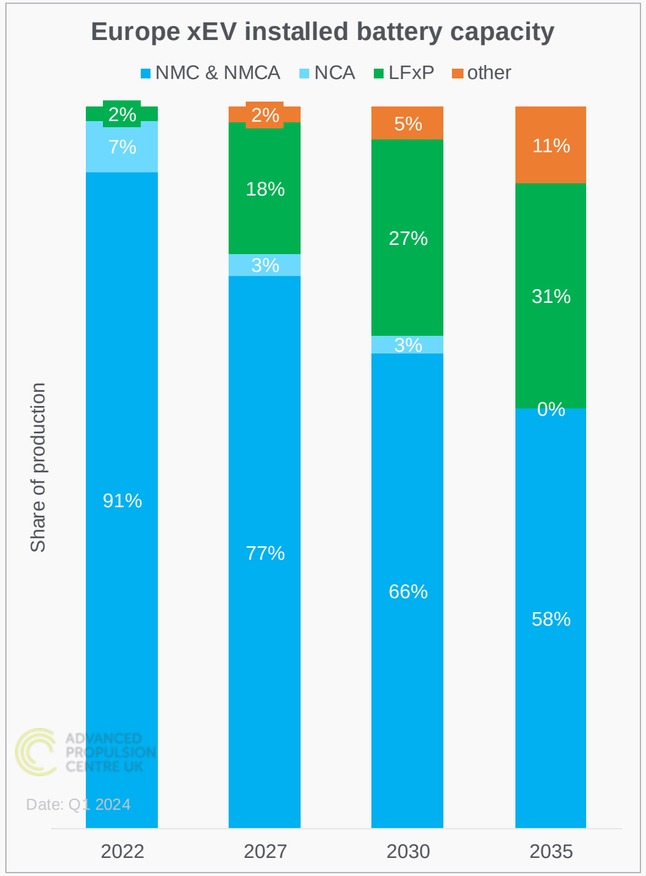
Note: Passenger cars & Light Commercial Vehicles < 3.5t only, *European forecast includes non-EU countries such as Turkey.

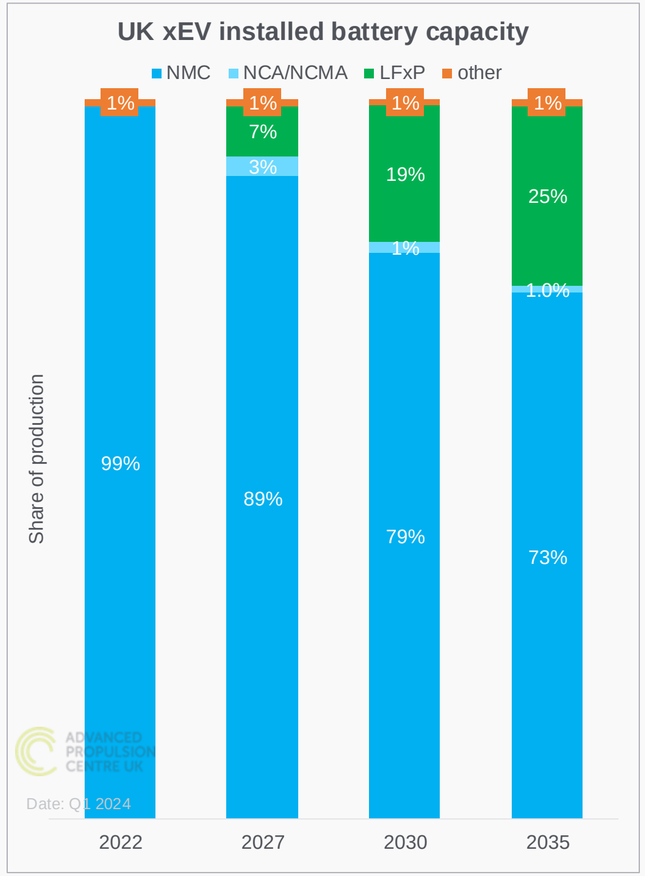
Forecasts for automotive battery production by cathode chemistry

Q1 2024 notes

- Demand for LFxP is expected to continue increasing through to 2035. At a global level demand starts to level out between NMC and LFxP, with each having different use cases. Also of note is the decreasing demand for NCA.
- In Europe, an increasing share of LMNO is expected in the ‘other’ chemistry category. By 2035, sodium-ion cells are expected to account for 1-2% of the chemistry demand for automotive.





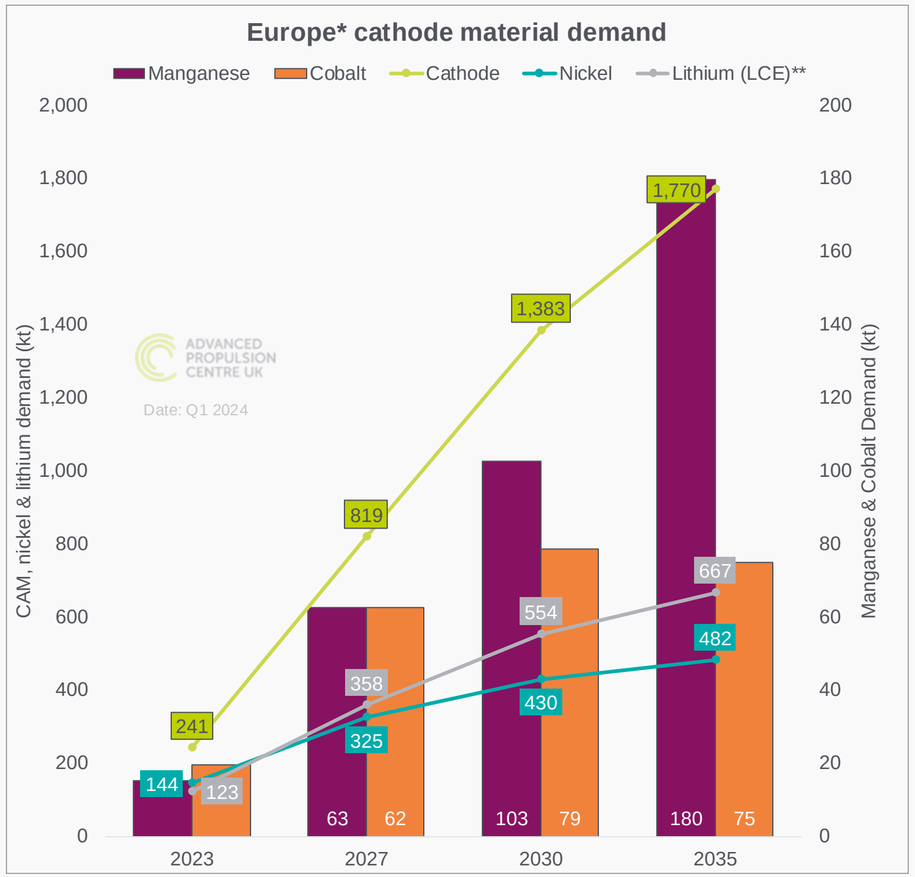


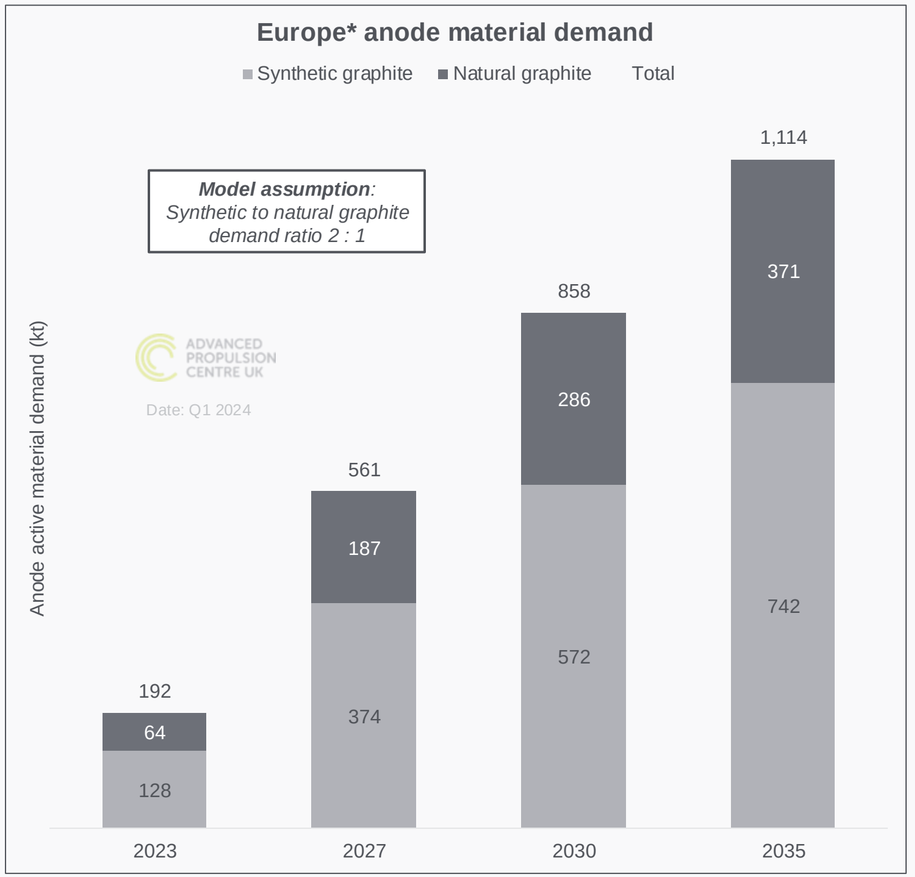
Source: APC Demand Databases using S&P Global AutoTechInsight (May 2024), BNEF forecasts (2024), Wood Mackenzie (2024)
Note: Passenger cars & Light Commercial Vehicles < 3.5t only, *European forecast includes non-EU countries such as Turkey, ‡Includes non-plug-in HEVs & ICE.

European Cathode Active Material (CAM) demand

Q1 2024 notes

- By 2035, growth in demand for cobalt is reversing due to changing chemistry split.
- There is also a notable slowdown in demand growth for nickel. Demand for manganese continues to grow due to use in LFxP as well as NMC.
- Demand for graphite is expected to reach over 1 Mt by 2035 despite increasing use of silicon in anodes. The demand for natural graphite may outpace supply.



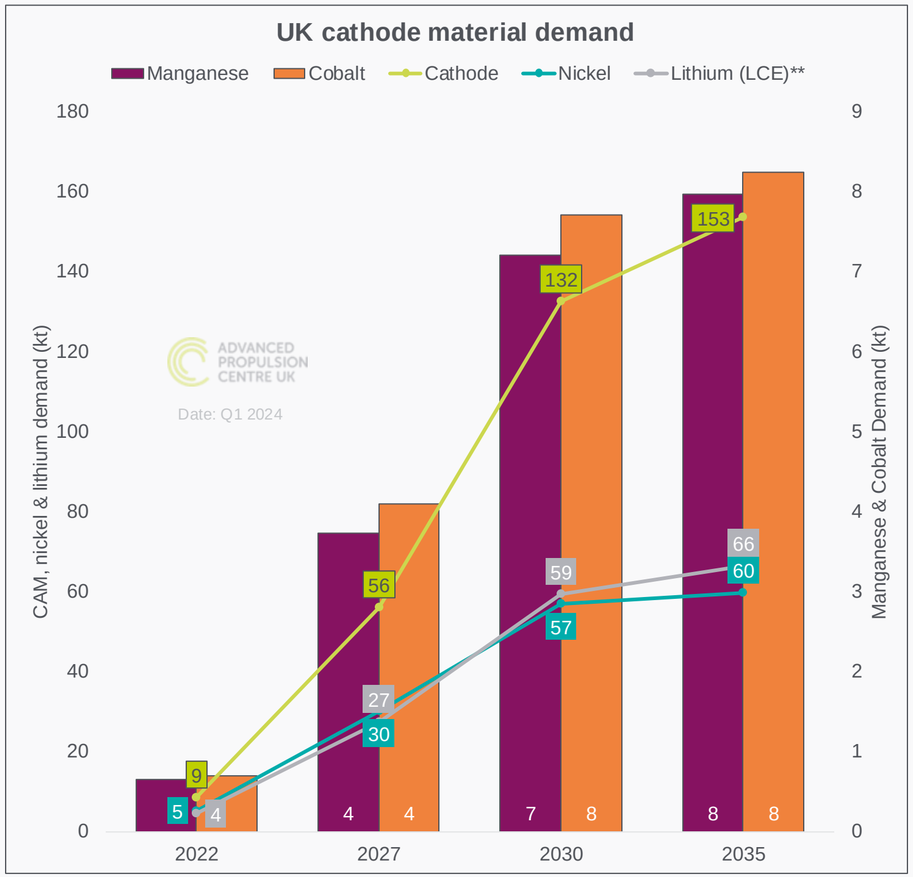


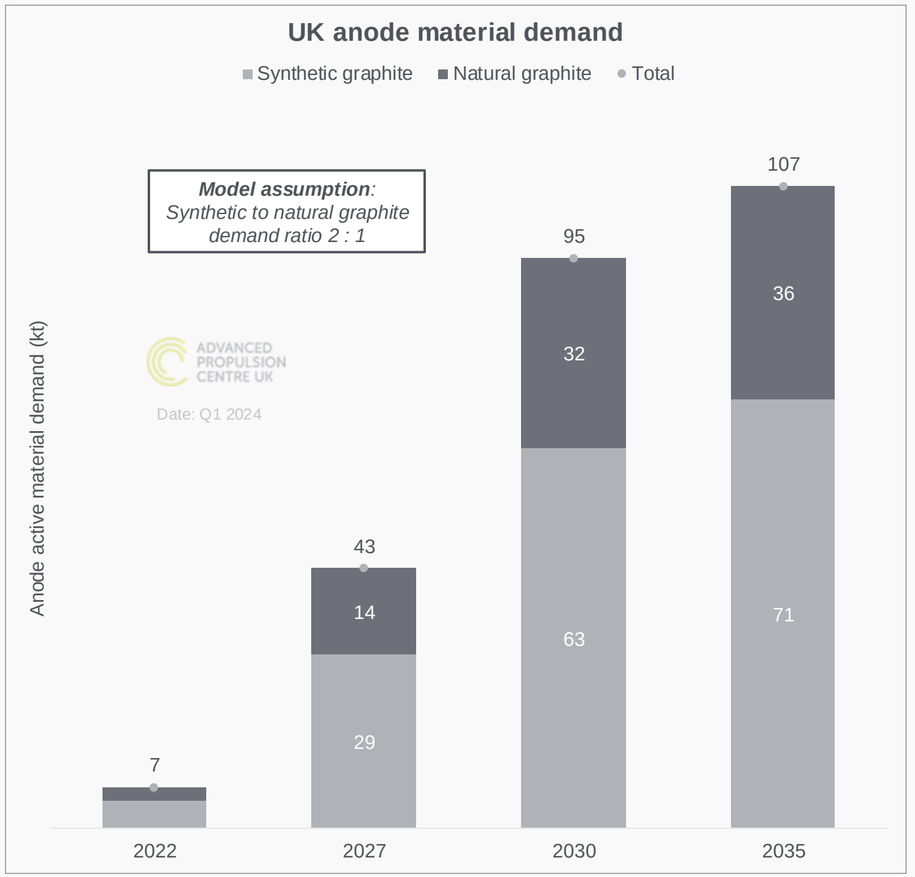
Source: APC Demand Databases using S&P Global AutoTechInsight (May 2024), Rho Motion data (2024), BNEF forecasts (2024)
Note: Passenger cars & Light Commercial Vehicles < 3.5t only, *European forecast includes non-EU countries such as Turkey, **Contained Li metal would be 5.3x lower.

UK Cathode Active Material (CAM) demand

Q1 2024 notes

- UK expects to see rapid growth in material demand as existing models are switched to BEV models and new BEV models are introduced. This rapid growth is expected to slow after 2035 as 95% of production will be BEV by that point.



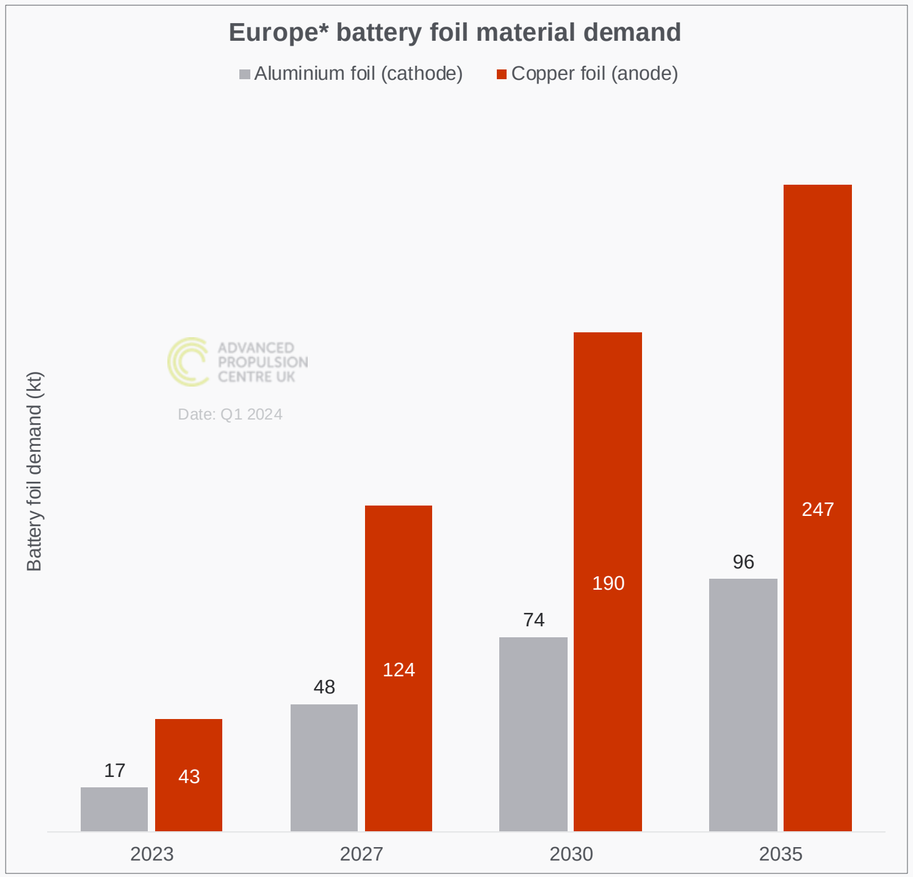


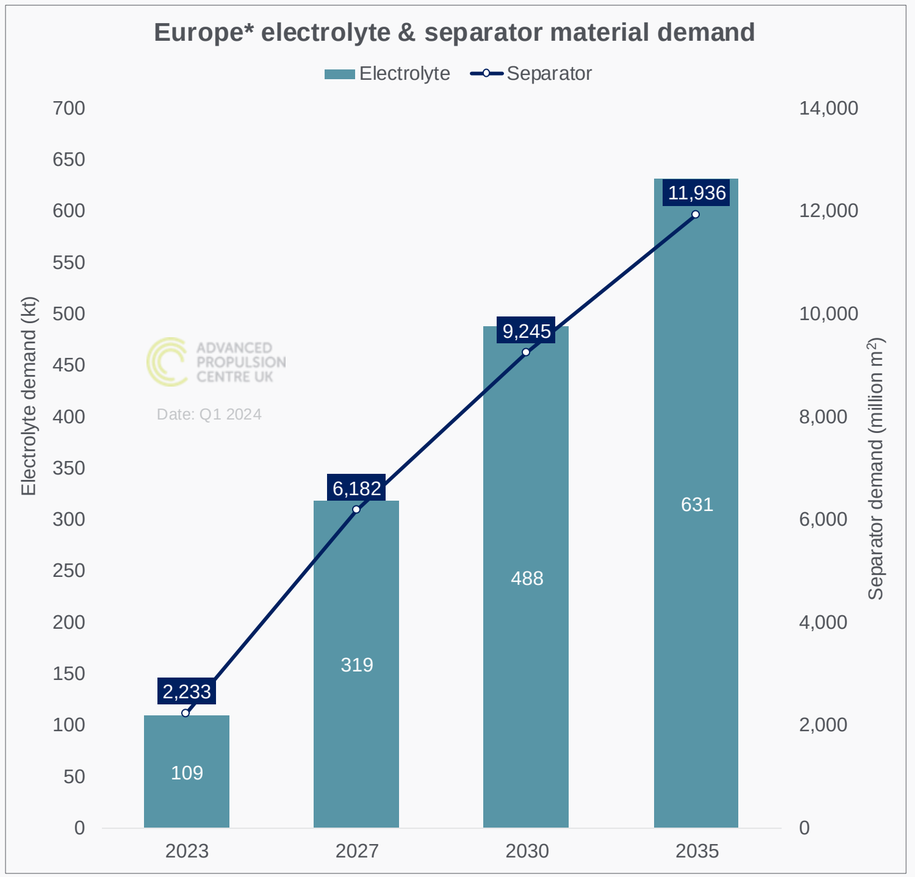
Source: APC Demand Databases using S&P Global AutoTechInsight (May 2024), Rho Motion data (2024), BNEF forecasts (2024)
Note: Passenger cars & Light Commercial Vehicles < 3.5t only, **Contained Li metal would be 5.3x lower.

European demand for battery foils, electrolyte, and separator material

Q1 2024 notes

- Demand for electrolyte, separator material, and battery foils expected to grow six-fold in the next decade.
- These materials will increase in importance to meet local content requirements and yet remain underinvested in.



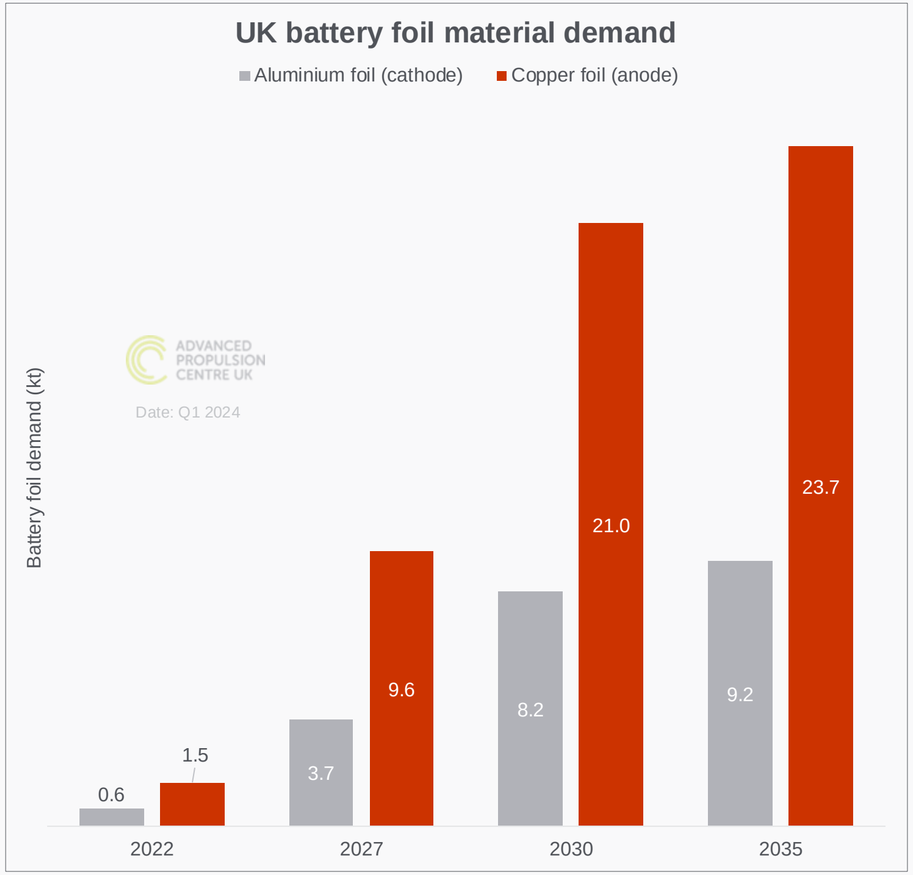


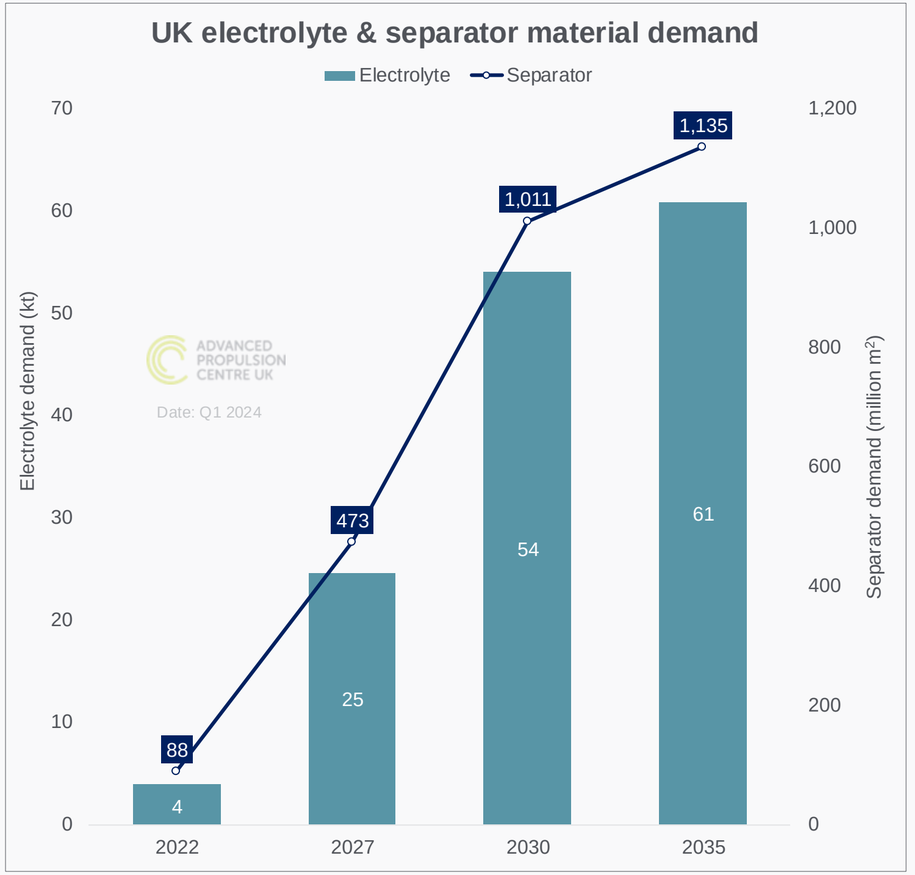
Source: APC Demand Databases using S&P Global AutoTechInsight (May 2024), Rho Motion data (2024), BNEF forecasts (2024)
Note: Passenger cars & Light Commercial Vehicles < 3.5t only, *European forecast includes non-EU countries such as Turkey.

UK demand for battery foils, electrolyte, and separator material

Q1 2024 notes

- Much like Europe, the UK will see large growth in demand for electrolyte, separators, and battery foils and, as with Europe, risks a reliance on external supply chains without investment.



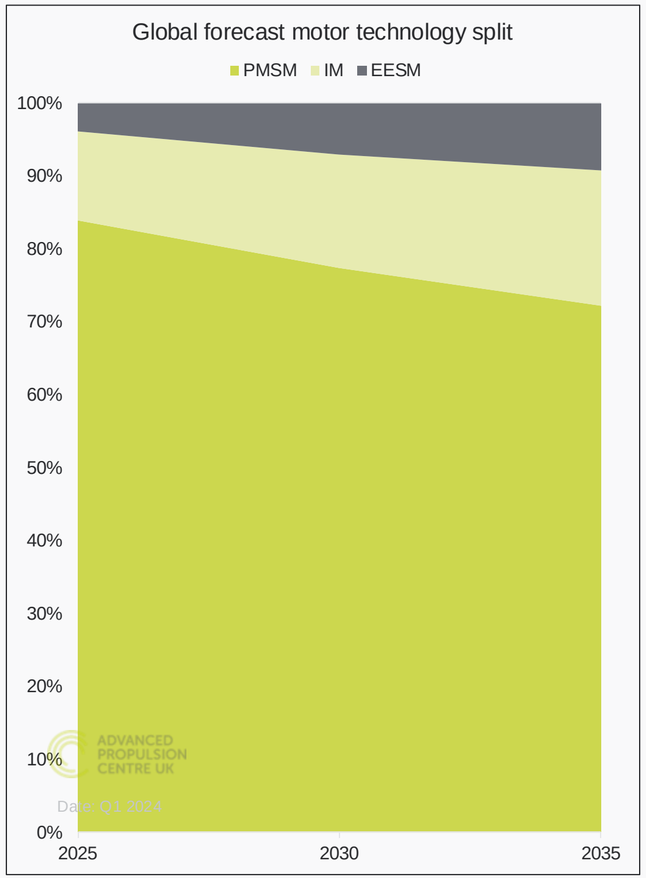


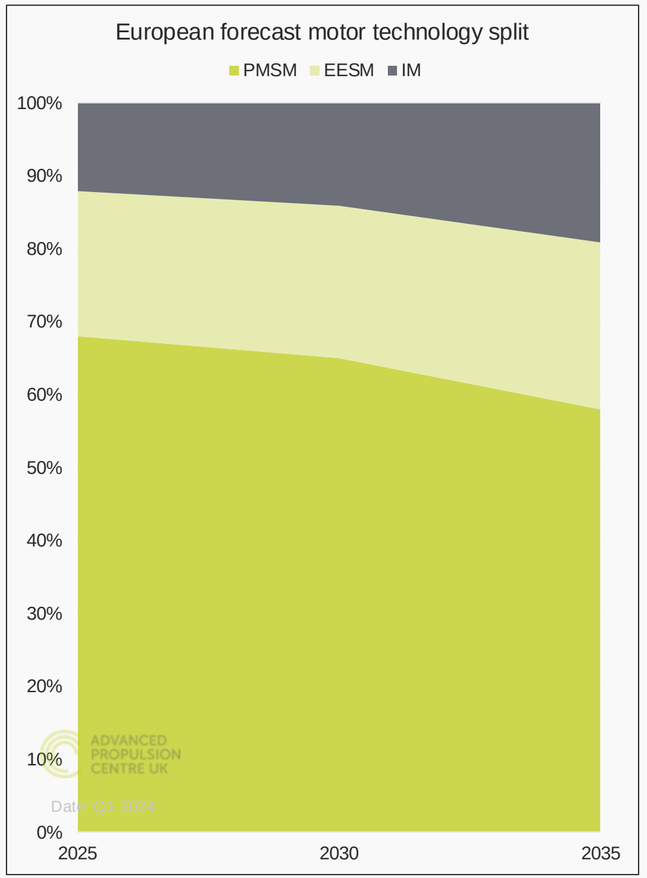
Source: APC Demand Databases using S&P Global AutoTechInsight (Dec 2023), Rho Motion data (2023)
Note: Passenger cars & Light Commercial Vehicles < 3.5t only.

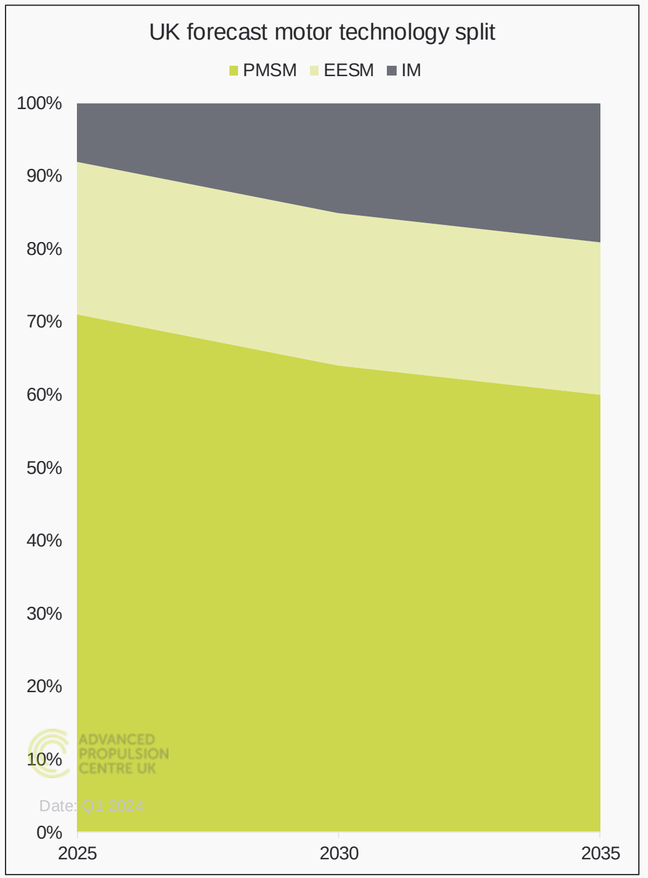
Forecasts for automotive traction motor demand by technology

Q1 2024 notes

- Motor technology forecast split into:
  - PMSM – Permanent Magnet Synchronous Motor
  - EESM – Electrically Excited Synchronous Motors
  - IM – Induction Motor
- Split includes LDV and HDV.





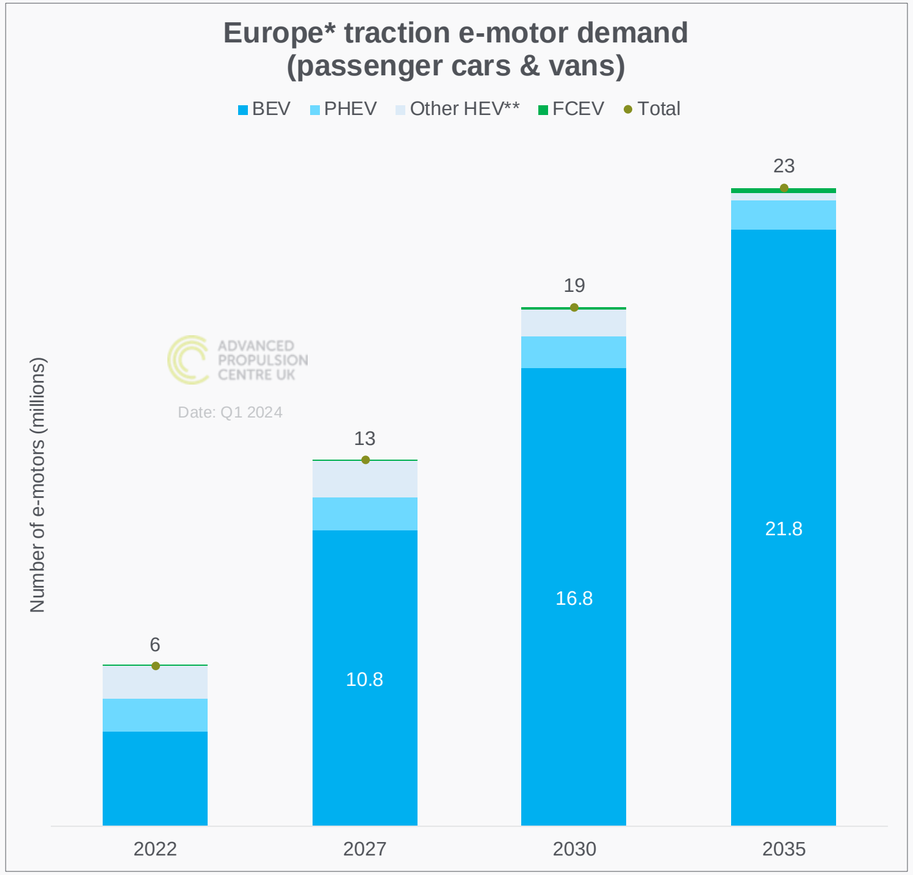


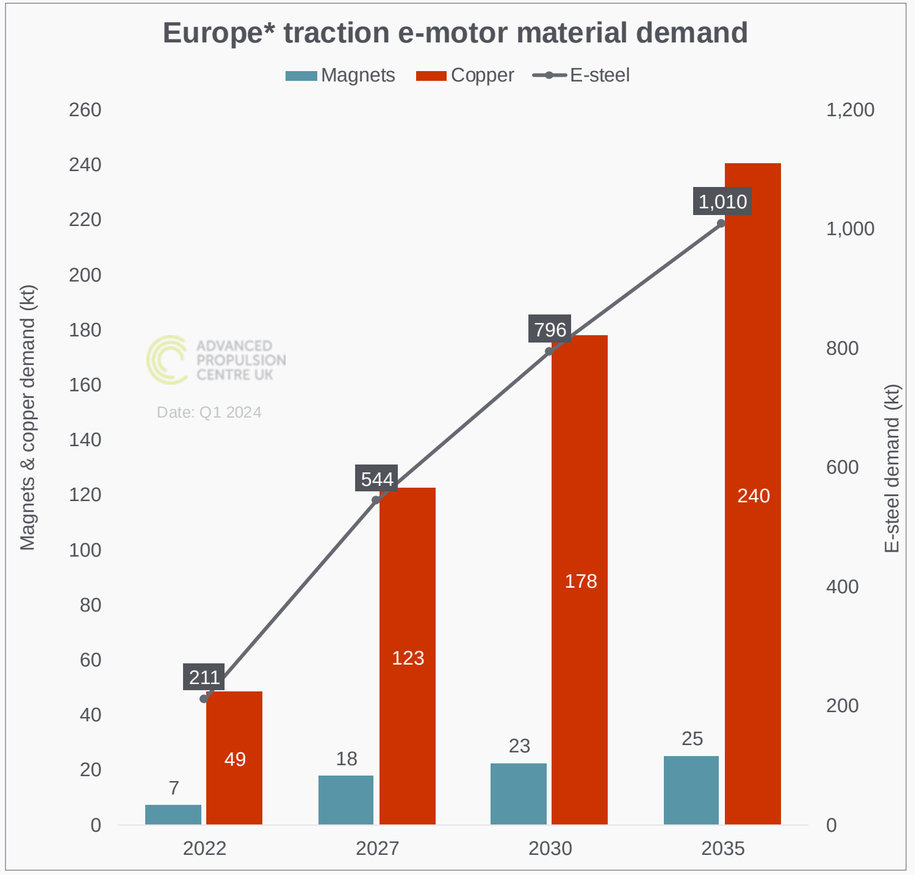
Source: APC Demand Databases using S&P Global AutoTechInsight (May 2024), Rho Motion data (2024), BNEF forecasts (2024)
Note: Passenger cars & Light Commercial Vehicles < 3.5t only, *European forecast includes non-EU countries such as Turkey, ‡Includes non-plug-in HEVs & ICE.

European demand for traction electric motors

Q1 2024 notes

- Demand for 23 million motors in Europe by 2035, requiring 25 kt of magnet material, over 1 Mt of e-steel, and 240 kt of copper.
- Magnet material covers all magnets with varying material composition. There is potential for significant change in the material used for permanent magnets which may impact demand.



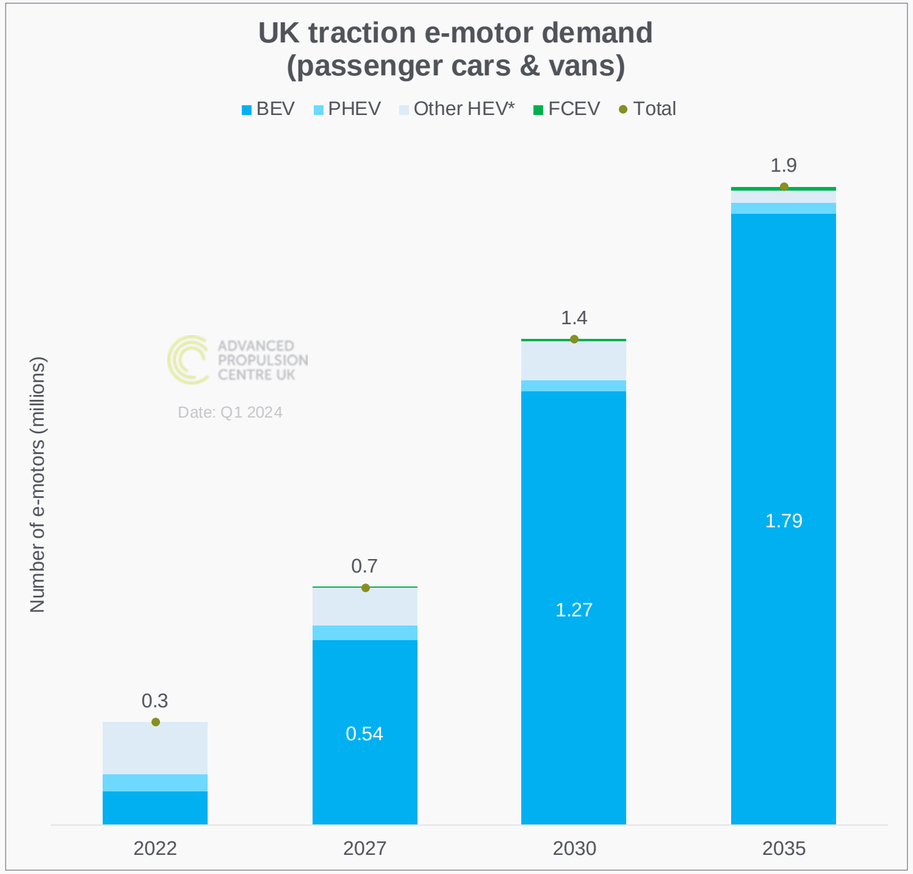


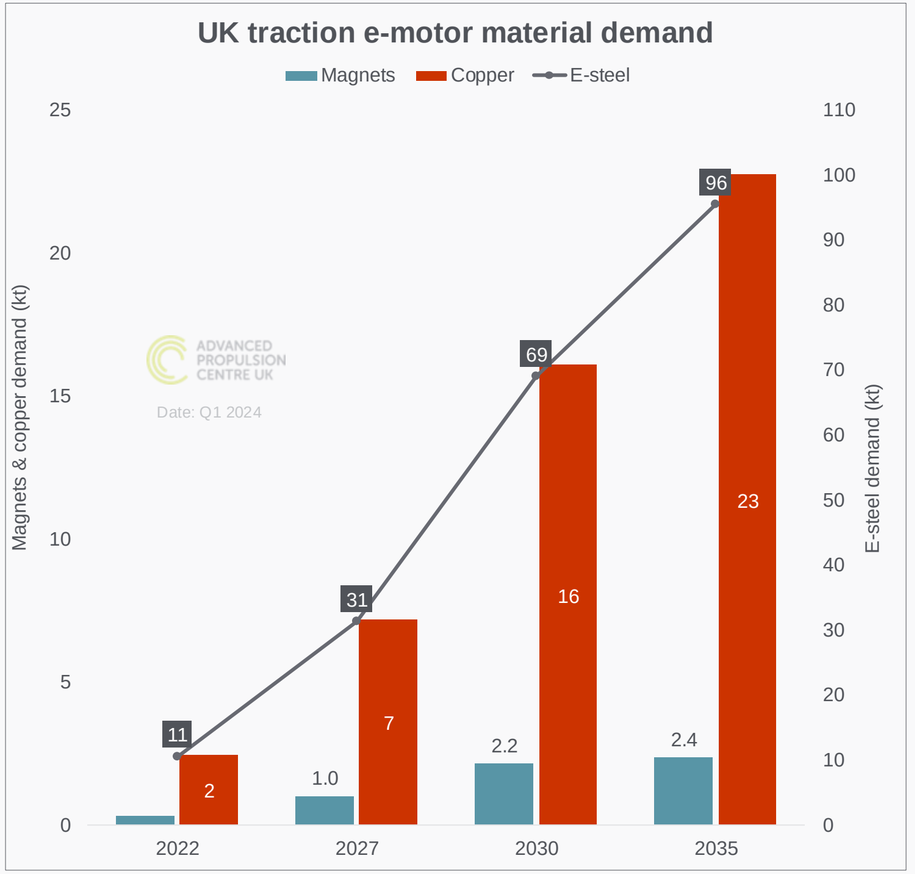
Source: APC Demand Databases using S&P Global AutoTech nsight (May 2024), Rho Motion data (2024), BNEF forecasts (2024)
Note: Passenger cars & Light Commercial Vehicles < 3.5t only, *European forecast includes non-EU countries such as Turkey, **Excluding mild hybrid electric motors.

UK demand for traction electric motors

Q1 2024 notes

- UK demand for traction motors expected to reach almost 2 million by 2035.
- Increasing demand for magnet material will slow in rate of growth as some manufacturers use magnet-free motors in their designs.





Source: APC Demand Databases using S&P Global AutoTechInsight (May 2024), Rho Motion data (2024), BNEF forecasts (2024)
Note: Passenger cars & Light Commercial Vehicles < 3.5t only, *Excluding mild hybrid electric motors.

Glossary

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APC	Advanced Propulsion Centre UK
BEV	Battery Electric Vehicle
CAM	Cathode Active Material
EESM	Electrically Excited Synchronous Motor
FCEV	Fuel Cell Electric Vehicle
HDV	Heavy Duty Vehicle
IM	Induction Motor
LCE	Lithium Carbonate Equivalent
LCV	Light Commercial Vehicle
LDV	Light Duty 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 an 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
xEV	Electrified Vehicle including BEV, PHEV, HEV, FCEV
ZEV	Zero Emission Vehicle

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This Q1 2024 automotive demand forecast is provided by the Technology Trends team at the APC.

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

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