PLATINUM ESSENTIALS

The slowdown in BEV market growth is driving investor interest in platinum on a higher-for-longer ICE automotive thesis; are budget BEVs a threat to this outlook?

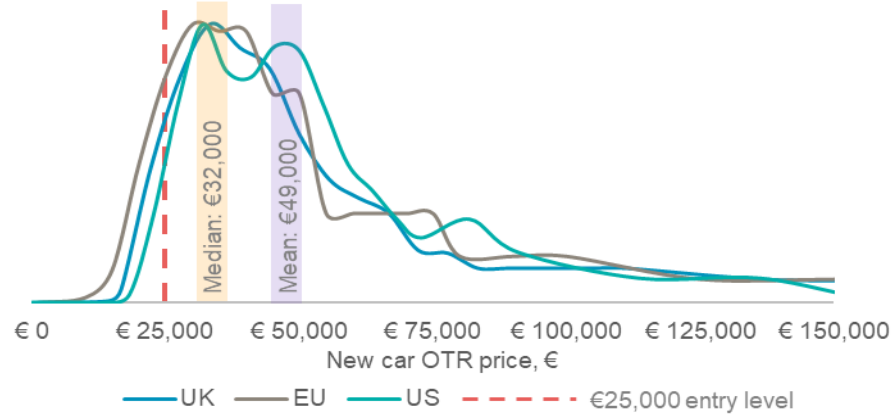
The slowdown in pure Battery Electric Vehicle (BEV) market growth is driving investor interest in platinum on a higher-for-longer Internal Combustion Engine based (ICE) vehicle automotive demand thesis. This report examines if slowing BEV demand is temporary or structural, and whether the BEV market could be reinvigorated by announced budget friendly BEV models. Our key conclusion is that budget BEVs are unlikely to lift overall declining BEV growth as, in reality, they address a small market and are ultimately less cost-effective for a cohort of buyers that typically do not have access to cheaper at-home charging.

Contrary to expectations, the sub-€25,000 new car market is small and only accounts for ~15% of listings in developed economies. This is not the "mass transportation" segment it is sometimes described as by automakers. The true mass-market lies within the €30,000 to €50,000 price range where around 45% of new cars (including BEVs) are priced in developed markets. This suggests that BEVs are already competing in the mass market and that producing cheaper BEVs to compete in the niche €25,000 low-end vehicle market is no panacea for stalling overall BEV demand growth.

Furthermore, we expect a BEV's perceived lower running costs versus an ICE/hybrid equivalent to unwind, raising doubts about achieving "price parity". Firstly, governments are already tapering purchase and running subsidies. Secondly, are changes to the commonly cited benefit of BEVs being cheaper to run versus petrol/diesel. Cheap electricity is largely a function of access to "at-home" charging, whereas the reality is that public charging can be more expensive than petrol/diesel. Housing stock data shows a skew towards smaller homes/apartments which, by inference, will not allow installation of private charging. However, residents of small homes and apartments are likely to be the target market for affordable BEVs. Therefore, buyers of affordable BEVs residing in small homes (unable to install at-home charging) are reliant on expensive public charging eliminating running cost advantages over an ICE.

Finally, we are uncertain how prevalent €25,000 BEVs will be given affordable cars generate lower margins, which without subsidies could make BEVs loss-making. Moreover, access to China's competitive BEV imports in developed countries is likely to be constrained by trade tensions between the west and China. Thus, we see several factors that point to slowing BEV demand growth being structural and implying higher-for-longer automotive PGM demand.

Figure 1. €25,000 no longer represents the mass market for new vehicles



*Source: Autotrader (May 2024), Auto-scout (May 2024), WPIC research, *OTR: On-the-road*

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BEV demand growth is slowing while hybrid sales are accelerating

The launch of BEV models to compete at a price point below €25,000 is unlikely to reinvigorate slowing consumer BEV demand growth

Automotive PGM demand is expected to remain higher-for-longer as a multi-technology approach is required to decarbonise LV transport

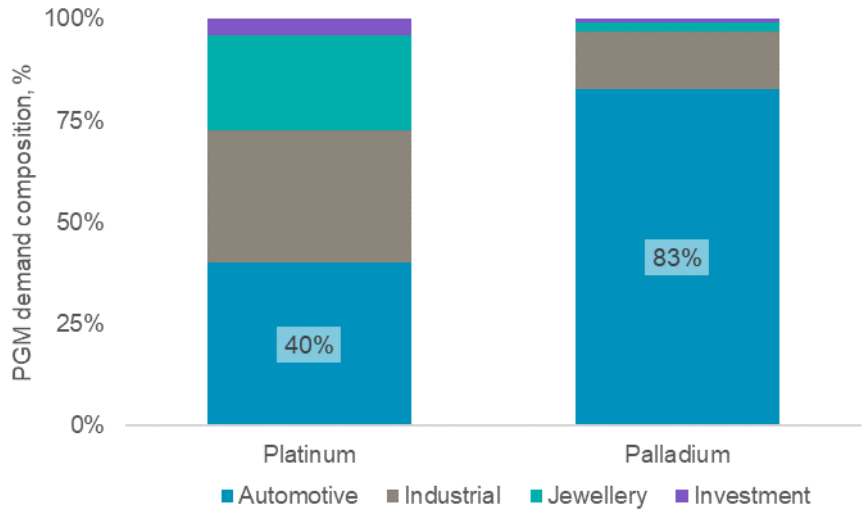
Contents

Introduction

Road transport accounts for 20% of global CO_2 emissions underlying the importance to decarbonise the drivetrain.

Platinum Group Metals (PGMs) demand is closely tied to the automotive sector, where a combined 65% of platinum and palladium demand is used for autocatalysts (Fig. 2). Decarbonising transport is key to meeting the Paris Agreement with the IEA estimating road transport accounted for 20% of global CO_2 emissions in 2020. Battery only, battery electric vehicles (BEV) will play a key role in decarbonising the light-vehicle (LV) fleet since they release no tailpipe emissions. BEV demand has grown by 70% CAGR globally between 2020 to 2023 which has led to its market share rising from 3% to 11% over this period.

Figure 2. The automotive sector is a key constituent of annual PGM demand, 2023



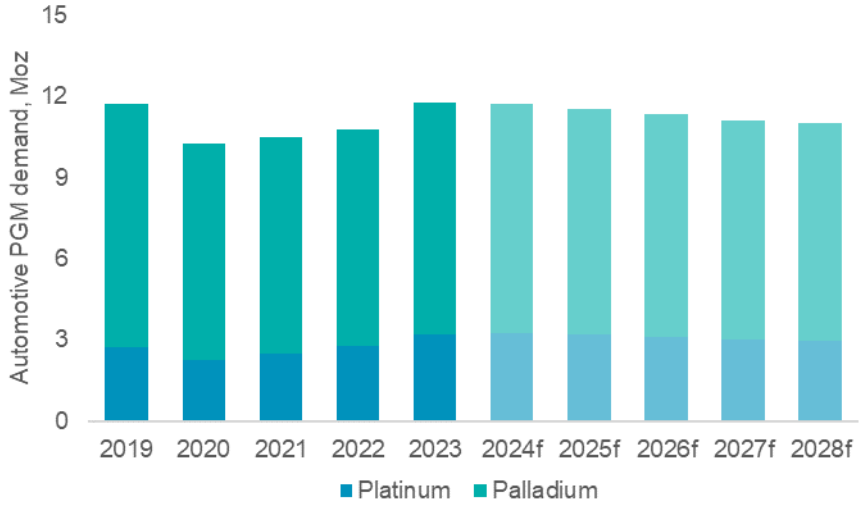
Source: Metals Focus, WPIC research

The growth of BEV market share comes at the expense of internal combustion engine (ICE) and hybrid vehicles. Both ICE and hybrids require an autocatalyst which contains PGMs. Therefore, the received wisdom is that PGM demand will be negatively impacted as BEVs' market share increases. However, automotive PGM demand erosion is commonly overstated with too much emphasis given to BEV penetration. WPIC expects 2E automotive PGM demand to decrease by only 1.4% CAGR between 2023 to 2028f (Fig. 3). This resilient automotive PGM demand is underpinned by:

- **Hybridisation of the drivetrain:** Hybrid vehicles will play a role alongside BEVs in decarbonising LV transport. We forecast hybrid vehicles will increase market share from 19% to 31% over the next five years to 2028. Notably, greater hybrid market shares support higher PGM loading intensity (plus 10% to 15% versus ICE) due to less efficient operating temperatures.
- **Heavy-duty vehicle demand:** HD production volumes (ex-BEV) are forecast to increase by 3% CAGR between 2023 to 2028 to 4.6 m units.
- **Fuel cell electric vehicles (FCEVs):** While FCEV adoption has been slow to materialise, we have previously discussed easing economic hurdles (*link*) within the HD segment which should support incremental platinum demand of ~200 koz by 2028f.
- **Slowing BEV demand growth:** In the first quarter of 2024, BEV demand growth slowed to 7% y/y compared to 20% growth over the comparative period a year ago. The slowdown in BEV demand growth is attributed to price, range anxiety and charging anxiety where BEV growth rates have now been outpaced by hybrid demand growth for over 12-months.

Hybridisation, heavy-duty, fuel cells and slowing BEV adoption will support higher-for-longer PGM automotive demand.

Figure 3. Hybridisation of the drivetrain will support higher-for-longer automotive PGM demand despite rising BEV market share



Source: Metals Focus (Pt: 2019 to 2024f; Pd: 2019 to 2023), WPIC research

Although the rate of BEV demand growth is slowing, it must be emphasised that demand is still growing. Global BEV market share is expected to increase 3% to reach 14% in 2024f. This is a key juncture for BEV technology as it reaches early mass adoption. The much-anticipated rollout of budget friendly BEV models competing in €25,000 market segment is being touted by automotive OEMs as an upcoming catalyst that will reinvigorate BEV demand growth, particularly amongst more price sensitive consumers. While lower cost BEVs will undoubtedly find a market, they may not be as compelling a growth driver as many might hope. Arguably socio-economic factors are becoming more acute which we expect will support consumer preferences for hybrids and drive higher-for-longer automotive PGM demand.

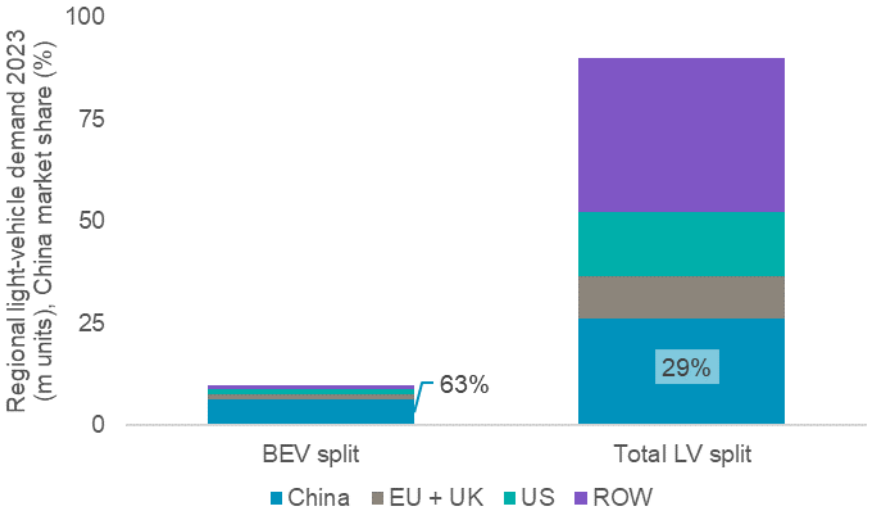
China's comprehensive policy framework has setup its global leadership across the BEV value chain.

Chasing China

China has an outsized share of global BEV sales. Compared to China's ~28% share of the global light-vehicle market, it accounted for ~62% of global BEV sales in 2023 (Fig. 4). China's comprehensive policy framework has supported its lead in BEVs. Notably, Chinese policy is broad-based across the entire BEV value chain from raw-materials procurement, battery production,

automotive producers, and consumers. These have cumulatively enabled improving BEV quality alongside reducing costs, whereby it is not uncommon for BEVs to be priced at parity with combustion engine vehicles within China.

Figure 4. China is comfortably the largest regional BEV market as it has benefitted from a comprehensive policy framework that targeted the entire EV value chain



Source: Bloomberg, ACEA, CAAM, Regional auto industry bodies, WPIC research

Developed economies with higher levels of GDP per capita and comprehensive infrastructure should be best placed to grow their BEV markets.

In terms of the large global automotive markets, China's BEV market penetration of 25% in Q2 2024 is well ahead of peers. Although BEV demand growth is slowing, China still appears well placed to meet its medium-term LV decarbonisation target of having 45% of passenger car sales being BEV or PHEV. Comparatively, Europe and the US accounted for 15% and 12% respectively of global BEV sales in 2023. Developed markets should be best placed to electrify LV transport given, existing underlying infrastructure and high levels of GDP per capita. Yet, the EU's BEV market share was 13% and the US's was 8% during Q2 2024.

The political will of the West may be lagging that of China, but Western automakers often cite the lack of affordable BEVs as a reason for lower market adoption. But what is the €25,000 car and where does it sit within developed country's new car market? Moreover, will the rollout of new BEV models in this more affordable vehicle segment help developed markets such as the EU and US reaccelerate BEV demand and raise market penetration.

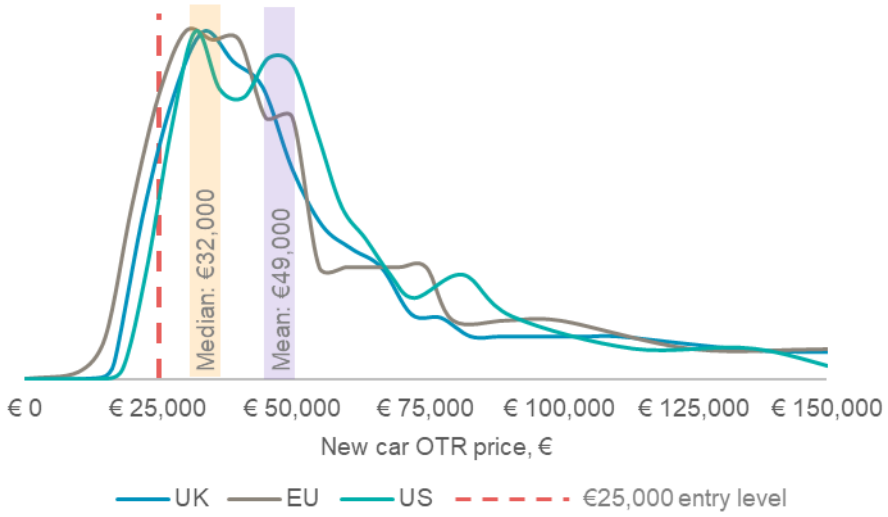
A €25,000 car is rare

The perception that a €25,000 car is commonplace is becoming unrealistic in Western markets. New car prices have risen, reflecting both rising underlying CPI and technology creep. Technology creep is the inclusion of more advanced features to the standard vehicle configuration. These are often mandated, such as more advanced emission control requirements or other safety technology. But technology creep is also part of a "premiumisation" trend which often occurs when a new or refreshed model is released. Ford's popular small hatchback Fiesta model is an example of how new car prices have significantly outpaced CPI, with the starting on-the-road (OTR) price of £9,995 increasing to £19,350 between 2013 and 2023 (+94%). Ford's family hatchback, the Focus, witnessed a 64% increase over the same period to £27,080.

The entry of BEVs into the €25,000 market segment is, according to automakers, expected to reinvigorate stagnating BEV growth.

New car marketplace data across the UK, EU, and US highlights that the €25,000 price is not the largest vehicle segment in developed markets. Rather, the median vehicle price is €32,000 in developed markets (Fig. 5).

Figure 5. A distribution of developed market new vehicle prices highlights a higher median and mean price than the often discussed €25,000 target of many automotive OEMs

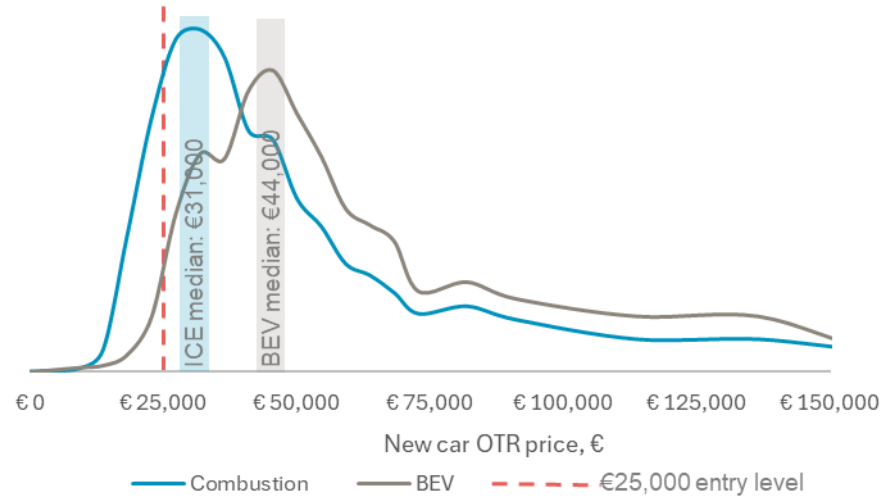


*Source: Autotrader UK and US (May 2024), Auto-scout EU data (May 2024), 2,062,646 vehicle listings, WPIC research, *OTR: On-the-road*

A €25,000 vehicle serves a niche market segment and thus the entry of BEVs into this market segment will not meaningfully add to total market growth.

It is worth noting that the distribution of new vehicle prices is "right" or "positively" skewed, meaning that it is more likely that a new vehicle costs more than the median price of all vehicles. The readthrough of a right-skewed distribution is that the sub-€25,000 new car market accounts for around 10% of US listings, 14% of UK listings and 18% of EU listings. Sorting the new car price data by BEV and ICE-based variants illustrates a distribution for BEVs which lies to the right of combustion and hybrid vehicles (Fig. 6).

Figure 6. The distribution of BEV vehicle prices illustrates the technology's premium to combustion engine-based vehicles in Western markets



*Source: Autotrader UK and US (May 2024), Auto-scout EU data (May 2024), 2,062,646 vehicle listings, WPIC research, *OTR: On-the-road*

The median new BEV car price is listed within the €40,000 to €45,000 range. Higher list prices highlight that BEVs are not addressing the sub-€25,000 consumer, accounting for only ~5% of electric vehicle listings in the UK and EU and 0% in the US. Whilst this is a low constituent of sales, we have previously highlighted that affordable cars in totality only account for around a seventh of total new car listings. Therefore, it is unclear how the launch of affordable BEVs will materially bolster slowing BEV demand growth because the addressable market merely increases by a seventh.

The median price of BEVs lies within the mass market price segments of €30,000 to €50,000.

The more pertinent observation about BEVs' rate of demand growth lies within the €30,000 to €50,000 new vehicle price range. This €30,000 to €50,000 price band accounts for 40% to 45% of total new vehicle listings. Similarly, around 42% to 48% of BEV listings lie within the €30,000 to €50,000 price band suggesting like-for-like competition in the mass market. This means that despite having ample choice of BEVs within the €30,000 to €50,000 price band, the rate of BEV demand growth is still slowing. This ongoing preference for combustion-based drivetrains probably suggests consumers believe:

- **Combustion drivetrains offer better value:** Comparisons between a vehicle with choice of either combustion/hybrid or full electric drivetrain highlights a like-for-like BEV premium of >€10,000, or
- **BEV's drawbacks have not been fully addressed:** Consumer surveys continue to cite range, charging infrastructure availability and charging times as reasons to not transitioning from ICE to full electric.

If a ~€40,000 BEV is perceived to be like-for-like inferior to a ~€40,000 combustion/hybrid vehicle whilst still requiring user compromises, it raises the question of what an affordable BEV is going to offer. More specifically, consumers are unlikely to want a €25,000 BEV which is inferior to like-for-like ICE vehicle where the engine has been replaced with a battery. Instead, price parity between ICE and BEVs is more likely to reaccelerate BEV demand growth rather than an absolute BEV price point.

High BEV prices have generally been justified by subsidies, emission free transport and lower running costs.

The challenge of price parity

Price parity between BEVs and ICE is a nuanced topic. Like-for-like comparisons of retail prices have been favourable for ICE/hybrid variants. BEV premiums have generally been around €10,000 per vehicle. However, it has long been argued that BEVs benefit from lower running costs (recharging relative to refuelling) and maintenance costs. This in turn supports lower operating costs to narrow the total cost of ownership differential between ICE/hybrid and BEV. As the industry scales and more battery development occurs, automakers are targeting the deployment of affordable BEVs in the €25,000 price segment where expectations are high.

The threshold automakers are striving to achieve for their affordable BEVs generally appears to be a 250-mile range (400 km) at the €25,000 price point. European markets have three sub-€25,000 BEV models launching in 2024 (Citroen e-C3, Dacia Spring and Renault 5). however, none are offering the psychological 250-mile range. The 2024 affordable BEVs offers WLTP ranges of around 160 miles. From 2025, Volkswagen's ID2.all and Skoda's Eqip are planned to launch at €25,000 with a 250-mile range. Similarly, Kia's EV2 will match those specifications and will launch in 2026.

An important component of achieving the €25,000 price point scale is the technology and platform development which should help narrow the broad €10,000 retail price delta between like-for-like BEV and ICE/Hybrid models. However, in chasing the affordable market, it is likely the operating cost dynamics of BEVs change. This may mitigate some of the expected narrowing of total cost of ownership premiums between BEV and ICE/hybrid.

Automakers expect to release €25,000 BEVs with a 250-mile range from 2025.

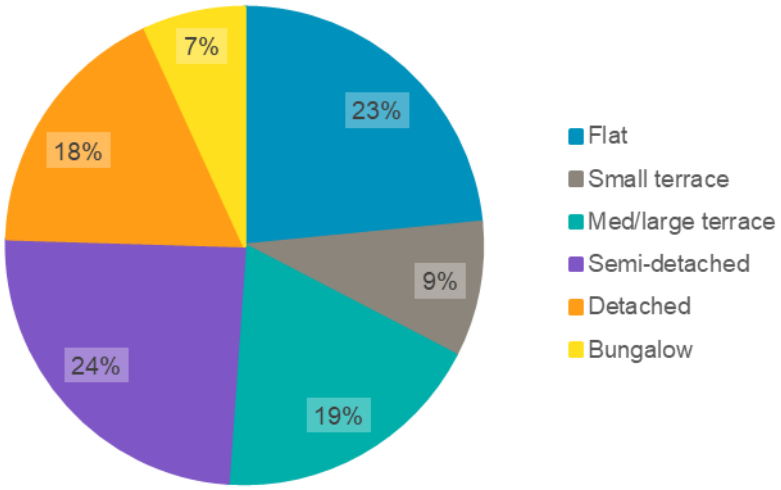
The built environment

The step change of electric vehicle market share gains is likely to come from developed markets such as Europe, the US and Japan. These markets lag China's BEV adoption rate and have higher-than-average consumer income allowing the consideration of a BEV purchase. These regions can be characterised as urban markets where consumers are likely to require smaller cars and on average drive less miles, which makes some BEV range compromises that are possible with a €25,000 model more digestible. Rural consumers are likely to remain EV hesitant given range anxiety concerns.

Given limited data availability, we will use the UK as a proxy for the developed urban market and highlight some of the challenges presented by the built environment. Since BEVs have traditionally been a premium product, it is fair to assume that more affluent buyers are more likely to have access to off-street/private parking where owners can utilise "home" charging. The transition to mass market affordable electrified driving has an associated shift in the consumer base. Less affluent consumers are less likely to have access to home charging for their BEVs, particularly those within large urban markets. Looking at the UK, the housing stock is skewed to smaller properties (Fig. 7).

Smaller properties in urban markets are likely to be unable to install at-home charging.

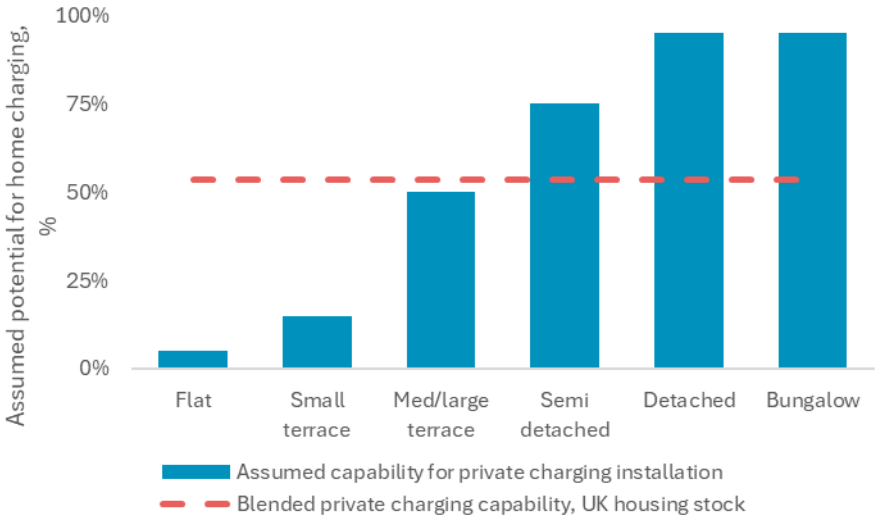
Figure 7. Much of the UK's 24-million housing stock is skewed to smaller property types where private charging may be difficult or impossible to implement



Source: UK 2021 Housing Survey, WPIC research

Smaller properties such as flats and small terraces will predominantly rely on public charging infrastructure since they are less likely to be able to accommodate home charging installations. Furthermore, not all mid-sized, large-terraced or semi-detached properties can install a home charger. WPIC estimates that the larger the property, the more feasible it is to be able to be able to install a home charger. Accordingly, based on the UK's housing stock, WPIC estimates ~50% of houses could potentially accommodate home charging (Fig. 8). Zap-map estimates the UK has >700,000 "home or work" charge points installed.

Figure 8. With smaller dwelling types probably less able to accommodate at-home charging, WPIC estimates around 47% of households would be reliant on public charging if they were to adopt an EV drivetrain

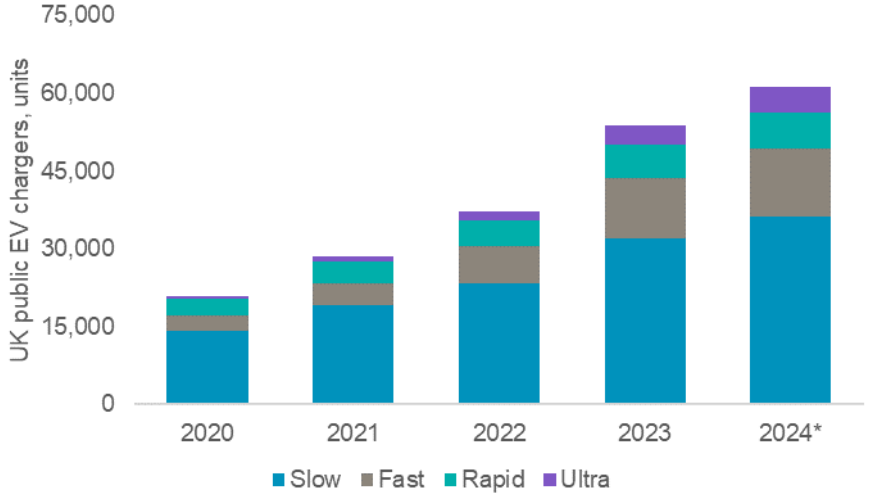


Source: UK 2021 Housing Survey, WPIC assumptions

Broadening BEV sales to the mass market will require a greater reliance on public charging if a large proportion of the housing stock cannot accommodate home charging. The UK's public charging infrastructure is growing in response to rising BEV market share. The UK reported growth of 37% CAGR in available public chargers between 2020 to 2023 with the number of public chargers reaching ~61,200 by March 2024 (Fig. 9).

Growth in the UK's public charging infrastructure has lagged growth in BEV demand which places additional pressure on public chargers.

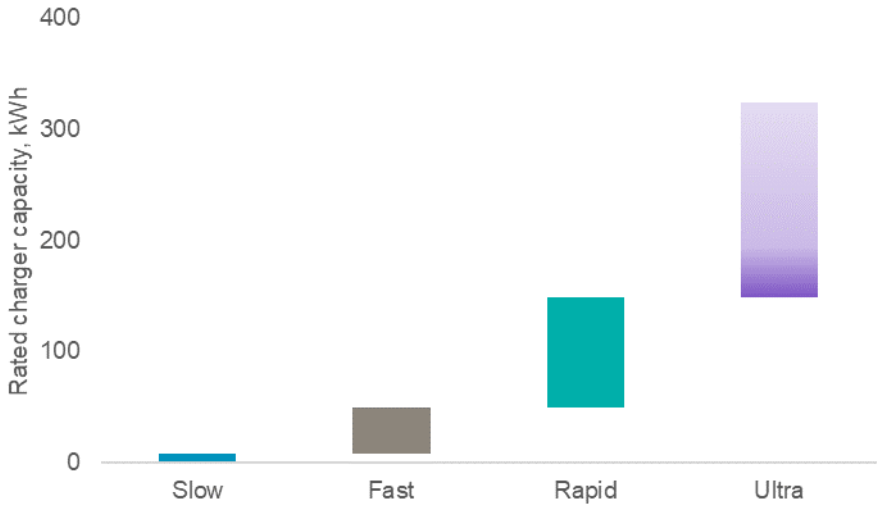
Figure 9. The number of UK public charging sites has increased by 37% CAGR between 2020 to 2023



*Source: ZapMap (www.zap-map.com/), WPIC research, *Year-to-date Mar'24*

In comparison to growth in public charging infrastructure, the UK's BEV fleet has increased from 190k units to 980k units between 2020 to 2023 (73% CAGR). Public charging infrastructure growth has been outpaced by BEV sales growth, leading the ratio of public chargers to BEVs to increase from 9:1 in 2020 to 18:1 in 2023. This may suggest deteriorating ability to charge a BEV. However, this ignores the estimated 700,000 private chargers in the UK and the rated capacity of newer chargers. That is to say that newer chargers with higher output ratings (expressed as kWh) can charge more vehicles than older chargers (Fig. 10).

Figure 10. Technology advancements are leading to higher-rated charging which will reduce recharge times

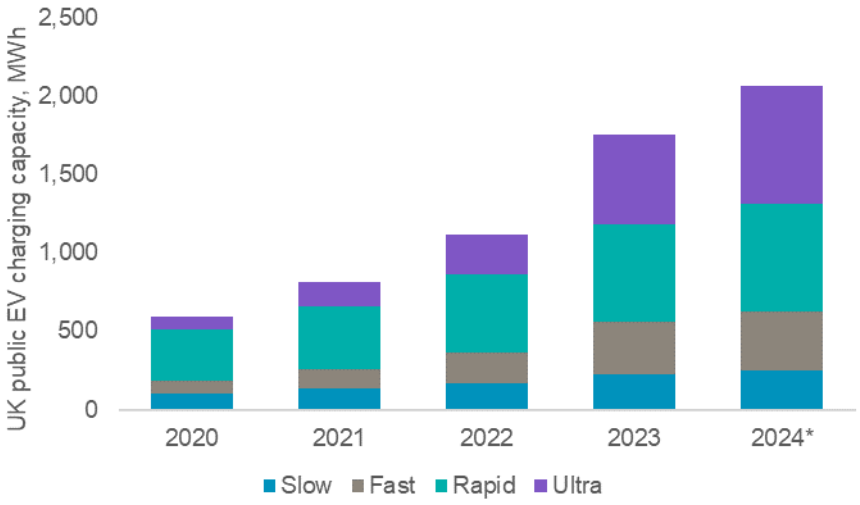


Source: ZapMap (www.zap-map.com/), WPIC research

Therefore, with the installation of ultra-rapid charging outpacing slow charging the UK, it is more apt to note that UK public charging capacity (by kWh output) has increased by 43% CAGR between 2020 to 2023 (Fig. 11). Notably, rapid and ultra-rapid charging respectively account for 33% and 36% of the UK's distributable charging capacity despite only accounting for 11% and 8% of physical charging installations respectively (Fig. 9).

Public charging capabilities should reflect newer charging technology which increases total available energy delivery capacity.

Figure 11. Rapid and ultra-rapid charging account for the majority of charging "capacity" based on higher respective energy outputs



Source: ZapMap (www.zap-map.com/), WPIC research

The development of improved charging technologies helps overcome two obstacles related to BEVs. These include reducing:

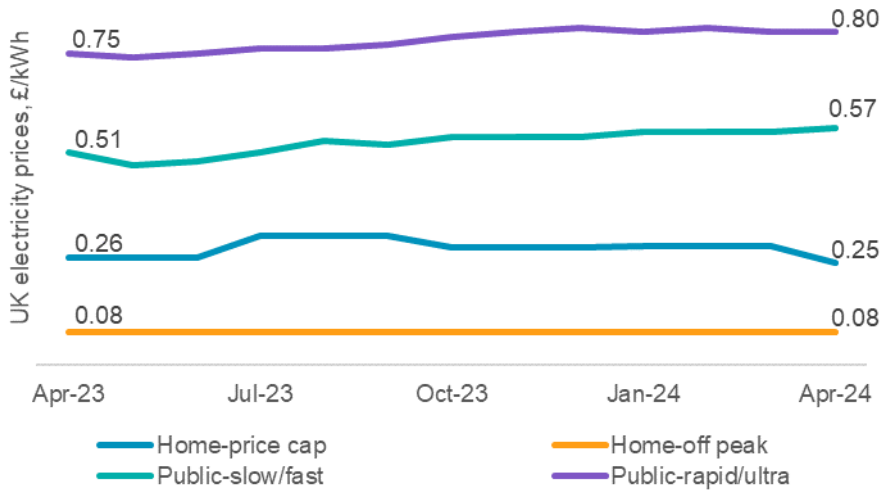
- **Long charging times:** a slow charger rated in the 3.5 – 7.0 kW range will take around ten to twenty hours to charge a 70 kWh BEV from empty to full. This reduces to around an hour on 50 kW rated fast charger, and 30 minutes on a 150 kW rapid charger, and
- **The absolute number of physical charging installations:** by reducing charging times, more vehicles can be charged on the same charger. This will reduce the number of public chargers which are required to be installed, mitigating some of the perceived engineering burden of the transition away from ICE LVs to BEVs.

With different charging offering a significantly different capacity to charge BEVs, it stands to reason that BEV owners seeking public charging will seek out energy delivery capacity rather than "plug points". That is to say that because rapid chargers can "turnover" more frequently than a slow public charger (which charges two cars in a day), a rapid charger is deemed more convenient even if it may be further away. A drawback to public charging networks and particularly rapid and ultra-rapid chargers is that they are more expensive to charge a BEV than compared to private home charging.

Charging a BEV at public charger is two- to three times more expensive than private "at-home" charging costs.

Public charging prices across the UK have been aggregated at £0.57 per kWh for slow and fast charging, and at £0.80 per kWh for rapid and ultra-rapid charging (Fig. 12). This represents a more than two- and three-times respective premium for slow/fast and rapid/ultra when compared to a standard tariff at home charging. The differential increases to ten times when comparing at home off-peak tariffs to public rapid charging costs.

Figure 12. Recharging prices at public infrastructure is on average two to three times higher than home charging on a private regulated tariff



Source: ZapMap (www.zap-map.com/), Ofgem, WPIC research

A breakdown in BEVs' running costs

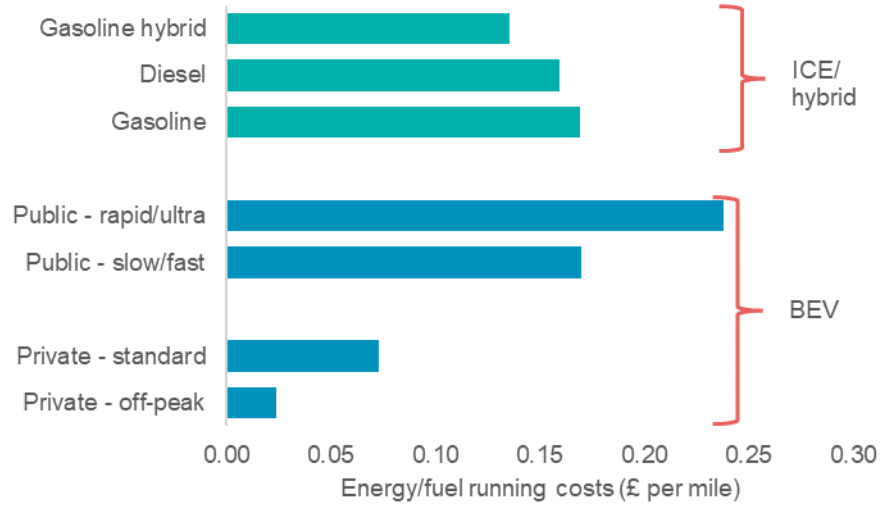
Where does this leave our nuanced interpretation of price parity? We left off by saying that price parity does not mean price parity because a €25,000 BEV still lacks some of the utility of a comparably priced ICE/hybrid. However, that retail price comparison was deemed flawed since BEVs' premium cost was offset by lower running costs.

Public charging costs are comparable to more expensive on a per mile basis than petrol/diesel for an ICE or hybrid.

But by analysing an urbanised economy such as the UK, which along with the likes of the US, Europe, Japan and Korea, is best placed to underpin the next wave of BEV adoption, we see that transitioning BEVs to more affordable consumer segments will require owners to be more reliant on public charging (due to housing profiles). Accordingly, where affluent BEV first-movers probably benefitted from home charging and low running costs, less affluent mass market consumers are likely to be penalised with increased running costs because they would inherently be more reliant on public charging due to the corresponding home ownership profile of this cohort. Thus, the traditional BEV cost of ownership model of high capex (i.e. purchase price) and low opex fundamentally changes.

Comparing the running costs (Fig. 13), a BEV which is predominantly charged privately has a lower cost-per-mile than a BEV charged at a public charger. Moreover, the cost-per-mile of a BEV (efficiency 298 Wh/m) using public charging is comparable to, or more expensive than, the per mile fuel costs of an ICE (efficiency: 40-45 mpg) or hybrid vehicle (efficiency: 50 mpg).

Figure 13. Using public charging infrastructure mitigates the running cost advantage BEVs have traditionally enjoyed over ICE-based vehicles

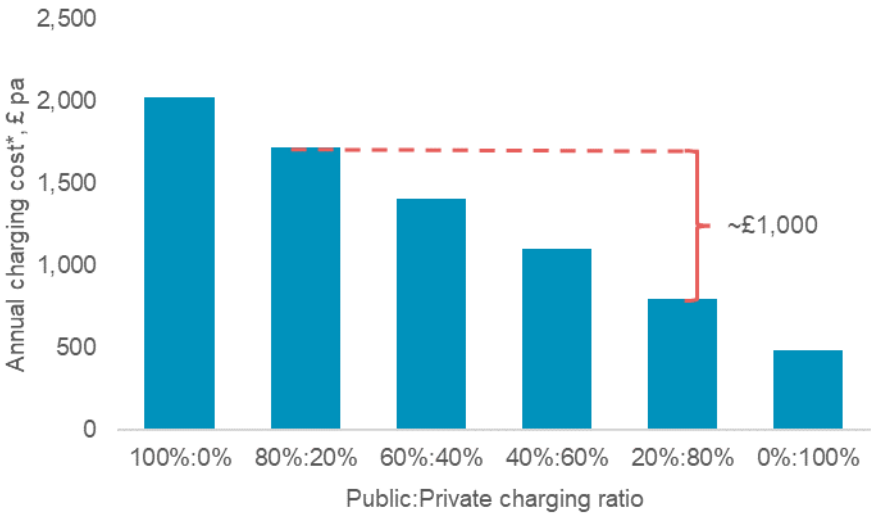


Source: ZapMap (www.zap-map.com/), Ofgem, WPIC research

While a BEV owner will have a regular charging location, it is not practical to assume a BEV uses a single type of charging. Hence, blending a range of charger types (slow or rapid) and locations (private or public) would be more representative to understand longer term (annual) charging costs. Assuming ten thousand miles of annual driving for an urban resident, there is ~£1,000 pa cost difference for a BEV owner using an 80:20 split of public/private charging compared to a 20:80 split of public/private charging (Fig. 14).

With small housing stock unlikely to install home-charging, a growing BEV car park becomes more reliant on more expensive public charging which eliminates the perceived low running cost benefits of BEVs.

Figure 14. Increasing use of public charging will increase the annual running costs for BEV owners



*Source: WPIC research, *public charging costs are blended at the ratio of energy capacity supplied via UK slow/fast and rapid/ultra chargers (www.zap-map.com/), and private charging costs evenly split between standard and off-peak tariffs*

The annual recharging costs for a BEV using an 80:20 public/private charging split would be £1,713. This is broadly equivalent to the annual fuel costs of a gasoline ICE at £1,692 (40 mpg fuel efficiency at £1.49 per litre costs) and 27% higher than a gasoline hybrid at £1,353 (50 mpg fuel efficiency).

This analysis would reiterate our expectation that the BEV cost of ownership model (low running costs) fundamentally changes as BEV ownership transitions into more affordable consumer segments where there will be greater reliance on public charging due to the makeup of available housing stock. Without any benefits to running costs, this leaves prospective purchasers of the €25,000 BEV asking whether the lower upfront price is worth the ongoing utility compromises compared to ICE/hybrid. This is arguably not the case and therefore expectations for BEV demand growth to reaccelerate on the back BEVs entering the €25,000 price segment appear ill-conceived.

Subsidies TBC

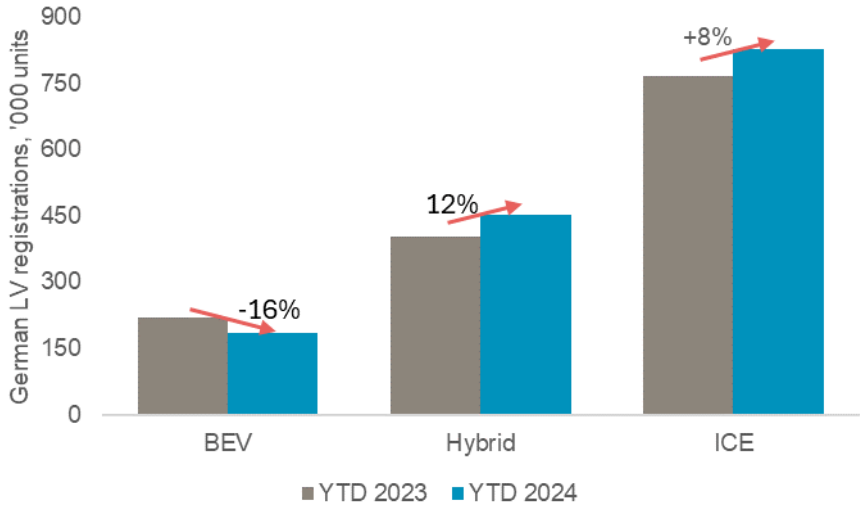
Governments are reducing the incentives to purchase BEVs which may offset lower prices.

Given the upfront purchase premiums of BEVs, first movers to adopt the technology have typically assumed to have been more affluent consumers. But discretionary purchasing power alone has not been the only driver of early BEV adoption. Instead, most markets have and continue to offer subsidies for purchasing BEVs as governments try to decarbonise LV transport and stimulate the nascent sector.

Subsidising the supply side and demand side of a nascent industry is not uncommon. The longer-term expectation is that the industry becomes economically sustainable with R&D improvements and scale, thus subsidies can be tapered. BEV subsidies have two guises for consumers, tax benefits or purchase incentives. Tax benefits may pertain to lower sales tax rates or road tax exemptions, while incentives pertain to some form of “cash-back” or support for home charging etc. For automakers, BEV subsidies may include tax reductions, direct funding support or favourable borrowing terms.

The challenge faced by BEV’s thus far is that each time incentives are phased out, demand is negatively impacted. Most recently, Germany removed a €4,500 purchase subsidy in December 2023 and BEV registrations in the first half of 2024 decreased by 16% according to ACEA.

Figure 15. BEV sales are negatively impacted in the aftermath of the withdrawal and/or tapering of incentives



Source: ACEA Jan-Jun 2024, WPIC research

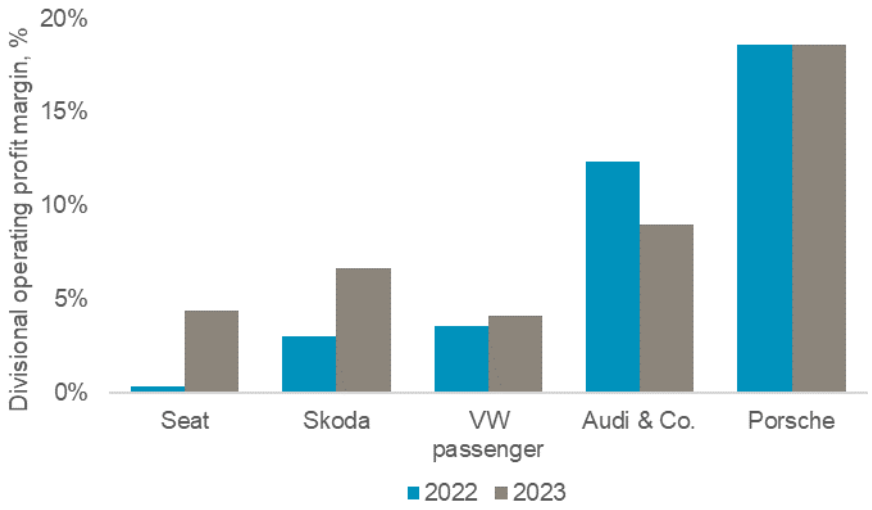
Lower income households are understood to be more price sensitive than more affluent consumers. So, the future tapering of incentives is likely to disproportionately impact BEV demand within the lower-priced more affordable market segments, i.e. €25,000 or less. The irony is that more affluent consumers buying premium BEVs will have benefited disproportionately more from more generous early incentive schemes. In the coming years financial support will be tapered in all markets including:

- **The United States:** The US$ 7,500 US clean tax credit has two primary sourcing assessments, namely, critical minerals and battery components. Critical mineral and battery component sourcing needs to meet a domestic or free trade country agreement threshold to receive the credit. The sourcing threshold is set at 50% in 2024 and rises 10% per year to 80% by 2027. As the threshold increases, it is likely that fewer vehicles become applicable for the tax credit.
- **China:** Purchase tax exemptions for New Energy Vehicles will be halved from RMB 30,000 to RMB 15,000 in 2026 and 2027. Thereafter, tax exemptions will fully unwind.

Larger/premium vehicles generate higher margins than smaller/budget vehicles raising questions about whether affordable BEVs will be profitable if subsidies get sequentially tapered.

Subsidies not only benefit consumers. Automakers have also benefitted from regulation to stimulate BEV development (primarily indirectly). These subsidies have supported the development of battery manufacturing and BEV-related production infrastructure. However, automakers continue to cite low-to-negative margins on their current slate of larger premium BEV models. In general, premium vehicles have historically achieved larger margins than more affordable vehicles (Fig. 16). Hence, the combination of affordability and BEVs is likely to compress margins and margins may face further pressure with less incentives for automakers to produce BEVs.

Figure 16. The Volkswagen Group's stable of brands highlight that premium vehicles tend to achieve higher operating margins which does not bode well for low-cost BEVs when subsidies get tapered



Source: Company data (VW corporate), WPIC research

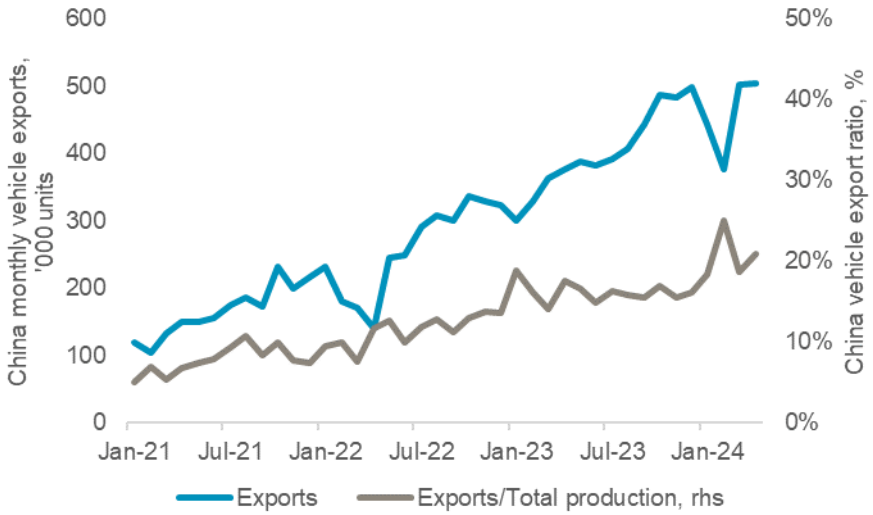
Should automakers battle to grow margins for upcoming €25,000 BEV models, there could be less incentive to actively persist in mass market BEV segments. This trend may already be playing out. Despite BEV sales being forecast to increase and gain market share, several automakers have scaled back BEV growth plans due to one or a combination of weak demand, high costs and lack of government support.

Slowing BEV demand growth has already led several automakers to defer BEV growth plans.

Where does China fit in?

Unlike Western automakers, Chinese automakers are producing low cost BEVs at scale. Chinese passenger vehicle exports increased by 56% y/y in 2023 (Fig. 17). Higher Chinese exports are driven by domestic automakers' global expansion plans but also a response to slowing domestic demand. Notably, increasing Chinese production capacity and slowing domestic demand has led to aggressive discounting within China's automotive market.

Figure 17. China's total vehicle exports increased to 4.9 m in 2023 as domestic automakers target global expansion in the face of slowing domestic demand



Source: Bloomberg, WPIC research

China's automakers are increasing exports.

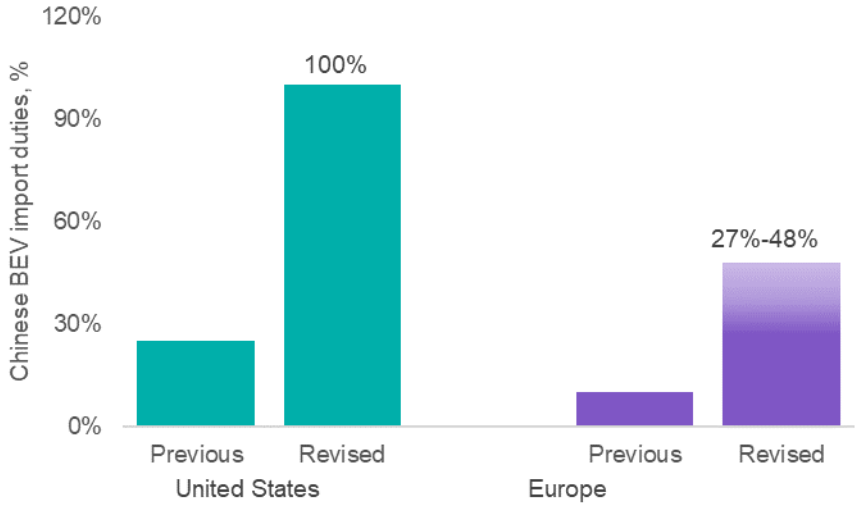
The irony of China's competitively priced BEVs is that importing these vehicles would accelerate the West's drivetrain decarbonisation efforts. However, Western governments appear highly resistant to emerging Chinese entrants due to the key socio-economic role played by domestic automotive sectors where:

- In the US, the auto industry accounted for 11% of manufactured output and around 920,000 manufacturing jobs during 2021, and
- In the EU, the sector employed 2.4 million people in direct manufacturing roles in 2021 (8% of the EU's total employment in manufacturing).

Given the potential for Chinese BEV imports to disrupt large swathes of US and EU manufacturing, regulators have proactively sought to raise trade barriers. The US has increased import tariffs on Chinese BEVs to 100% from 25%, while the EU's competition commission has increased tariffs from 10% to between 27% to 48% (Fig. 18). The US and EU represent China's largest and third largest markets for vehicle exports respectively.

China could support western light-vehicle decarbonisation goals by exporting cost competitive BEVs.

Figure 18. The United States and Europe have both increased import duties for Chinese BEVs in response to perceived illegal subsidies and dumping practices



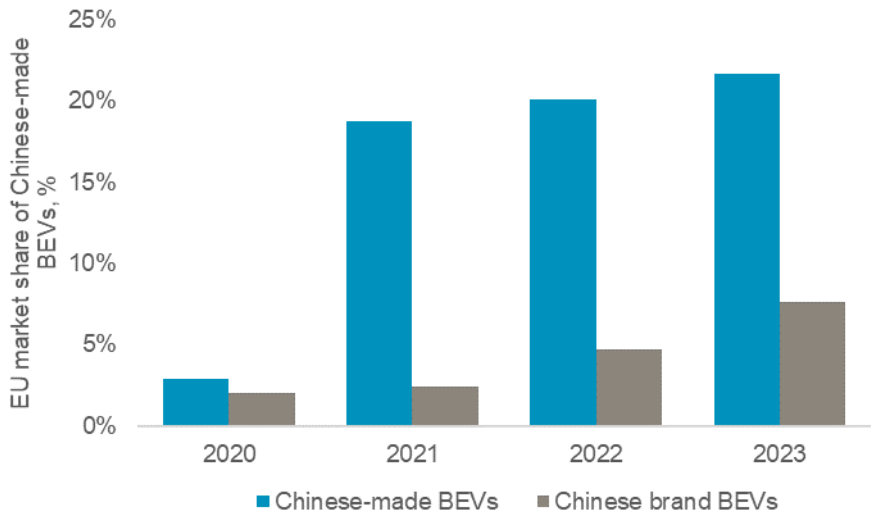
Source: USITC, TARIC, WPIC Research

Western tariffs may allow legacy automakers time to improve their BEV offerings relative to those of their cost-competitive Chinese rivals. However, tariffs will consequently keep BEV prices uncompetitive, likely delaying the time taken to achieve price parity with ICE and hybrid drivetrains. As previously suggested, €25,000 is not a silver bullet to reaccelerate BEV demand, but instead price and utility parity are important. Consequently, US and EU consumers may continue to exhibit a preference to decarbonise through hybrids. Each 1% of LV market share accounts for 21 koz and 29 koz of annual 2E PGM demand in the US and EU, respectively.

Tariffs against Chinese BEV exports are negatively impacting Western producers with manufacturing capacity in China.

It is worth noting that tariffs would extend across all price segments and would impact more premium BEVs in addition to budget-friendly models. Furthermore, western aligned automakers with Chinese production bases used to export vehicles back to their home markets are impacted by tariffs. Europe's automotive industry body, ACEA, notes that 22% of Europe's BEV sales were imported from China in 2023. However, most of these carried western badges with only around one-third being Chinese OEM vehicles (Fig. 19). Thus, large exporters from China into Europe such as Tesla could pass the tariff onto consumers which may exacerbate existing BEV premiums to ICE/hybrids (Fig. 6) and further decelerate BEV demand growth.

Figure 19. The majority of Chinese-made BEVs exported to Europe were not Chinese branded vehicles but rather Western branded vehicles getting exported back to their "home" markets



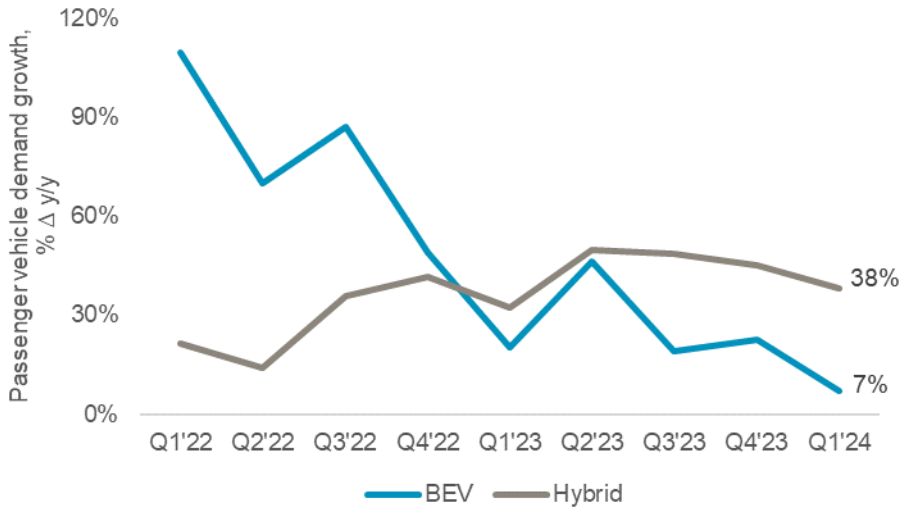
Source: ACEA, WPIC Research

Transition gets greater emphasis

Global BEV demand growth slowed to 7% y/y in Q1'2024 from 20% y/y in Q1'2023. Although base effects likely help explain some of the slowdown in BEV demand growth rates, there appears to be some hesitancy from the next cohort of consumers regarding willingness to go full electric. Hybrid vehicle demand growth accelerated to 38% y/y in Q1'2024 (Fig. 20) compared to 32% y/y recorded in Q1'2023.

Hybrid vehicles sales growth has been higher than BEVs of the past 18-months which highlights the challenges facing BEV markets.

Figure 20. BEV demand growth has systematically slowed, highlighting unwinding subsidies and challenges in converting the next cohort of buyers from ICE to BEV



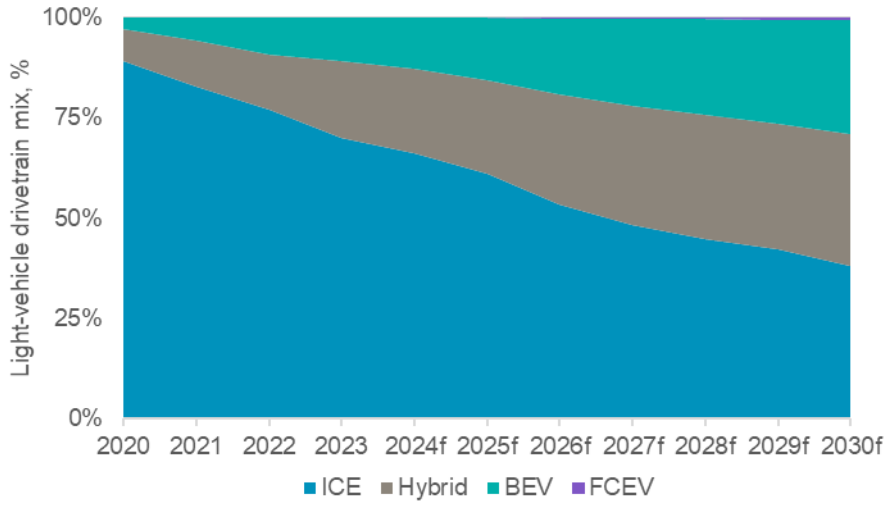
Source: Bloomberg, ACEA, CAAM, WPIC Research, Cumulative China, Europe, and US

Diverging growth trends have led to hybrid market share increasing ahead of BEVs in Q1'2024 (18% versus 15%). Higher hybrid demand growth highlights consumer ambition to decarbonise, but an unwillingness to decarbonise with some of the incumbent compromise of BEV (price, range and charging time and infrastructure).

Automakers are responding to divergent BEV and hybrid trends by following consumer wallets. Over the past twelve months, several automakers have announced plans increase the development pipeline of hybrid vehicles and/or scale back or deferred the development pipeline of BEVs. Strategy changes have not been entirely consumer led. It is worth noting that updated emission reduction legislation has also been considered by automakers when reviewing their vehicle pipeline. Notably, in the US, the EPA's 2032 emission targets are drivetrain agnostic. While in the UK, a ban on combustion vehicles sales was deferred five-years to 2035. Considered holistically, we expect hybrid vehicles to play a prominent role alongside BEVs in the global drivetrain transition where each technology achieves a 33% and 28% light-vehicle market share by 2030f, respectively (up from 19% and 11% in 2023).

Each 1% of light-vehicle market share in the EU and US accounts for a combined 50 koz of 2E PGM demand annually.

Figure 21. LV emission reductions require a multi-technology approach given several hurdles to near-term growth in BEV's market share gains



Source: OICA, National automotive associations, WPIC Research

Conclusion

The rollout of affordable electric transport is oft cited as the next incremental driver of BEV demand growth. Western automakers frequently highlight high hopes for their €25,000 BEV models which have begun launching from 2024. While we expect BEV demand to continue growing and for BEV to gain light-vehicle market share (28% by 2030f), affordable BEVs are unlikely to reaccelerate slowing BEV demand growth since,

Both BEVs and hybrids will gain market share to 2030f, however, the entry of BEVs in the €25,000 price segment is unlikely to reaccelerate BEV market growth.

- Mass market and low-income consumers are less likely to have access to lower-cost private charging facilities. These consumers will be more reliant on higher-cost public charging which changes the long-standing total cost of ownership equation for a BEV (high capex, low opex). Thus, within the affordable market segment, price parity may not in fact be price parity between a BEV and ICE/hybrid which may in turn dampen consumer enthusiasm for BEVs.

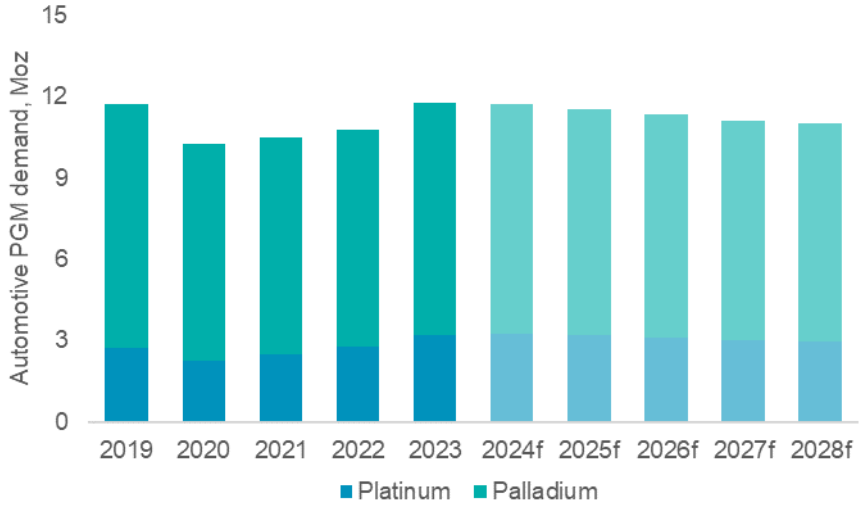
- As the BEV market matures, financial support and incentives to either or both automakers and consumers will get tapered. Mass market consumers are more price sensitive when considering vehicle purchases. Thus, consumer demand may be negatively impacted by any winding down of purchase incentives just as affordable BEVs are being launched, particularly when affluent early adopters of premium BEVs received the more generous subsidy support. Conversely, automakers who are already facing compressed to negative margins on BEVs risk incurring unsustainable margins on more affordable BEV models given these smaller car segments are already deemed less profitable than larger premium and SUV segments. Accordingly, automakers may slow the rollout of affordable BEVs if proven uneconomical without government support.

- China automakers are maturing and able to build cost competitive BEVs. As part of strategic growth ambitions, several Chinese automakers have global expansion plans through increased export sales. Although competitively priced, Chinese BEVs would benefit Western consumers and Western governments' ambitions to decarbonise light-vehicle transport, the important socio-economic role of the auto industry is raising protectionist measures. This will slow BEV adoption in the West.

With headwinds to BEV adoption in the affordable market segment, hybrid demand growth has outperformed BEV demand growth over the past year. There is growing emphasis on the role hybrids will play in decarbonising transport over the next decade. WPIC expects that due to hybridisation of the drivetrain, calls for automotive PGM demand erosion have been overly pessimistic. We forecast that 2E PGM demand will decrease by a nominal 1.4% CAGR between 2023 to 2028f (Fig. 22).

The €25,000 BEV is entering a niche market and their launch will likely change traditional ownership perceptions of lower running costs and attractive subsidies.

Figure 22. Hybridisation of the drivetrain will support automotive higher-for-longer PGM demand despite rising BEV market share

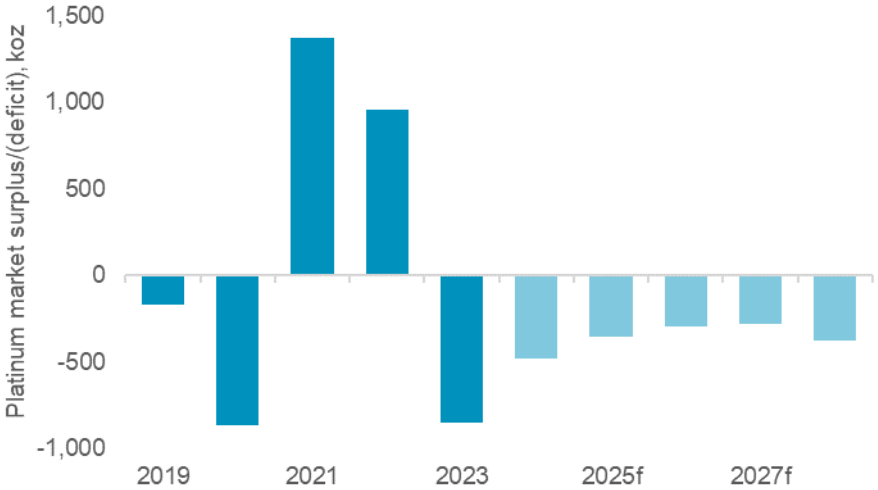


Source: Metals Focus (Pt: 2019 to 2024f; Pd: 2019 to 2023), WPIC research

PGM demand will benefit from higher-for-longer ICE and hybrid ownership.

Alongside, higher-for-longer platinum automotive demand, the jewellery sector seems to have troughed, with demand now geographically diversified away from China. Additionally, industrial demand should continue benefitting from platinum's unique catalytic properties whereby process efficiency is improved or energy consumption reduced. From an investment demand perspective, heading into a rate-cutting cycle, non-yielding assets such as platinum are likely to benefit. Cumulatively, then, total platinum demand should prove resilient over the next five-years which underpins our expectations for platinum markets to record consecutive markets deficits to 2028f at an average of 328 koz (~5% of total demand).

Figure 23. Hybridisation of the drivetrain will support automotive higher-for-longer PGM demand despite rising BEV market share



Source: Metals Focus (Pt: 2019 to 2024f; Pd: 2019 to 2023), WPIC research

Platinum markets are expected to record consecutive annual deficits to 2028f that average 328 koz.

Platinum's favourable market dynamics may offer the metal price support as above ground stocks (AGS) are depleted. Furthermore, downside risks to platinum supply could act as an incremental tailwind to AGS depletion.

Platinum supply may be negatively impacted by either or both mining and recycling sources. From a mining supply perspective, low PGM basket prices have led each of South Africa's large PGM miners to announce restructuring plans which are aimed at addressing their cost bases. Restructuring

announcements will reduce short and medium term capital expenditure which has been shown to weigh on mining flexibility and correlate to lower future production volumes (*link*). From a recycling supply perspective, the industry has seen ongoing challenges in the autocatalyst recycling market sourcing, over capacity and hoarding are limiting spent catalyst supply. Over the past two-years recycle autocatalyst platinum supply has been recorded at 17% lower than the prior five-year average of 1,487 koz.

Glossary

BEV - Battery electric vehicle (Battery only)

HEV - Hybrid electric vehicle

FCEV - Fuel cell electric vehicle

PHEV - Plug-in hybrid electric vehicle

ICE - Internal combustion engine

LV - Light duty vehicle

OTR - On the road

WLTP - World harmonised light vehicle test procedure

AGS - Above ground stocks

OEM - Original equipment manufacturer

CO_2 - Carbon dioxide

PGM - Platinum group metals

Capex - Capital expenditure

Opex - Operating expenditure

WPIC aims to increase investment in platinum

World Platinum Investment Council (WPIC) was established by the leading South African PGM miners in 2014 to increase investment ownership in platinum. This is done through both actionable insights and targeted development. We provide investors with the information to support informed decisions e.g. the *Platinum Quarterly* and monthly *Platinum Perspectives* and *Platinum Essentials*. We also analyse the platinum investment value chain by investor, product, channel and geography and work with partners to enhance market efficiency and increase the range of cost-effective products available to investors of all types.

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