KPMG

Charging ahead: Addressing the EV cost hurdle

High purchase price and increasing charging costs create significant challenges in Europe

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Content

Executive summary

Electric vehicle (EV) sales continue to grow unabatedly in Europe. However, automotive executives have increasing concerns that growth may be hampered as an effect of rising costs for both purchasing and using EVs.

Increases in battery raw material prices, and electricity prices have stretched the tipping point for EVs vs. Internal Combustion Engine (ICE) vehicles. Moreover, many consumers are now thinking twice about buying an EV as the driving cost for many ICE vehicle models in Europe has become lower than existing EV models.

Geopolitical issues continue to impact the supply and availability of critical battery raw materials and disrupt the electricity supply to Europe. This has impacted the way new EV models have been introduced into the European market, and comprehensive EV offerings that meet or exceed consumer expectations remain a distant reality.

While governmental support programs for EVs are being reduced, the purchase price of EVs is not decreasing at the anticipated rate – thus denting the potential demand of the same. Given the current reality, it is not surprising that automotive executives have significantly lower confidence in future EV sales. Global automotive executives believe that by 2030, the share of BEVs in Europe will be 24 percent as percent of new vehicle sales. This is a major dip from the sentiment expressed in 2021, according to KPMG's Global Automotive Executive Survey.[1]

However, the good news is multiple players within the EV manufacturing and EV charging ecosystems are pursuing multiple strategies to make their offerings more affordable and available to consumers. Carmakers are looking to secure strategic partnerships with resource rich countries in South America to ease the supply chain disruption. EV and EV battery leasing, and subscription services are also being pursued by players in the EU – aiming to overcome the higher upfront investment as compared to ICE vehicles.

A plethora of EV charging options are making headway into Europe with "Smart charging", "Battery swapping", "Rapid charging" and potentially "Electric Road System (ERS)" solutions. However, we believe that the national governments have the biggest impact on the rapid uptake of EVs and further penetration of EV charging infrastructure – mainly through regulations and financing.

We also believe that future EV adoption is highly dependent on cost hurdles related to both the initial purchase price as well as costs incurred during the EV lifecycle. EV value chain players, including consumers, automotive OEMs, battery manufacturers, Charge Point Operators (CPOs), service providers and governments have important roles to play in addressing these cost hurdles to have successful EV adoption in Europe.

1. KPMG, 23rd Annual Global Automotive Executive Survey, December 2022

Current challenges

High purchase price dents consumer confidence in EVs

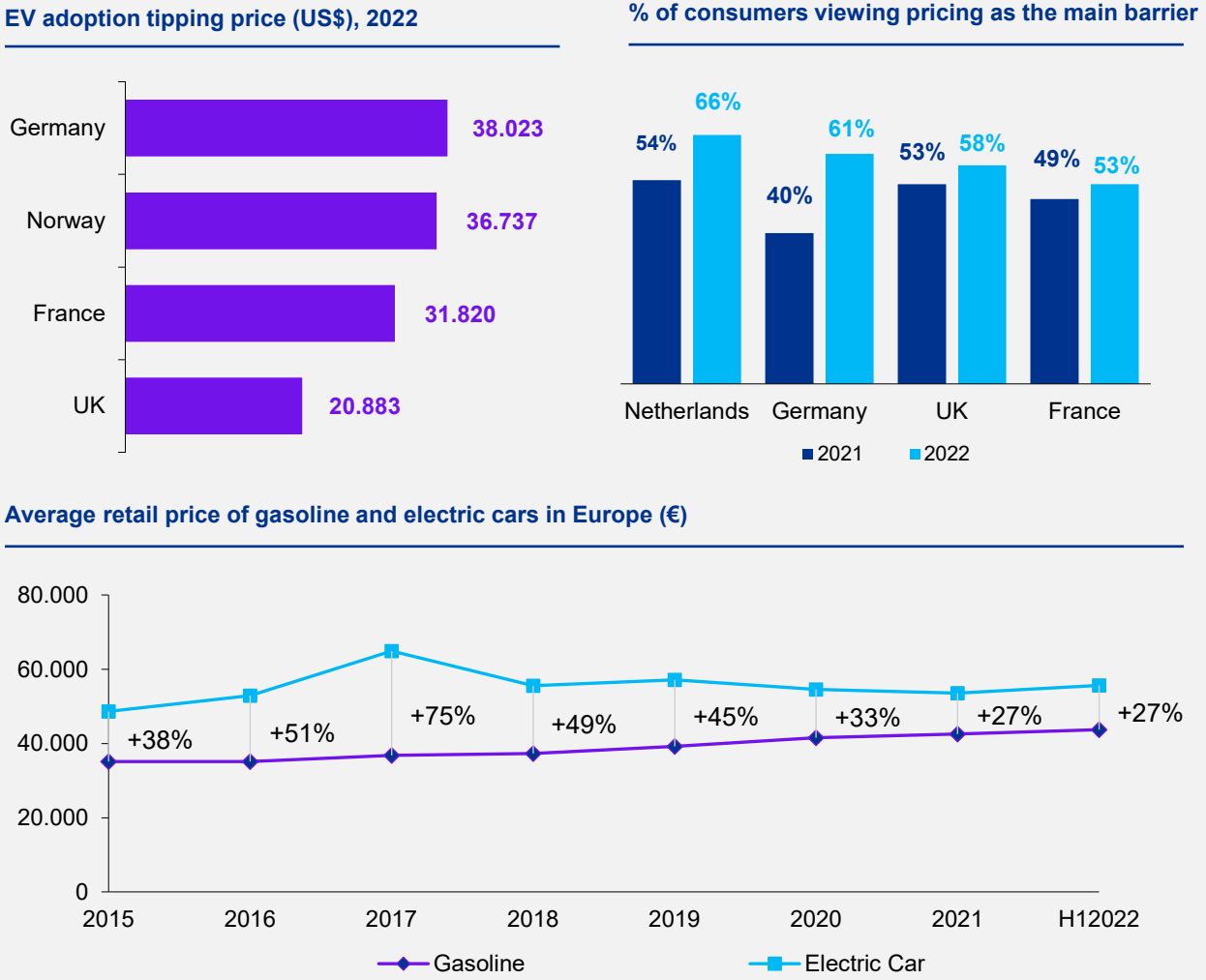
An electric vehicle (EV) is usually considered as an investment with a heavy upfront cost that gets paid off in the long run, thereby making it less expensive than a gasoline or diesel vehicle. However, the payback time depends on the circumstances of the EV usage. Short distance travel with cheap home charging possibilities are more cost-effective than long distance travel with public charging needs. Therefore, upfront costs vs. payback time is an important decision-making factor to switch to EVs for consumers.

In European countries, such as the Netherlands, Germany, France, and the UK, consumers consider pricing as a main barrier to opt for an EV (See Figure 1).

The average EV adoption tipping point – the price point at which adoption rate is likely to increase – needs to decrease to a level below the price of an equivalent ICE vehicle. Currently, the EV adoption tipping price in Germany, Norway, France and the UK is US$34,115 (€35,950).[2] However, the average price of an EV is €55,821[3], which is ~30% more expensive than a gasoline car[4] and ~90% higher than the average EV adoption tipping point.[5]

Figure 1

The importance of purchase price for EV adoption in Europe



Source: EVBox Mobility Monitor, Ipsos, June 2022

"Accelerating the Evolution", Castrol Study 2020, as accessed on 10th March 2023

"Affordable EVs and Mass Adoption: The Industry Challenge", JATO, 2022, as accessed on 10th March 2023

An EV model can cost about a third more than a similarly sized internal combustion engine vehicle. For instance, in Denmark, the price premium is significant, as an entry-level Peugeot 208 petrol is available from approximately €25,537 whereas the electric version starts from €38,978. Similarly, in the Netherlands, an Active trim Peugeot 208 petrol costs about €23,210, while the electric variant starts from €32,250.[6]

Higher costs of batteries increase EV purchase prices

The major driver of the high upfront price for electric cars is the cost of batteries – which accounts for 30-40 percent of the EV price.

Key factors behind this are the expensive processes involved in battery manufacturing and costs related to the value chain, such as higher battery raw material costs. EV battery prices have witnessed a steady decline over the last decade. Prices have reduced to US$141 per kWh in 2021 compared to more than US$1,200 in 2010.[7] However, certain events such as the pandemic-induced supply chain disorder, the Russia-Ukraine conflict and raw material capacity shortages as well as the energy price hikes, have contributed to an increase in battery pack prices, with a jump of 7 percent in 2022 vs 2021.

Exponential rise in prices of key metals like Nickel, Cobalt and Lithium is primarily responsible for the halt in declining battery pack costs. For instance, Russia accounts for about 15 percent of global battery-grade Nickel supply. In the months following the conflict, Nickel prices approximately doubled.[8] Lithium hydroxide costed about US$70,000 per tonne in October 2022, which was about eight times more than the price in the beginning of 2021.[9] Similarly, the price of Cobalt rose to about US$80,000 in May 2022.[10]

While prices of Lithium, Nickel and especially Cobalt have since stabilized, they are still higher than previous years.[11]

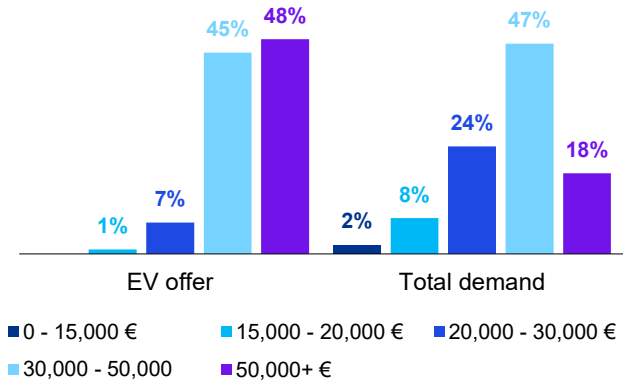
Higher input costs for batteries along with other EV components could directly translate to less affordable EVs and lead to a delay in achieving the adoption tipping point.

EV models are concentrated in premium segments instead of mass market

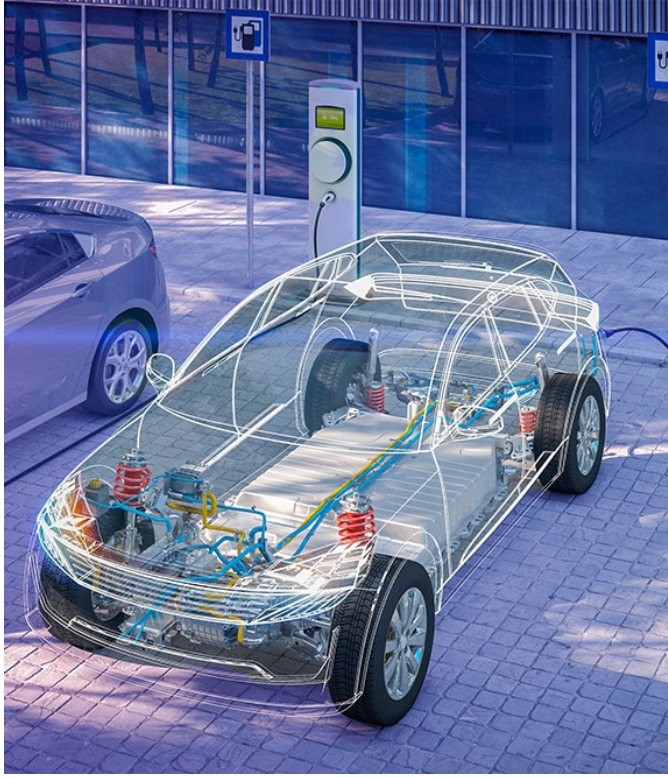
EV offerings across different price categories, are skewed towards more premium categories if compared with the entire vehicle population (see Figure 2). European OEMs have prioritized profitable and expensive EV segments and have been relatively less successful in developing affordable EV offerings for mass adoption.[12] However, carmakers are now resorting to price wars to increase sales across EV segments (see next page).

Figure 2

EV sales distribution by retail price range, 2022



Note: Numbers may not add to 100 percent due to rounding off
Source: "Affordable EVs and Mass Adoption: The Industry Challenge", JATO, 2022, as accessed on 10th March 2023



2. "Accelerating the Evolution", Castrol Study 2020, as accessed on 10th March 2023
3. "Affordable EVs and Mass Adoption: The Industry Challenge", JATO, 2022, as accessed on 10th March 2023
4. Ibid
5. Average EV adoption tipping point in EU was €29,920 in 2022; US$1 = €0.877
6. "Will electric cars reach price parity with petrol and diesel cars and if so, when?", euronews.next, as accessed on 29th March 2023
7. "Increase in Battery Prices Could Affect EV Progress", BloombergNEF, as accessed on 29th March 2023
8. "Will electric cars reach price parity with petrol and diesel cars and if so, when?", euronews.next, as accessed on 29th March 2023
9. "Carmakers take control of supply sourcing as battery costs rise", Financial Times, as accessed on 29th March 2023
10. "Cobalt prices poised to average lower this year and beyond", Mining Weekly, as accessed on 29th March 2023
11. "Increase in Battery Prices Could Affect EV Progress", BloombergNEF, as accessed on 29th March 2023
12. "Affordable EVs and Mass Adoption: The Industry Challenge", JATO, 2022, as accessed on 10th March 2023

Disruptive EV pricing strategies of new carmakers can trigger a race to the bottom

Despite EV portfolios being focused on premium models leading to less affordable options, carmakers like Tesla are now resorting to price wars in order to stimulate higher demand across segments.

Tesla is aggressively cutting prices of its popular EV models like Model 3 and Model Y, impacting residual values of car owners and competitiveness of other players. It seems to have an effect, as Tesla's Model Y was one of the best sold EVs in Europe in the first few months of 2023.

With new sales models including the introduction of the agency retailer model, many carmakers now have increased pricing flexibility. Initially, many EV makers were reluctant to change their prices, but after a few months some (VW, BMW, Ford) seem to follow Tesla. At the same time, European carmakers are getting ready to launch new EV hatchback or sedan models below US$30,000 (at least in the US) by 2025 or 2026 which can lead to more affordable options.

While this is good news for EV consumers, a price war across EV segments can lead to low margins for carmakers. Tesla, for now, can sustain these low margins as it had kept its margins relatively high compared to other EV makers – thereby, providing a cushion. Reducing prices is a way of capturing more market share and clearing out inventory – and Tesla is clearly taking a leaf out of this playbook.

What will remaining incumbent carmakers do? Will they also reduce prices aggressively across their EV portfolios and across regions? More importantly, will this price war significantly push the demand for EVs across segments?

Rising electricity prices increase EV lifetime ownership costs

If costs, such as depreciation, interest, insurance, taxes, maintenance and energy/fuel are factored in, then the ownership costs of EVs are on par with ICE vehicles across multiple vehicle segments in most European countries.

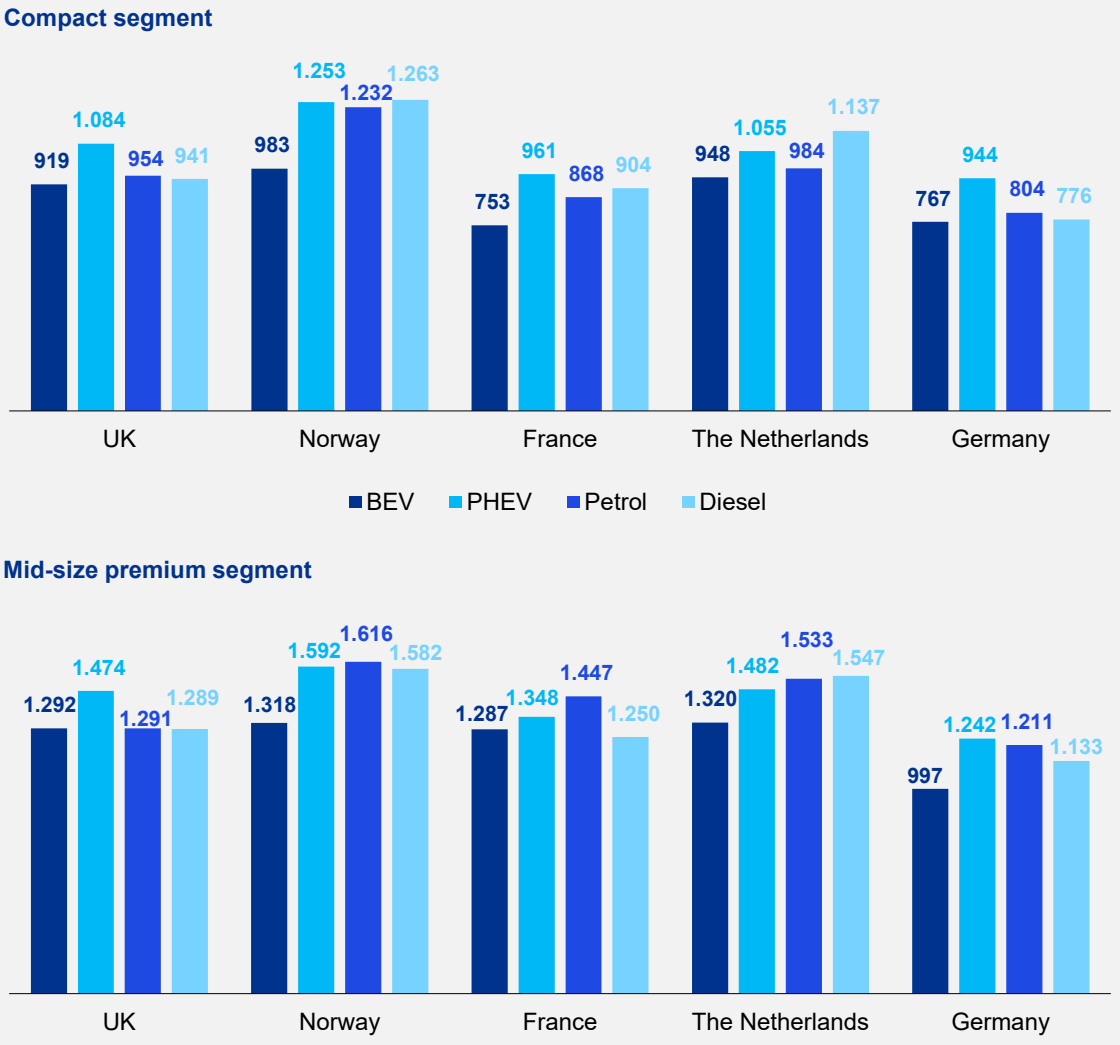
In some countries such as Norway and the Netherlands, the EV ownership costs are comparatively much lower than ICE vehicles (See Figure 3).

The post-purchase operating costs of BEVs in most examined countries are on par or lower than the ICE vehicles across the premium segments. The largest difference can be experienced in Norway, thanks to various EV incentive schemes introduced a long time back.

The operating cost difference between BEVs and ICE vehicles must decrease in order to counteract the purchase price difference and to come closer to the EV adoption tipping point.

Figure 3

Average annual post-purchase ownership cost by country (in €) – Compact and Mid-size premium segments, 2022[(a)]



Note (a): The above-mentioned ownership costs doesn't include the upfront purchasing cost, it includes other cost elements such as depreciation, interest, insurance, taxes, maintenance and energy/fuel.

The ownership costs are averaged over the first four years of possession considering a yearly mileage of 30,000 km.

Source: "Car Cost Index 2022", LeasePlan, as accessed on 29th March 2023

Over the last year, both fuel and electricity prices have risen sharply. As the electricity costs are a smaller part of an EV's ownership cost, the effect of the energy price inflation on operating an EV would be less than that for an internal combustion engine (ICE) vehicle.

For instance, energy costs account for 22 percent of the Volkswagen Golf's ownership cost whereas energy accounts for only 11 percent of Volkswagen ID.3's ownership cost (see Figure 4). Hence, if fuel and electricity prices both increase by 50 percent, the ownership cost for Volkswagen ID.3 would increase by 6 percent, whereas it would increase by 11 percent for the Volkswagen Golf.

Hence, electricity and fuel costs, which are key factors in the ownership cost comparison between EVs and ICE vehicles, impact EVs less than ICE vehicles.[13]

However, with rising electricity prices in Europe (see Figure 5) due to the Russia-Ukraine conflict, the running or driving cost of EVs has risen considerably, and in a few cases, made driving EVs more expensive than conventional petrol- or diesel-powered vehicles.[14]

Figure 4

Ownership cost breakdown between VW ID.3 (EV) and VW Golf (ICE vehicle), 2021[(a)]

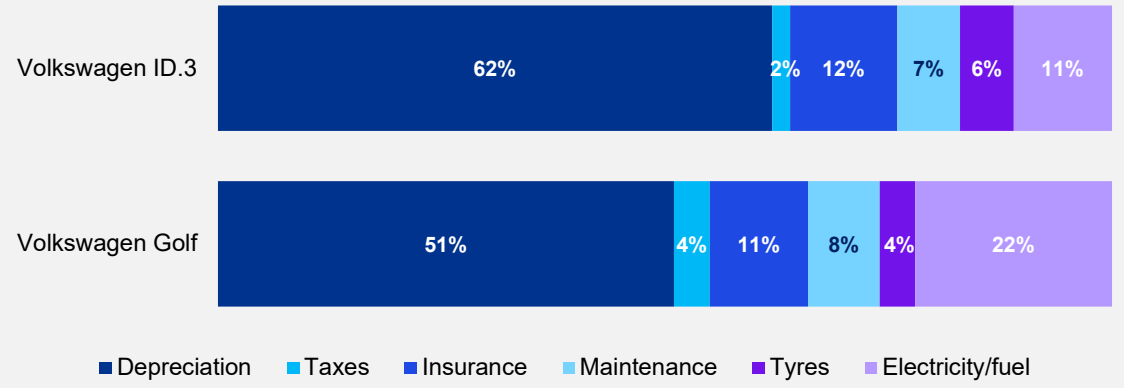
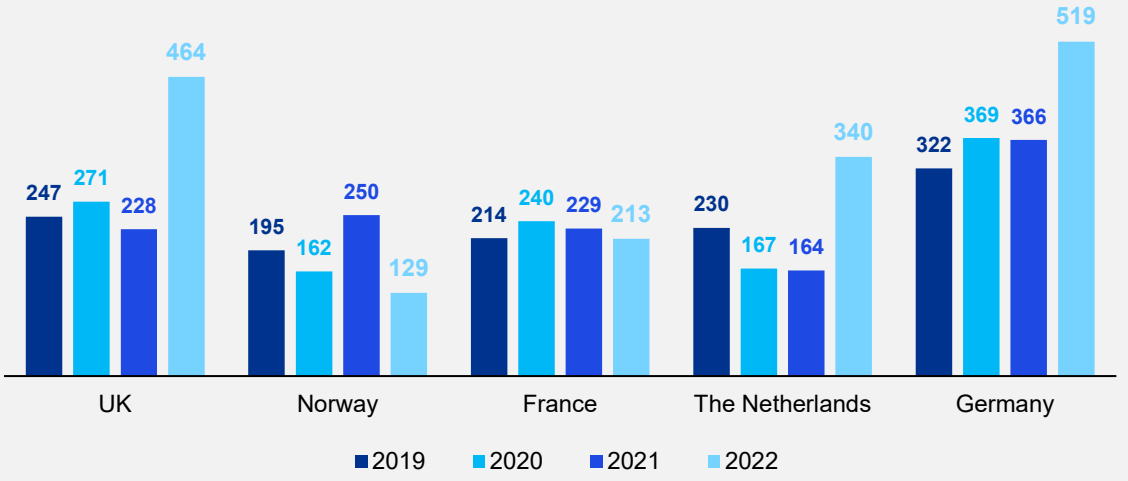


Figure 5

Household electricity prices in major European countries, 2019 – 2022 (US$/Wh)[(b)]



13. "Total cost of ownership: How electric vehicles and ICE vehicles compare", LeasePlan, as accessed on 29th March 2023
14. "Rising Power Prices in Europe Are Making EV Ownership More Expensive", WSJ, December 2022

Note (a): The ownership costs doesn't include the upfront purchasing cost, it includes other cost elements such as depreciation, interest, insurance, taxes, maintenance, and energy/fuel.

The analysis considers a duration of 48 months and annual mileage of 30,000 km.

Source: "Total cost of ownership: How electric vehicles and ICE vehicles compare", LeasePlan, as accessed on 29th March 2023

Source (b): "Household electricity prices in Europe", Countryeconomy.com, as accessed on 10th March 2023

"Electricity prices for households", GlobalPetrolPrices.com, as accessed on 10th March 2023

"Average Cost of Electricity per kWh in the UK 2022 to Increase", Casita, 26th August 2022, as accessed on 10th March 2023

For instance, at an Allego fast charging station in Europe, it costs €26.3 to drive 100 miles with sufficient charge for a Mini Cooper Hardtop. However, it costs just €20.3 for a petrol-powered Mini Cooper – a difference of €6.0. In the mid-size SUV category, the charging/fuelling cost difference to drive the same distance, between a petrol-powered Nissan Rogue (€22.9) and the Hyundai Kona Electric (€20.0) is of ~ €3.0. Thus, rising electricity prices have disproportionately impacted the small-car segment rather than the mid-size SUV segment.

As a result, consumers who were willing to pay a heavy upfront price for an EV earlier (and given national incentives for EVs are declining as mandated by governments) will now likely reconsider the option of buying an EV as total ownership costs over the EV lifetime may rise, widening the affordability gap between EVs and ICE vehicles.

In 2019, for example, charging a mid-sized EV (with 450 miles driving range) costed around 72 to 78 percent less on home charging with a conventional outlet, and 9 to 13 percent less on a public DC fast charger – compared to a mid-sized petrol vehicle in Europe.[15]

Now this equation might have changed post the COVID-19 crisis and the Russia-Ukraine war, but the gap has considerably narrowed between fuel prices and the electricity prices. In fact, major Charge Point Operators (CPOs) in Europe such as Allego have already increased EV fast-charging prices at their stations.

15. "How Expensive Is It to Charge an EV in Europe? And Is It Really Cheaper Than Gas?", RealClearScience, September 2022

The way forward

The success of EV adoption and expansion of EV charging infrastructure in Europe differs between varied use cases. Over time, it is imperative to reach a situation in which EVs can compete with ICE vehicles on competitive market terms without resorting to incentives or governmental interventions.

In order to achieve this, the EV ecosystem should target ways to optimize operating costs in order to counteract the high purchase price of current EV models. Efforts should primarily be targeted on use cases with clear operating cost advantages vs. ICE vehicles. Examples include:

1. Stimulating the adoption of smart home energy and charging solutions in combination with self-generation of electricity with solar panels.*
2. Promoting EV drivers who are willing to shift their charging sessions to cheaper time-slots leveraging a dynamic electricity contract.
3. Directing EV drivers to cheaper publicly available charging stations. Usually, tariffs of public charging stations vary widely among different charging providers and often public charging stations work with long-term fixed tariffs, which makes it beneficial for the EV drivers to compare prices before charging.

At the same time, governments should focus on implementing pan-European standardization across the EV value chain in order to simplify the usage of EVs. This includes charging protocols, payment options and relevant services across the lifecycle of EVs as well as regulatory harmonization in order to simplify cross-border transportation.

* The return on investment in solar panels – and thus the effect on cost reduction for EV usage – may vary by country

National governments disincentivize uptake of ICE vehicles while rolling back EV subsidies

As of September 2022, national purchase subsidy packages were in place in 21 countries in the EU. However, several programs have been terminated or restricted owing to factors such as fulfilment of certain targets or budget cuts. For instance, in France, from 1st January 2023, the purchase subsidy decreased from €6,000 to €5,000 for BEVs. Moreover, plug-in hybrid vehicles will no longer be eligible for state subsidies. In the Netherlands, a gradual decrease in subsidies has been implemented until 2025. Furthermore, demand considerably outstrips the annual budget in this country. Hence, the incentives are often exhausted in a few months. The UK and Sweden have implemented the most significant reductions in monetary assistance. From 2023, both battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) will not be able to avail any incentives (already in place in Sweden since November 2022).[16,17]

At the European level, CO2 emission performance standards for cars, vans and heavy-duty vehicles (HDVs) are already in place with a view to progressively transition to EVs. The Energy Performance of Buildings Directive (EPBD) contains obligations for charging points in buildings and the Alternate Fuels Infrastructure Regulation (AFIR) ensures comprehensive support for deployment of charging infrastructure.[18]

Governments also need to foster a conducive environment that shores up confidence among potential investors and allows them to scale back fiscal support without jeopardising deployment of EVs and charging stations.

For instance, the UK government established the Charging Infrastructure Investment Fund (CIIF) to accelerate the rollout of public EV charging networks. The fund involves a £422 million investment with £200 million provided by the government and the rest from private sector partners. The fund can enable greater capital investment in the electric mobility space and lead to increased adoption of EVs.[19]

Taxation is one of the important tools, employed intensively by countries such as Norway, the Netherlands and France to discourage purchase of ICE cars and improve EV uptake. For instance, France has increased the deployment of zero-emission vehicles partly with the help of high-emission taxes that can cost up to €40,000 or nearly 50 percent of the vehicle's purchase price. The tax is triggered by polluting cars with emissions more than 128 grams of CO2 per km and this threshold has repeatedly been lowered over the last few years. For example, a purchase of the baseline Ford F-150 model in France would result in high carbon emission fees up to €35,000. ICE cars are also subjected to a weight tax for vehicles that exceed the threshold of 1,800 kg.[20] Similarly, in the Netherlands, all ICE cars are subject to a registration tax that rises progressively with the different thresholds of CO2 emissions. As of January 2022, new passenger cars with CO2 emissions of 1g/km are charged a minimum fixed amount of €376.[21]

Hence, fiscal and policy regulations are a major lever for promoting EV uptake and offering confidence to customers, automakers, suppliers and investors. The question remains how to make EVs more attractive than ICE vehicles while decreasing public intervention over time.

16. "Sweden drops EV subsidies with immediate effect", electrive, as accessed on 29th March 2023
17. "What's changing in 2023?", Volkswagen AG, as accessed on 29th March 2023
18. "Six essentials for mainstream EV adoption", Eurelectric, as accessed on 29th March 2023
19. "Taking charge: the electric vehicle infrastructure strategy", GOV.UK, as accessed on 29th March 2023
20. "With Carbon Emissions Higher Than Ever, Can We Tax Polluting Cars to Reduce Vehicle Pollution, Urban Institute", as accessed on 29th March 2023
21. "2022 Tax Guide", European Automobile Manufacturers' Association (ACEA), as accessed on 29th March 2023

EV leasing solutions are making a foray into the European market

Given that depreciation costs for BEV are relatively high (given the higher purchase prices), and energy costs are lower than that of ICE vehicles (the current high electricity prices being an exception), this makes the case for BEVs to be leased rather than purchased outright. The London-based car subscription firm Onto, for example, offers monthly subscription service to EV consumers with comprehensive insurance, maintenance, charging, and servicing benefits – all rolled into a package to boost simplification of EV usage.[22]

A few OEMs are experimenting with the concept of battery leasing as well.[23] This will lower the initial purchase price as well as allow consumers to replace batteries whenever needed, without having to worry about its long-term performance and durability.

Supply chains need to be optimized to reduce costs of EV materials and components

OEMs will now have to look at different alternatives to reduce the upfront cost of their EV models, so that the ownership cost gap between a conventional vehicle vs. an EV doesn't get increased further. While some OEMs have reduced the prices on their EV models so that demand picks up[24], this is only a short-term measure which cannot be sustained for long without affecting the carmakers' profitability. Ramping up EV and EV battery capacity and production, where economies-of-scale comes into play, remains another option.

Managing the supply chain for battery raw materials remains a thorn among battery manufacturers and EV makers. With high dependency on China for majority of this supply, European OEMs are looking at establishing strategic partnerships with South American countries like Chile which are resource rich in critical battery raw materials. "The Critical Raw Materials Act" and the "European Battery Alliance" are a step in the right direction which will push and incentivize European players to secure and own their supply chain backyard thus reducing any disruptive negative influence which might emanate from a geopolitical situation or a global pandemic.

A plethora of EV charging solutions are making themselves available

For Charge Point Operators (CPOs), implementing dynamic pricing across their public charging networks can help.[25] CPOs such as Ubitricity, GeniePoint, Tesla and Char.gy have utilized dynamic pricing across their charging networks. This will enable consumers to take advantage of lower charge rates during off-peak hours while benefiting the CPOs during peak demand.

National governments in Europe are also in the early stages of implementing "Smart Charging" regulations which will enable electricity grid stability, optimize charging, and reduce costs for consumers.[26]

Chinese EV maker Nio is also planning to establish 100 battery swap stations in Europe by 2023. This will enable EV drivers to replace their used-up battery with a fully charged one, in under 5 minutes. In fact, Nio has already opened its 1st European "power swap station" in Denmark this year.[27]

Countries like Sweden are implementing an Electric Road System (ERS) which will enable vehicles to be charged while on the road.[28] This will allow for travelling longer distances (especially for cars with smaller batteries) and avoiding long wait times at EV charging stations. However, the ERS technology is still at an early stage and is likely to play a limited role until 2030.

The deployment of "Rapid or Fast Chargers" on critical routes across Europe (especially trans-national highways) will also likely alleviate the "range anxiety" among consumers leading to greater adoption of EVs. In fact, the number of fast chargers expanded by 55% in Europe in 2022 (vs. 2021), which is good news.[29]

The various developments in the EV market will likely induce a change in the way existing or potential consumers intend to use different EV charging options. More and more European consumers, especially in countries like Germany where electricity prices are higher, will increasingly opt for the less expensive private, slow-charging option at their homes rather than the expensive public, fast charging options on highways or commercial buildings – if other charging solutions are not popularized or made cost-effective soon enough.[30]

The jury is still out on how different players in the European EV ecosystem come together and make a success of the elaborate plan to attain the EV charging infrastructure targets in the EU as envisaged by 2030. However, EV manufacturing costs also need to be brought down through cost optimization of production and supply chains, thereby reducing the possibility of under-utilized EV charging infrastructure.

22. "Flexible Leasing Options Drive Transition to Sustainable Mobility in Europe", PYMNTS, February 2023
23. "Electric vehicles in Europe: gearing up for a new phase?", Amsterdam Roundtable Foundation, April 2014, as accessed on 10th March 2023
24. "Tesla cuts prices of its EVs in US, Europe by 20% to boost demand: Report", 15th January 2023, as accessed on 10th March 2023
25. "Chargepoint operators adding dynamic pricing amid volatile energy prices, says Cornwall Insight", Solar Media Limited, 9th January 2023, as accessed on 10th March 2023
26. "EV Smart Charging Regulations Protect the Grid and Optimize the Charging Experience", Driivz, December 2022
27. "Tired of waiting to charge your EV? First 'battery swap stations' open in Europe", euronews.next, May 2023
28. "Sweden is building the world's first permanent electrified road for EVs to charge while driving", euronews.next, May 2023
29. "Global EV Outlook 2023: Trends in charging infrastructure", IEA, April 2023.
30. In Europe, 80% of EV charging takes place at home, on an average, already.

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