



Government pays a lot to bring e-mobility forward

- **Demand for electric vehicles has recently surged.** In H1 2021, more than 22% of all newly registered cars in Germany were battery-electric or plug-in hybrid electric vehicles (BEVs or PHEVs, respectively). This share is considerably above the EU average.
- **Two key drivers are behind this gain in market share.** First, the EU has set tight caps on vehicle carbon emissions, and electric cars are classified as zero-emission vehicles by the regulatory authorities. This combination boosts supply. Second, the government offers generous subsidies to buyers of electric cars. So far, electric cars have not gained significant market shares without subsidies in any major car market.
- **In addition to direct purchase grants, owners of electric cars enjoy several fiscal benefits,** for example in the form of lower taxes (energy or mineral oil taxes vs electricity taxes, vehicle taxes, CO₂ levy on petrol and diesel, VAT). The tax effect is even larger for company cars.
- **The total fiscal effect of replacing a combustion-engine upper mid-range car by an equivalent BEV amounts to more than EUR 20,000 during the car's lifetime** (the sum of direct subsidies and tax revenue losses). For every one million electric cars sold in Germany in the next few years, the total fiscal effect amounts to at least EUR 15 bn over the twelve years after the sale.
- **The transition to e-mobility helps to protect the climate. While e-vehicles' contribution to climate protection will rise over time due to technological progress and scale effects in production, it is small and expensive for now.** Carbon abatement costs may amount to more than EUR 1,000 per ton, whereas carbon emission certificates in the EU ETS currently only cost just above EUR 50 per ton. The current regulatory regime is neither efficient from an economic vantage point nor effective in environmental protection terms.
- **A closer look at the fiscal effects also reveals major social imbalances. Right now, higher-income households benefit most from the subsidies, whereas lower-income car owners pay for a relatively large share of the subsidies (at least in proportion to their incomes).** If subsidies are gradually reduced in the future, demand for electric cars in general may dip and low-income households will be punished for not being able to afford a subsidised electric vehicle in time.
- **Many emerging markets are unlikely to set in motion a broad-based transition to e-mobility in the coming years because they cannot produce the necessary amounts of electricity or because they use (traditional) biofuels instead.** Alternative low-carbon fuels will be needed to reduce the carbon emissions of the transportation sector in these countries, too.

Eric Heymann

Senior Economist
+49-69-910-31730



Market share of electric cars increases considerably

Demand for electric vehicles has surged during the last few months. In 2020, battery-electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) together already accounted for 13.5% of all new car registrations in Germany, compared to 10.5% in the EU as a whole. The uptrend continued during the first half of 2021. Between January and June 2021, more than 22% of all newly registered cars in Germany were electric vehicles, with the share of BEVs being slightly smaller (10.7%) than that of PHEVs (11.8%).

Two drivers: Strict CO₂ emission limits for new cars ...

The increase in market share is largely due to two reasons. First, supply has recently expanded, seeing that selling electric vehicles makes it easier for carmakers to reach their fleet-wide emission targets. In 2021, carbon emissions by all newly registered cars in the EU must not exceed 95 grams per kilometre on average (down from 122 grams in 2019). The European Commission (EC) plans to reduce this cap by 55% by 2030. In addition, cars and light trucks must not emit any greenhouse gases from 2035. The current regulation foresees fines for carmakers if they miss their specific fleet-wide targets. As a result, carmakers offer more e-cars, which are classified as zero-emission vehicles under the current regulation (BEVs). Each electric vehicle sold reduces a carmaker's average fleet-wide carbon emissions. This makes it possible for car producers to sell cars with higher carbon emissions without excessively endangering the fleet-wide target.

... and state subsidies

Second, generous state subsidies have triggered potential buyers' interest. In Germany, electric car purchases are directly subsidised with up to EUR 9,000. The Federal Office for Economic Affairs and Export Control (BAFA) currently subsidises almost 600 different BEV models and more than 500 PHEV models. In addition, electric cars will be exempt from vehicle taxes for ten years; for now, this rule is set to run out by 2030. If company cars run on electricity, the taxable employee benefit amounts to only 0.25% (instead of 1%) of the gross official price, as long as the gross official price is below EUR 60,000. The company car tax on more expensive BEV models or on PHEVs is still halved. Moreover, employees who pay for the car's electricity consumption themselves can receive a monthly lump-sum payment of up to EUR 70 from their employers.

Additional money for the charging infrastructure

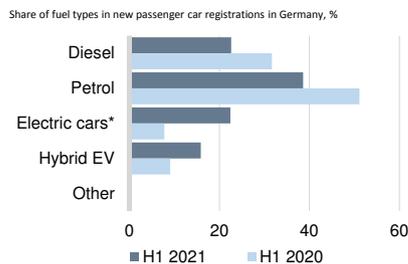
With the aim of helping to build a better charging infrastructure, the government, via KfW, grants subsidies of EUR 900 for the purchase and installation of charging points on private ground. In addition, the government has set apart more than EUR 5 bn for the expansion of the public charging infrastructure. Additional funds for new charging stations are available from the federal states, districts, cities and private electricity providers.

All in all, electric mobility is to be promoted with the help of a "carrot and stick" policy, i.e. by subsidies and strict CO₂ limits per car. The promotional measures artificially increase demand for electric vehicles. In addition, the carbon caps are an incentive for producers to increase supply.

Promoting e-mobility is very expensive for the government

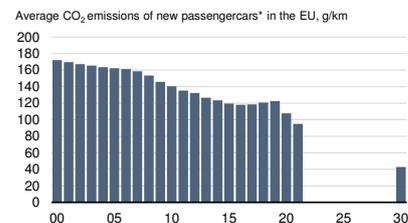
A look at the range of fiscal support measures shows that the government is spending much money on increasing the market share of e-cars in Germany. The

Figure 1: Share of electric cars* continues to increase in 2021



*BEV and PHEV
Source: KBA - Federal Motor Transport Authority

Figure 2: EU sets ambitious targets for CO₂ emissions per car



*Hist. development and targets for 2021 and 2030 (according to the new proposal of the EU Commission of July 2021)
Source: EEA, EU Commission, Deutsche Bank Research



total fiscal impact per car is the sum of direct price subsidies and tax revenue losses during the car's lifetime. While the subsidies for the expansion of the charging infrastructure do not have a direct effect on e-vehicle sales, they help to make e-cars appear more attractive for potential buyers.

Direct government subsidy of up to EUR 6,000 for the purchase of a BEV

Via BAFA, the government grants subsidies of EUR 6,000 for purchases of BEVs with a net official price of up to EUR 40,000. Initially, this so-called "eco bonus" amounted "only" to EUR 3,000. However, the government additionally introduced an "innovation bonus" due to the COVID-19 pandemic and thus doubled the eco bonus. According to a press release of the Federal Ministry for Economic Affairs and Energy published at the beginning of July, the innovation bonus will remain in place until 2025 instead of running out in 2021, as foreseen. In addition to the state eco bonus, car buyers can benefit from a subsidy of EUR 3,000 borne by the carmakers. This amount is deducted directly from the purchase price, which means that VAT revenues decline as well. Our calculations below will not include VAT, as we will compare vehicles with similar purchase prices. All in all, buyers of a BEV can touch EUR 9,000 in direct subsidies alone.

For BEVs with a net official price between EUR 40,000 and EUR 65,000, the subsidies add up to EUR 7,500 (EUR 5,000 from BAFA and EUR 2,500 from carmakers). PHEV buyers may benefit from subsidies of EUR 6,750 or EUR 5,625, depending on the car's official price.

By granting direct subsidies for e-cars, policymakers hope to make up for the price difference between electric and combustion-engine cars. In many cases, this difference is still large, particularly in the volume car segment. In contrast, electric cars in the luxury segment often cost roughly the same as their peers with a combustion engine. In May 2021, a special edition of the KfW Energy Transition Barometer found that the price difference was one of the main reasons (quoted by 61% of the survey participants) why people decided against buying an electric vehicle. Potential buyers also say that long charging times, the often insufficient charging infrastructure in both the public and private spaces and the vehicles' smaller range keep them from buying an e-car.

Considerable tax effects during the vehicles' lifetime

A set of sample calculations for electric and combustion-engine vehicles will help us gauge the fiscal effect during the whole lifetime of e-cars. Our calculations are based on several assumptions.

First, we assume that the electricity or fuel consumption of the cars used for our comparisons is indeed equal to what is officially announced by the carmakers – even though actual consumption is often (considerably) higher. Carmakers' consumption and emission statements are based on the WLTP standard. Second, we simplify the calculations by assuming a general lifetime of twelve years and an annual mileage of 15,000 kilometres, even though the average mileage is currently lower for BEVs or petrol-fuelled cars and higher for diesel cars.

At the beginning of 2021, the federal government's climate action package introduced an additional carbon levy on fossil fuels consumed for heating and transport purposes, including petrol and diesel. The levy currently amounts to EUR 25 per ton of CO₂. It is to rise to EUR 55/ton by 2025; after that year, a transition to an emissions trading system is planned. We assume that the levy continues to rise gradually to EUR 80/ton by 2030 and stagnates during the early 2030s. The resultant



mark-up at the filling station would rise from currently c. 7 cents to just above 22 cents per litre of petrol and from just below 8 cents to more than 25 cents per litre of diesel by the beginning of the next decade. Based on the assumed vehicle lifetime of twelve years, average prices for petrol will rise by 16.3 cents per litre and prices for diesel by 18.4 cents per litre (this calculation takes into account biofuel additions to petrol and diesel, which are not subject to the carbon levy).

In addition, we assume that the energy tax rate (the former mineral oil tax rate) remains unchanged at about 65.5 cents per litre of petrol and just above 47 cents per litre of diesel during the cars' lifetime. Since the carbon levy on petrol and diesel will rise over time, we do not assume additional tax hikes, despite regular calls for increasing the tax rate on diesel to equal that on petrol. Moreover, we assume an electricity tax of just above 2 cents per kWh. Right now, petrol costs about 156 cents per litre and diesel about 137 cents per litre (German Petroleum Industry Association, June 2021). Households currently pay about 35 cents per kWh of electricity (basic tariffs). Taxes obviously make up a larger share of petrol and diesel prices than of electricity prices. According to the German Petroleum Industry Association, energy or mineral oil tax accounts for 42% of the petrol and 34% of the diesel price, respectively (as of June 2021). In contrast, electricity taxes account for only about 6% of the electricity price for households; still, electricity is subject to several other fees and levies (renewable energy surcharge, other levies, VAT). VAT excised on fuels and electricity ultimately depends on the price for these energy sources. VAT revenues will therefore fluctuate in line with changes to petrol, diesel and electricity prices over the coming twelve years. However, we assume constant fuel and electricity prices for our calculations.

Fiscal effect: More than EUR 15,000 for a compact car ...

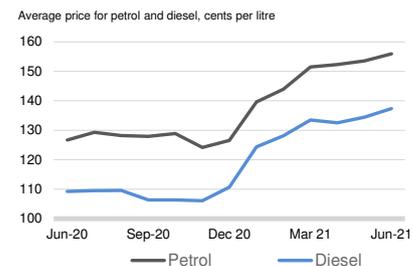
In order to calculate the total fiscal effect stemming from the purchase and use of an electric vehicle we will first compare a petrol-fuelled and an electric car from the compact class. The VW Golf Life and the VW ID.3 Pure offer a similar performance and cost about the same before subsidies (c. EUR 30,000). Direct BAFA subsidies for cars in this price category amount to EUR 6,000. As mentioned above, we assume the same lifetime and the same mileage per year for both cars and rely on the producers' statements on fuel consumption. The ID.3 is to consume 15 kWh/100 km, the Golf 5.5 l/100 km (WLTP).

The biggest difference in terms of tax revenues stems from the difference between energy (mineral oil) and electricity taxes. During a lifetime of twelve years, energy taxes on the fuel needed for the Golf will add up to EUR 6,500. The equivalent electricity tax total for the consumption of the ID.3 is only EUR 550. Moreover, the government misses out on income from the carbon levy on each litre of petrol. Over the twelve years of the car's lifetime and based on our fuel consumption assumptions, the aggregate revenue loss amounts to about EUR 1,600. As petrol is more expensive than electricity, VAT revenues will be lower, too. And finally, the BEV is partially exempt from vehicle taxes. Lower VAT revenues and vehicle tax exemptions will each lead to tax revenue losses of c. EUR 1,000. As a result, the government will lose out on c. EUR 9,500 in tax revenues from energy and electricity taxes, carbon levies, VAT on fuel and vehicle taxes during the cars' lifetime. Including the eco bonus, the total fiscal effect amounts to EUR 15,500 for the car's lifetime or EUR 1,300 per year during this period.

... and more than EUR 20,000 for an upper mid-range car

We have also compared an upper mid-range diesel car with its BEV equivalent. Buyers of an Audi E-Tron 50 quattro (net regular price: c. EUR 59,000) can touch

Figure 3: Prices for petrol and diesel have increased significantly in the past year



Source: MWV



direct state subsidies of EUR 5,000 plus the producer's rebate. The Audi SQ5 offers a similar performance and has a similar purchase price. Assuming that the SQ5 consumes 8.1 l/100 km and the E-Tron 21.9 kWh/100 km, total tax revenue losses come to EUR 22,000 for twelve years or more than EUR 1,800 per year including the eco bonus; we will explain the details below.

Revenue losses from the energy tax are smaller for a diesel-fuelled car than for a petrol-fuelled car because the tax rate on diesel is lower. At the same time, the carbon levy is higher for diesel than for petrol, resulting in significant differences between the relevant tax revenues. Nevertheless, diesel is cheaper than petrol at the filling station, which is why VAT losses are smaller. However, there is a significant vehicle tax revenue loss, as vehicle taxes are considerably higher for diesel than for petrol-fuelled cars. Since mid-range cars generally consume more fuel, revenue losses from energy and vehicle taxes and the carbon levy tend to be higher if buyers purchase an electric car instead of a diesel-fuelled vehicle.

Let us take a look at the concrete figures. The loss from vehicle tax revenues is the largest. Total vehicle taxes come to EUR 7,400 for the SQ5 over twelve years, but only about 15% of that amount for the E-Tron. Since the BEV will be tax-exempt until 2030, vehicle taxes will only be levied for two years and amount to a total of EUR 184. Revenues from energy and electricity taxes differ considerably, too. While they amount to c. EUR 6,850 for the SQ5, they come to only EUR 800 for the E-Tron. In addition, the government will lose out on almost EUR 2,700 from carbon levies and on c. EUR 1,000 from VAT revenues on fuel.

Moreover, we assume the same annual mileage for the diesel-fuelled SQ5 as for the E-Tron. This is quite improbable, seeing that the latter's range amounts only to about 325 km.¹ If we realistically assume that diesel-vehicle owners drive more kilometres per year, the fiscal impact will be even larger.

Tax effect is bigger for company cars

If a BEV is used as a company car, the fiscal effect increases by another EUR 1,000 per year for the compact car and EUR 1,800 per year for the mid-range car during the first three years of the car's life. This is due to the fact that the taxable employee benefit for a Golf class BEV amounts to only 0.25% of the gross official price, instead of 1%. The taxable employee benefit for a BEV from the E-Tron price segment comes to 0.5% of the gross official price. Tax revenues from a regular Golf-sized company car amount to EUR 1,400 per year, based on a taxable employee benefit of c. EUR 3,400. The comparable amount for the ID.3 is only EUR 400 per year, even though the car itself is more expensive than its combustion-engine counterpart. Tax revenues from the taxable employee benefit for the SQ5 are EUR 3,600; however, only half of that amount is due for the E-Tron. We assume that a company car is used for three years before it enters the used car market. That is why we calculate the tax effect only for the first three years of the car's life. In addition, we assume that the employee in question touches a gross annual income of EUR 80,000, which means that he or she pays the top income tax rate of 42% on the taxable employee benefit.

All in all, the total fiscal effect of buying a BEV instead of a combustion-engine car may amount to EUR 2,300 for a compact car or EUR 3,700 for an upper mid-range car per year during the first three years of the car's life, provided that the car is used

¹ The range of 324 km is based on a battery capacity of 71 kWh and a consumption of 21.9 kWh/100 km and differs not much from the producer's statements concerning the range (338 km).



as a company car. This means that, over the first three years, the company car effect amounts to c. 44% or 50%, respectively, of the total fiscal impact.

To sum up: For every one million electric cars sold in Germany in the next few years, the total fiscal effect amounts to at least EUR 15 bn over the twelve years after the sale.

Ecological effectiveness and economic efficiency

State support for e-mobility pursues an overarching goal, namely climate protection. However, all investments in better climate protection should be both efficient from an economic vantage point and effective in terms of environmental protection. We will now analyse whether the support for e-mobility meets these criteria.

Beyond fiscal effects, we will take a look the carbon emissions of BEVs compared to petrol or diesel-fuelled cars during their lifetimes. In order to calculate the average carbon emissions of BEVs we assume that the carbon intensity of the German electricity mix declines considerably, from 427 g/kWh in 2019 to 130g/kWh by the beginning of the 2030s. This gives a carbon intensity of 280 g/kWh on average during the observation period. We assume that electric cars are charged with the average electricity mix in Germany and calculate their carbon emissions accordingly. This translates into emissions of 61g/km for an upper mid-range car (Audi E-Tron) or 42 g/km for a compact car (VW ID.3). However, these figures refer only to the daily use of the car and do not include its production or the production of the battery.

E-cars come with a larger “carbon backpack”

A useful comparison of a combustion engine and an electrical engine should, of course, include the carbon emissions caused by its production. As a rule, the production of e-vehicles leaves a larger environmental footprint, mainly due to the commodity and energy-intensive battery production. Thus, they carry a large “carbon backpack”. During their lifetime, however, their carbon emissions tend to be lower across more and more countries. Technical progress is likely to further reduce specific energy consumption and carbon emissions during the battery (and, in turn, car) production process.

Our comparison of the cars’ carbon emissions is based on the carbon intensity of the German electricity mix. Since charging electric cars increases overall demand for electricity, one might argue that electric vehicles are charged with the marginal electricity mix, i.e. the last additional kWh of power. Right now, the marginal kWh is usually provided by traditional power plants, as renewables get priority access to the electricity net and have lower marginal costs. In line with the merit order curve, they are fed into the net first. If we assume that all electricity consumed by electric cars comes from traditional power plants, the carbon emissions of electric cars will deteriorate accordingly. Still, using the average values for the power mix is the standard procedure for comparing the climate impact of electric and combustion-engine cars. As the share of renewables in the overall power mix grows, the marginal kWh will increasingly be provided by renewables anyway. The most climate-friendly solution would be to use excess renewable power (which is not needed for other purposes) for charging e-vehicles. Within EMU, however, it is irrelevant in terms of carbon emissions which type of electricity is used for charging electric cars, as the emissions of the electricity sector are part of the EU Emissions



Trading Scheme (EU ETS) and therefore subject to a binding cap. E-mobility will therefore shift emissions from the traffic sector (for which there is no cap) to the electricity sector (which does).

High abatement costs for each ton of carbon dioxide

Based on our assumptions, driving a BEV instead of a traditional car saves 15 tons of carbon in case of a compact car or 27 tons in case of a mid-range car during the twelve years of the car's lifetime. This is equivalent to savings of 67% and 72%, respectively. If we compare these savings with the fiscal impact, the avoidance cost for the government comes to EUR 1,000 and EUR 800 per ton, respectively, for a privately owned car. For company cars, the avoidance costs per ton of carbon are even higher. And including the additional emissions created during the car production process lifts them even more. This calculation does not include the expenses for the transformation of the car industry and the costs of the transition to renewables in the electricity sector.

In any case, marginal avoidance costs under the EU ETS are considerably lower, at EUR 50-55 per ton (as of early August 2021). Theoretically, the money spent on avoiding a ton of carbon by supporting the shift to electric mobility could be used to avoid 16-20 tons of carbon in any other sector in the framework of the EU ETS. Efficient climate protection means that emissions be avoided at the lowest possible cost. However, avoidance costs in the transport sector are often quite high. Including the transport sector in the EU ETS would help to reduce total carbon abatement costs.

Static and dynamic efficiency

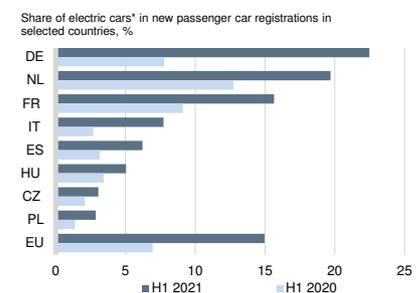
Carbon avoidance costs in the area of e-mobility are currently high. However, this is obviously a static observation. If we look at the potential development of efficiency and not at the current status, the conclusion may be somewhat less pessimistic at least. Carbon abatement costs for e-mobility are likely to decline (further) in the future thanks to technological progress and scale effects. Government subsidies may accelerate this trend, as they enable quicker ramp-ups and provide incentives to carmakers to invest in the technology.

Path of future technological developments is laid out in advance

In any case, we need technologies to reduce the dependence of the transport sector on fossil fuels. However, by granting technology-specific subsidies and classifying e-cars as zero-emission vehicles the government narrows the options. For example, increasing the use of synthetic low-carbon fuels might also help to reduce the emissions of the large existing fleet of cars around the world. While the availability of such fuels is currently limited, this does not need to remain the case, provided that the necessary investments are made. Technological progress and economies of scale are also possible in the field of synthetic fuels. Moreover, combustion-engine cars using low-carbon synthetic fuels may be a better solution for some users in the long run than BEVs, at least from the drivers' vantage point. This applies, for example, to frequent travellers or vehicles that regularly carry or pull significant loads.

In addition, numerous less prosperous countries, countries where electricity is scarce or countries with a large share of (conventional) biofuels, such as India, the ASEAN countries, Brazil or large parts of Africa, are unlikely to shift to electric mobility on a large scale in the near future. Even within the EU, the share of electric cars is relatively small in many eastern European countries or in Spain or Italy. For

Figure 4: E-mobility less relevant in southern and eastern Europe



*BEV and PHEV
Source: ACEA



reasons of technological neutrality, it would be desirable to research and support other options to avoid carbon emissions in the transport sector. While it seems likely that more and more customers in central Europe will prefer e-mobility and carmakers believe this to be the best option for this market, too, this does not mean that other solutions might not make more sense in other countries or for certain user groups.

14 million electric vehicles on German roads by 2030?

During the past decade, the federal government set itself the target of having one million e-vehicles on the road by 2020. With the help of generous subsidies during the corona pandemic, the target was reached about half a year later. The new goal is to have about 7-10 million electric vehicles on the road by 2030. Two studies commissioned by the Ministry for Economic Affairs and Energy and the Ministry for the Environment in spring 2020 deal with the question of how to reach this goal. Based on the framework conditions in place at the time of writing, the Ministry for Economic Affairs expected 7.1 million e-vehicles by 2030, whereas the Ministry for the Environment forecast only 5.6 million. A report by the Working Group 1 "Transport and Climate Change" of the National Platform Future of Mobility (NPM) says that, by 2030, about 14 million e-vehicles should be on the road if the government's ambitious (and recently raised) climate protection goals are to be met. In addition, e-vehicles would need to account for more than three-quarters of all new car registrations by then. The federal government has recently taken up the goal of 14 m electric cars on the road in Germany by 2030.

Demand mostly from large income earners

In order to reach the targets, the government recently announced that it plans to extend the higher subsidies provided during the corona crisis until 2025. The car producers themselves also invest a lot of money in order to bring more e-cars to the market, in the hope that these investments will pay off in the long run on the back of technological progress and scale effects in production. In the end, it is necessary to generate mass demand for e-cars and to make this mass demand permanent even if subsidies are reduced.

So far, buyers and drivers of e-cars mostly belong to the higher income strata. According to the KfW study, the share of households with above-average incomes among those who already own an e-car or plan to buy one was three times that of households with below-average incomes. The number of households who live in a single or double-family home is disproportionately high, too. In this, the availability of a parking lot and, in turn, a charging opportunity probably plays a role. Even though there are subsidies for installing a charging point, lower-income households in particular often do not have their own parking lot and do not have the money to have a charging point installed.

Social imbalance in promoting e-mobility

Overall, the promotion of e-mobility reveals certain social imbalances. As a rule, higher-income households currently avail themselves to a larger extent of government subsidies than lower-income households. E-cars are often second and/or company cars. At the same time, all taxpayers, depending on their individual ability to contribute, fund the subsidies and the expansion of the charging infrastructure. Moreover, combustion-engine car owners pay for the e-vehicle charging infrastructure every time they fill up due to the so-called greenhouse gas quota. This quota obliges fuel-selling companies to reduce the greenhouse gas emissions of their fuels. Providers of fossil fuels can buy certificates from charging point owners and offset them against their own quota. The related costs are passed



on via fuel prices. Low-income earners who have a car will pay a disproportionate share of these costs compared to their incomes, seeing that fuel costs make larger inroads into their overall disposable income than in the case of high-income earners. In addition, low-income earners are often not offered a company car either. And finally, there is often no viable transport alternative for commuting from rural areas in particular. In that case, it does not make sense to argue that people should simply not buy a car for cost reasons.

The total costs of ownership of BEVs and combustion-engine cars are converging. Thanks to the price subsidies, e-cars may already be a cheaper alternative in some segments, despite high electricity prices in Germany. However, this scenario is still further away in the volume car segment. Moreover, low-income households often buy used cars where availability of e-cars is so far limited. In addition, the eco bonus is not granted twice for the same car.

When will subsidies become superfluous?

A key question for the government and even more for the car industry is when demand for e-cars, particularly in the mass market, is no longer dependent on subsidies but driven only by the market. Technological progress suggests that this will be the case in many car segments (and for many user profiles) during this decade, as long as electricity prices do not rise significantly. Technological progress should result in lower purchase prices, larger ranges and shorter charging times. Moreover, driving a combustion-engine car is likely to become more expensive overall.

Apart from technological progress, the expansion of the charging infrastructure will play a role, even if, as ranges increase, charging at home and/or at work should be mostly sufficient for everyday use. Establishing a charging infrastructure in densely populated urban areas is a challenge not least for reasons of space. Cheap and easy to use charging concepts, similar to parking meters, might be a solution. Another task for the next few years is to establish a dense high-performance network of charging points along motorways and roads, as charging at home or at work is not feasible for long-distance travel (such as holiday trips or frequent commercial drivers).

For many high-income households, these questions are less relevant for now, as they often own several cars. If one of them has an (additional) combustion engine, charging infrastructure and range are of secondary importance. However, these issues gain relevance if a BEV is a household's only car. Again, this applies more often to low-income households. Even if e-cars begin to make economic sense across their lifetime without price subsidies, some households may decide for valid reasons that an e-vehicle is not a sensible option for them.

From a regulatory policy vantage point, it would be best if subsidies for electric vehicles were reduced as quickly as possible. 2025, the year up to which the current regime has been extended, might be a suitable end date, as the price gap between electric and combustion-engine cars should continue to narrow. This creates additional social policy issues. It is quite possible that lower-income households cannot afford to buy an electric vehicle until after the government subsidies are phased out. It might therefore make sense to introduce a degressive support scheme, under which the limit on the net official price of subsidised vehicles is reduced over time and the subsidy period is prolonged.



Conclusion

The transition to e-mobility helps to protect the climate. However, the impact is small right now. At the same time, the aggregate fiscal impact is very large, which is why subsidising e-mobility results in high carbon avoidance costs. During a car's complete lifetime, the fiscal effect may easily add up to more than EUR 20,000. For comparison: In 2019, the German government spent EUR 8,200 per pupil. This is indeed the payment in one single year and not total payment during a pupil's school time. The comparison is still impressive.

The current regulatory regime is obviously neither efficient from an economic vantage point nor effective in environmental protection terms. It would make sense to include transport-related emissions in the EU ETS; however, this is unlikely to take place before the second half of the decade at the earliest. Moreover, as we have pointed out in a study at the beginning of the year, the transition from combustion engines to electric mobility will lead to net value added losses in Germany. For more details on this issue, we refer to our previous report.

A closer look at the fiscal effects also reveals major social imbalances. Right now, higher-income households benefit most from the subsidies, whereas lower-income car owners pay for a relatively large share of the subsidies (at least in proportion to their incomes). If subsidies are gradually reduced in the future, demand for electric cars in general may dip and low-income households will be punished for not being able to afford a subsidised electric vehicle in time. Still, subsidies for e-cars should become less necessary during the current decade, as they will gradually become more affordable.

Government subsidies will help to make technological progress in the area of e-mobility. Specific energy consumption and carbon emissions during battery and vehicle production look set to decline, even though the commodity requirements for the production of e-cars will leave a significant carbon footprint for now. At the same time, the share of renewables in the overall electricity mix is likely to rise further. Overall, the climate impact of e-mobility will improve in the coming years, and carbon avoidance costs per ton will decline. Nevertheless, e-mobility is not a silver bullet in the fight for climate protection.

Many emerging markets are unlikely to set in motion a broad-based transition to e-mobility in the coming years because they cannot produce the necessary amounts of electricity or use (traditional) biofuels instead. Alternative low-carbon fuels will be needed to reduce traffic emissions in these countries, too. Technological progress should not remain limited to e-mobility, but also include low-carbon synthetic fuels, particularly since it will be impossible to use electricity for some types of transport. Low-carbon synthetic fuels will therefore be needed anyway.

We thank Katharina Knuth for her valuable contribution.



Appendix 1

Important Disclosures

*Other information available upon request

*Prices are current as of the end of the previous trading session unless otherwise indicated and are sourced from local exchanges via Reuters, Bloomberg and other vendors. Other information is sourced from Deutsche Bank, subject companies, and other sources. For disclosures pertaining to recommendations or estimates made on securities other than the primary subject of this research, please see the most recently published company report or visit our global disclosure look-up page on our website at <https://research.db.com/Research/Disclosures/FICCDisclosures>. Aside from within this report, important risk and conflict disclosures can also be found at <https://research.db.com/Research/Topics/Equities?topicId=RB0002>. Investors are strongly encouraged to review this information before investing.

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David Folkerts-Landau

Group Chief Economist and Global Head of Research

Pam Finelli
Global Chief Operating
Officer Research

Steve Pollard
Global Head of Company
Research and Sales

Anthony Klarman
Global Head of
Debt Research

Michael Spencer
Head of APAC
Research

Andreas Neubauer
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Gerry Gallagher
Head of European
Company Research

Matthew Barnard
Head of Americas
Company Research

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Peter Milliken
Head of APAC
Company Research

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Global Head of
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Global Head of Rates Research

George Saravelos
Global Head of FX Research

Peter Hooper
Global Head of
Economic Research

International Production Locations

Deutsche Bank AG

Deutsche Bank Place
Level 16
Corner of Hunter & Phillip Streets
Sydney, NSW 2000
Australia
Tel: (61) 2 8258 1234

Deutsche Bank AG

Equity Research
Mainzer Landstrasse 11-17
60329 Frankfurt am Main
Germany
Tel: (49) 69 910 00

Deutsche Bank AG

Filiale Hongkong
International Commerce Centre,
1 Austin Road West, Kowloon,
Hong Kong
Tel: (852) 2203 8888

Deutsche Securities Inc.

2-11-1 Nagatacho
Sanno Park Tower
Chiyoda-ku, Tokyo 100-6171
Japan
Tel: (81) 3 5156 6000

Deutsche Bank AG

1 Great Winchester Street
London EC2N 2EQ
United Kingdom
Tel: (44) 20 7545 8000

Deutsche Bank Securities Inc.

60 Wall Street
New York, NY 10005
United States of America
Tel: (1) 212 250 2500
