38th International Electric Vehicle Symposium and Exhibition (EVS38) Göteborg, Sweden, June 15-18, 2025

What we need to ensure for achieving considerable GHG emission reductions from switching from ICE vehicles to BEV

Benjamin Reuter[1]
[1] *Stuttgart University of Applied Sciences, benjamin.reuter@hft-stuttgart.de*

Executive Summary

This paper addresses the greenhouse gas (GHG) emissions for switching from conventional ICE passenger vehicles to BEV in Germany and most importantly it focusses on the emission development over time. It considers the production of new vehicles as well as the use of vehicles in the evolving fleet. It shows the significant delay between a measure e.g., the ban of new ICE vehicle registrations, and the positive effect on the overall emissions. The assessment further deals with important boundary conditions, i.e. the GHG emissions from electricity supply, the emissions from BEV production and the necessary turnover in the vehicle fleet, and it determines their importance by quantifying their emission reduction effect. The paper closes with conclusions from the assessment results and provides recommendations especially towards policy-making, such as the need for a higher control on the emissions caused by battery and BEV production.

Keywords: electric vehicles, environmental impact, climate change, life cycle analysis, modelling & simulation

1 BEV as effective lever for lower GHG emissions from transport – but with a considerable delay

It is clear that battery electric vehicles (BEV) can play an important role in reducing the greenhouse gas (GHG) emissions from the transport sector. This is urgently needed, since the transport sector has not yet decreased its GHG emissions in a similar amount as the housing or the energy sector were able to do. For that reason, policy-makers in many countries support the purchase and use of BEV and the European Union has even decided to ban conventional Diesel and gasoline vehicles from new vehicle registrations in Europe by 2035 [1].

Despite the overall benefits of BEV resulting in lower GHG emissions over the entire vehicle lifecycle, one needs to state that BEV do cause higher GHG emissions during the vehicle production, which is mainly related to the vehicle battery. The end-of-life phase of the vehicles, both for BEV and for conventional vehicles, has a negligible contribution to the lifecycle emissions. Figure 1 illustrates the GHG emissions over the life cycle or years of operation for both vehicle technologies.

Because of the initial disadvantage of BEV compared to conventional ICE vehicles, i.e. the higher GHG emissions caused in their production, it is very interesting to assess the evolution of the GHG emissions from the transport sector over time – including the production and use of the vehicles – together with the resulting effects, both positive and negative ones.

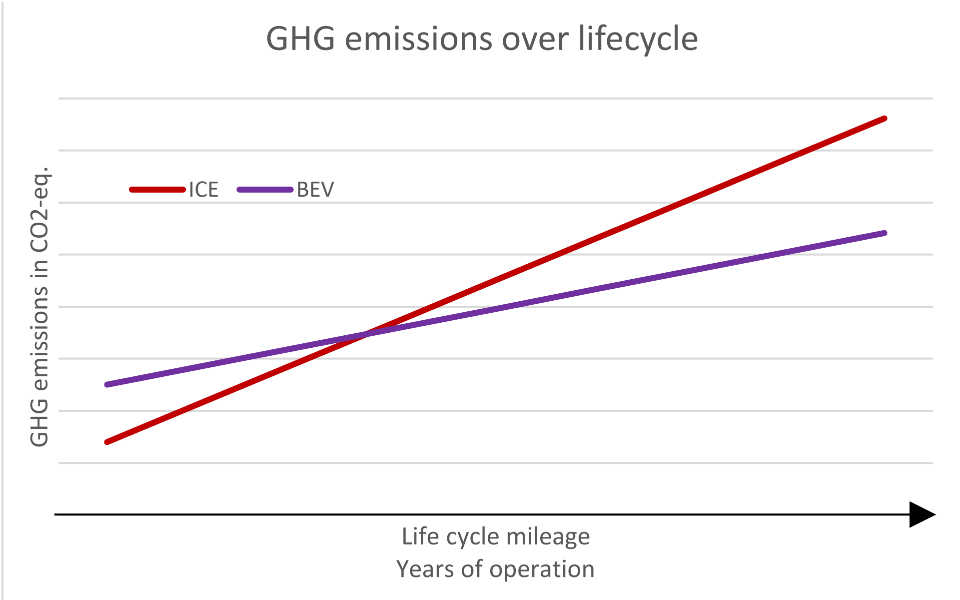
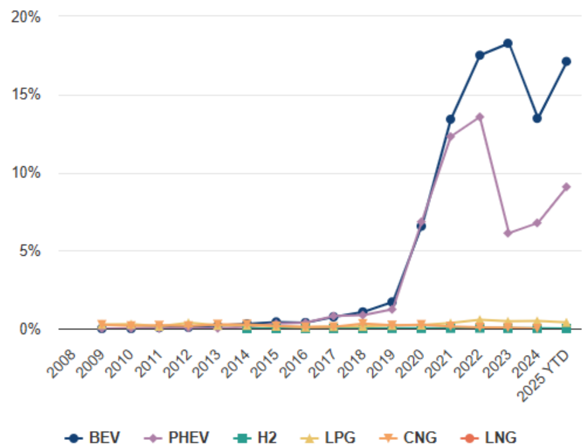


Figure 1: Illustrative GHG emissions for a conventional ICE vehicle and a BEV over their life cycle and years of operation

2 Developed model for assessing the transition to BEV vehicles

For assessing the overall GHG emissions in the vehicle sector, caused by the production of new vehicles and their use in Germany, we created a model with annual time steps in the time period from 2019 to 2050. We choose 2019 as a starting year, since the number of BEV was still quite small as indicated in Figure 2. As object of the assessment, we use the fleet of passenger vehicles in Germany, but of course the analysis could also address the vehicle fleet of other countries or the European Union as a whole. As Figure 2 illustrates, the development of recent market shares of BEV and plug-in hybrid vehicles (PHEVs) has been quite similar in Germany and the EU-27 and hence the main outcomes of the assessment are highly likely to remain the same.



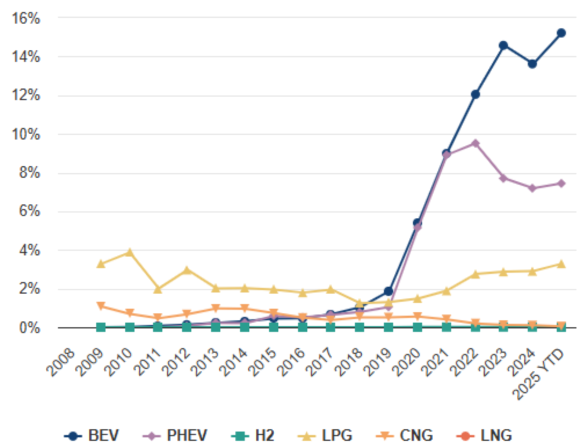


Figure 2: Market share development of passenger vehicles registrations with alternative powertrains in Germany (left) and EU-27 (right) [2]

The overall size of the passenger vehicle fleet in Germany comprises about 49 million vehicles with an average holding period of 10 years [3-5]. This results in a theoretical exchange rate of 10% of the vehicle fleet for each year or 4.9 million new passenger vehicles in Germany per year. This is a strong assumption since the real number of new vehicles registered every year has been significantly lower recently – slightly below 3 million vehicles [6] – and hence this aspect will be addressed in one of the later scenarios of this assessment (see section 3.3).

The average age of vehicles in the European Union is 12.5 years and hence considerably higher than in Germany (maximum car age is in Greece with 17.5 years) indicating an even slower renewal rate for the fleets of other European countries compared to Germany. [4]

We use the recent market share for new BEV registrations in Germany (Figure 2) in the years 2019 to 2024. For 2025 we assume a BEV market share of 20% rising to 50% in the year 2030 and to 100% in 2035 representing that no new ICE vehicles shall be registered any more in the European Union by that year. Table 1 summarizes the BEV market share for all years relevant for this assessment.

Table 1: Assumed share of BEV among new passenger vehicle registrations in Germany

Year	2019	2020	2021	2022	2023	2024
BEV share in new vehicle registrations	1.8%	6.7%	13.6%	17.7%	18.4%	13.5%
Year	2025	2026	2027	2028	2029	2030
BEV share in new vehicle registrations	20%	23%	27%	30%	40%	50%
Year	2031	2032	2033	2034	2035	2035+
BEV share in new vehicle registrations	60%	70%	80%	90%	100%	100%

Further, we do not differentiate between diesel and gasoline vehicles but just assess them as conventional vehicles with internal combustion engine (ICE) and we do neglect all other powertrain technologies since BEV is the most important one (compare Figure 1). Figure 3 shows the resulting ICE and BEV registrations and their development between 2019 and 2040.

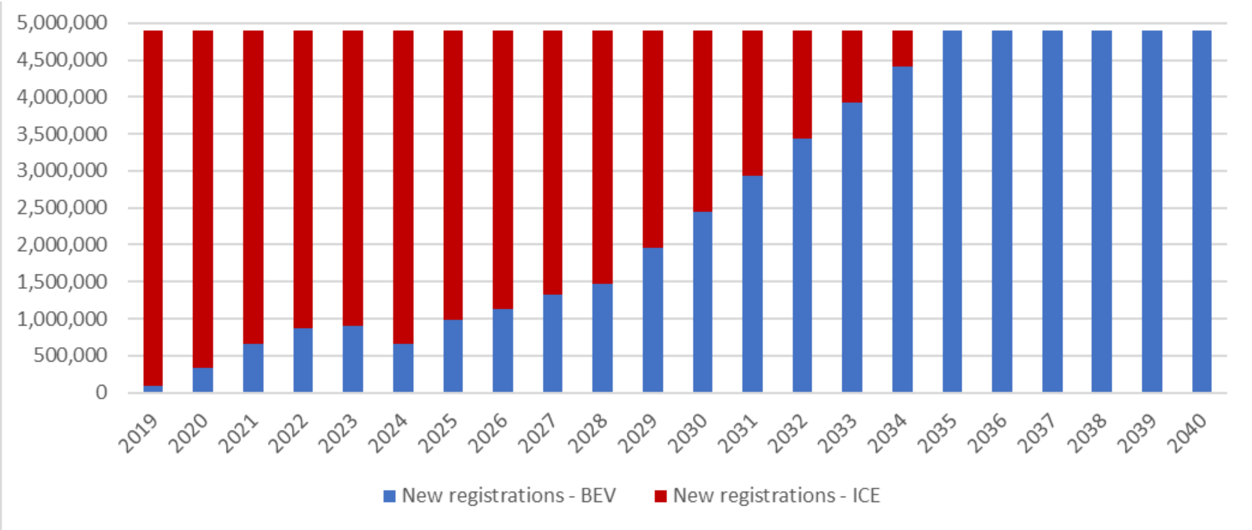


Figure 3: Development of the BEV and ICE share among new vehicle registrations in Germany between 2019 and 2040

Since ICE cars represent more than 98% of the fleet running in Germany in 2019 and BEV only make a share of 0.2% [3], we assume that all passenger vehicles in Germany were ICE vehicles. As mentioned earlier, the average age of passenger vehicles is approximately 10 years [3,5], which is why we assume that all newly registered vehicles will reach their end of life after 10 years. The resulting shares of both technologies, i.e. BEV and ICE, within the vehicle fleet are illustrated in Figure 4.

It is highly interesting to observe the occurring delay between the two aspects, new vehicle registrations and vehicle fleet. While 50% of new registrations are assumed to be BEV in 2030 and ICE registrations come to a full end in 2035, the effect on the vehicle fleet is significantly delayed. In 2030 only 16% of the vehicle fleet are BEV and in 2035 BEV account for 55%

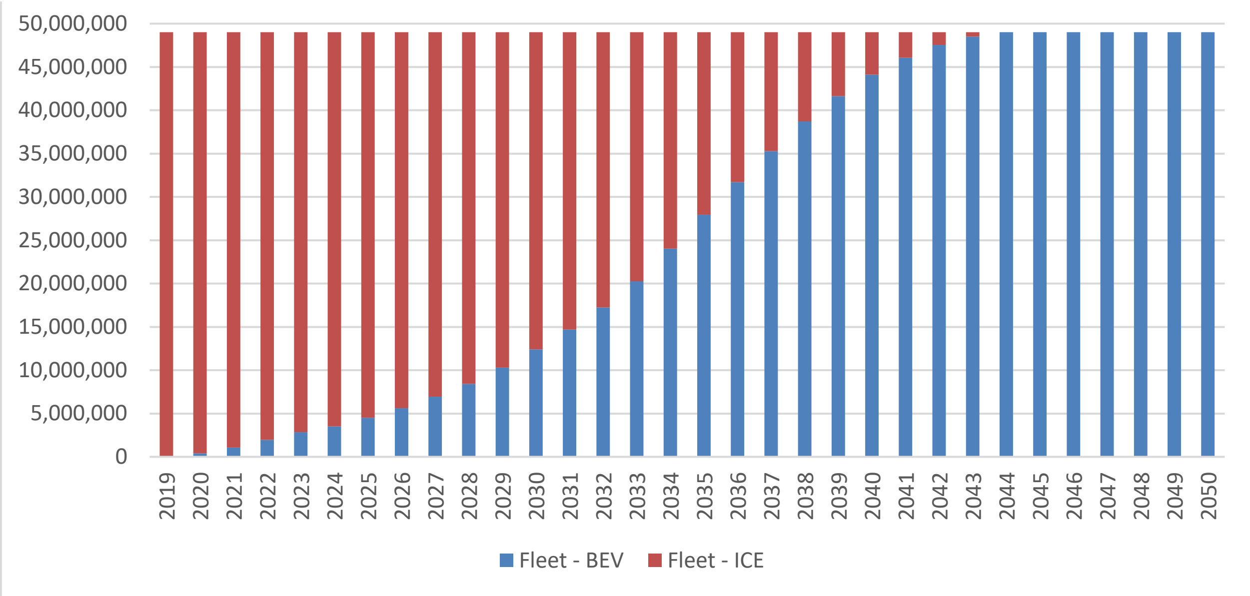


Figure 4: Development of BEV and ICE within the vehicle fleet in Germany between 2019 and 2050

Now we want to assess the GHG emissions that are caused by the production of BEV and ICE vehicles. Of course, such estimates vary between different sources but for ICE vehicles, the GHG emissions reported for their production are usually within the range of 6,000 – 8,800 kg CO2-equivalents per vehicle [7-9]. For this assessment, we use the value of 7,000 kgCO2-eq. (Table 2).

Regarding the GHG emissions from BEV production there is broad consensus that these are higher than those for ICE vehicles, mainly caused by the production of the vehicle battery, but the spread of reported estimates is significantly larger than for ICE vehicles. Reasons for these variations are for instance different assumptions on the battery capacities installed in vehicles, or on the battery chemistries and cathode compositions used, on the production volumes and related production process efficiencies, on the location of production and the related environmental impact of the local energy supply, or different points in time for the battery production. The GHG emissions per kWh of battery capacity installed in a BEV is within the range of 50 – 100 kgCO2-eq./kWh with higher outliers e.g. for production with a low share of renewables in China or estimates even below 50 kgCO2-eq./kWh for a production in Europe in 2030 and later [7,8,10-13].

Similarly important is the battery capacity that is installed in a BEV, which has increased recently from about 47 kWh in 2019 to about 58 kWh in 2022 [14]. We believe that this trend towards even larger vehicle batteries will continue since the limited range is the main disadvantages compared to ICE vehicles. We assume that the growth of the installed battery capacity will continue in the same pace until 2030 and at half the growth rate between 2030 and 2040 (see Table 2). Additionally, we use the GHG emissions for today's and for future battery production in China reported in [12] for our assessment, since China currently is by far the largest producer of vehicle batteries and has the largest manufacturing capacity for anode and cathode materials [15]. The resulting estimates used in this assessment are summarized in Table 2, which are linearly interpolated for the time before 2040 and are assumed to be constant beyond that year.

Table 2: Assumptions for GHG emissions related to BEV and ICE vehicle production

Year	Average battery size per BEV (kWh)	GHG from battery production (kg CO2-eq/kWh)	GHG from battery production (kg CO2-eq)	GHG from BEV production (kg CO2-eq)	GHG from ICE production (kg CO2-eq)
2020	50.6 [14]	109	5,515	12,515	7,000
2025	69.4	86.5	6,000	13,000	7,000
2030	88.1	64	5,638	12,638	7,000
2040	106.9	31	3,312	10,312	7,000

For modelling the GHG emissions from the use case of both vehicles, we require some more parameters. An essential one is the annual mileage of both vehicles, which has declined in Germany from a quite constant level over more than 15 years at around 15,000 km/a until 2019 to a level below 13,000 km/a for 2022 [16]. This average annual driving mileage is very similar to the value in other European countries [4]. For our analysis, we assume that this level does not decrease further, but stays constant over the entire period assessed and we assume the same value for BEV and ICE, since BEV vehicles are used for similar annual mileages as ICE vehicles already today [4].

Also, the fuel and electricity consumption of ICE vehicles and BEV respectively is assumed to be constant within the assessment period. Even though technological advancements may bring down the fuel and energy consumption, increasing comfort and safety features – and in the case of BEV, the increasing battery capacity on board – may offset potential efficiency improvements. A trend which was observed in recent years for ICE vehicles [17].
We assume an electricity consumption of 19.0 kWh/100km for BEV, which seems in accordance with the real-life electricity consumption reported by drivers of the recently most popular BEV in Germany such as the Tesla Model 3 or the VW ID.3 [18]. In many comparative assessments, the energy consumption of an ICE is a factor of 2.5 to 4 above the energy consumption of a BEV [7, 13, 19, 20]. From the mentioned publications, we determine an average at 3.2, which delivers a fuel consumption of 6.7 L/100km. Table 3 summarizes the estimates for the use of both vehicle types and the respective fuel and electricity consumption.

Table 3: Assumptions for the use and fuel/electricity consumption of ICE vehicles and BEV

Annual mileage	13,000 km
Consumption ICE	6.7 L/100km
Consumption BEV	19 kWh/100km

The GHG emissions for the supply and the use of gasoline and diesel are reported to be 2.7 kgCO2-eq./L and 3.1 kgCO2eq./L respectively with a mean at 2.9 kgCO2-eq./L, which we use for the ICE vehicles in our assessment [19]. An increasing share of biofuels or synthetic fuels may decrease the emissions related to future ICE use, whereas an increased production of unconventional fossil fuels would increase the related emissions. Since these trends might balance out each other and since the emissions related to fuel supply are considered to be quite constant until 2037 in [12], we assume the emission factor for fuel supply and use to be constant over the time considered in our assessment.
In contrast, we expect the GHG emissions from power generation in Germany to decrease significantly in the future. Due to the targets set by the German government, the emissions are considered to decrease from more than 400 gCO2-eq./kWh in 2022 to below 200 gCO2-eq./kWh in 2037 [12]. The economic recovery after the COVID pandemic and higher natural gas prices and the related shift to electricity production from coal have led to an increase of GHG emissions in 2021 [21] which even increased in 2022 when the war in Ukraine started and the North Stream pipelines were destroyed [22]. Based on the mentioned sources, we derive a development of GHG emissions from electricity production based on historic data until 2024 [21] and a subsequent decrease until 2039 [12] with further subsequent improvements assumed at 5% p.a. Figure 5 illustrates the resulting development of GHG emissions caused by power generation in Germany.

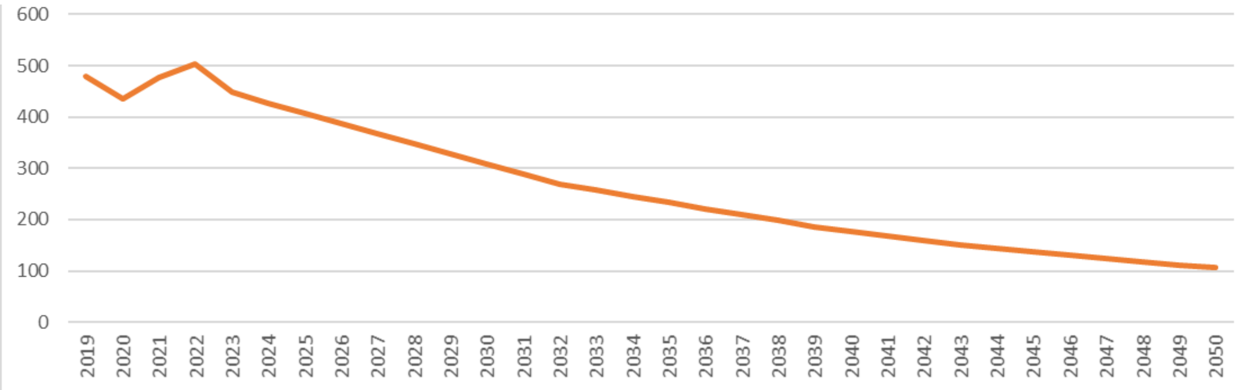


Figure 5: Development of GHG emissions from power production in Germany including fuel supply chains in gCO2-eq./kWh

In accordance with other similar assessments, we consider the GHG emissions from the end of life of both vehicle types to be insignificant, so we neglect the impact of this phase of life. [7, 8]

3 Results

The results from our assessment using the approaches and input parameters as described earlier is illustrated in Figure 6 for the timeframe from 2019 to 2050. One can see that the overall GHG emissions decline from a level at about 160 million t CO2-equivalents in 2019 to a level around 60 million tons in 2050, which is less than half the initial emissions. One can also see that the GHG emissions from the production of ICE vehicles decline over time and reach zero in 2035 when no new ICE vehicles can be registered any more. In contrast, the GHG emissions caused by the production of BEV increase constantly, mainly due to the growing number of BEV produced and reach a stable level at the end of the 2030s. The GHG emissions from the fuel consumption of ICE vehicles, which is the largest GHG contributor currently and until the mid-2030s, decrease over time and reach zero in 2044, i.e. when all ICE vehicles are out of the vehicle fleet ten years after the last registration of new ICE vehicles. The last GHG contributor to mention is the electricity production for the operation of BEV within the fleet. The related GHG emissions increase until 2040 and then decline since we assume further reductions of the GHG per kWh of electricity generated in Germany.

It's worth mentioning that a fleet of 49 million BEV is causing only about 13 million tons of CO2-eq. in 2050 compared to more than 120 million tons of CO2-eq. caused by an ICE vehicle fleet of the exact same size in 2019. There are two reasons for this: the first is that we assume only 106 gCO2-eq. from a kWh of electricity produced in 2050 (compared to a GHG impact of 2.9 kgCO-eq./L of fuel or 318 gCO2-eq./kWh energy content in the fuel), which is a factor of three. The second is the higher efficiency of the electric powertrain compared to that of ICE vehicles, which brings in another factor of 3.2, resulting in an overall improvement factor related to the GHG emissions of 9.6.

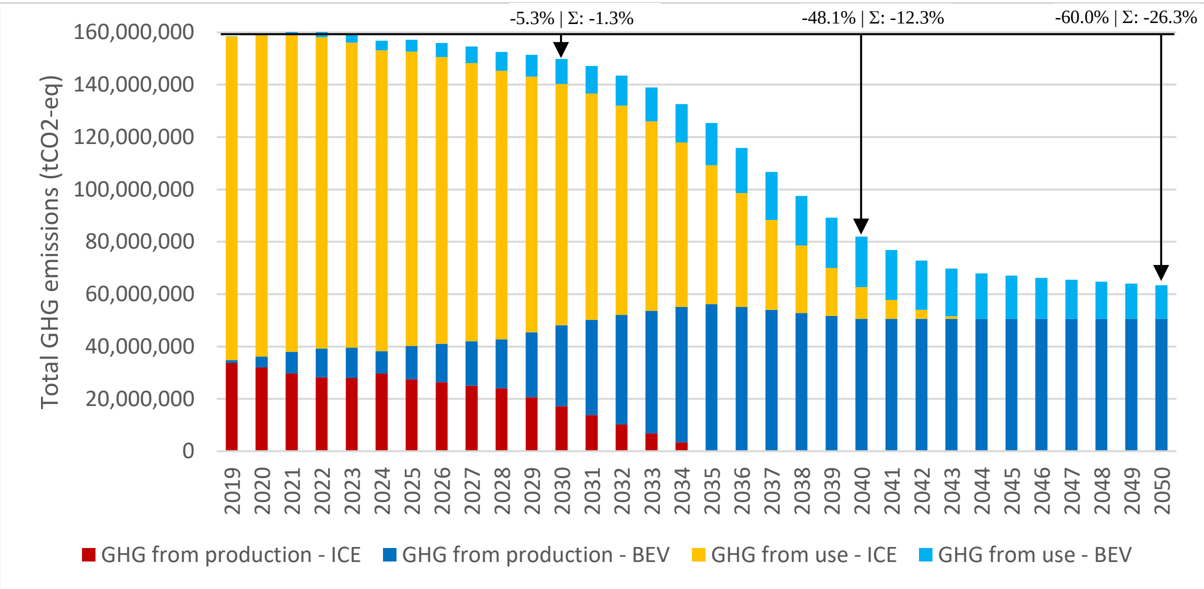


Figure 6: Development of the GHG emissions from the production and the use of BEV and ICE vehicles between 2019 and 2050

As additionally indicated in Figure 6, one can see that the GHG emission reduction is -5.3% in the year 2030 compared to 2019. For 2040 and 2050 the reduction of GHG emissions accounts for -48.1% and -60.0% respectively. Besides these year-specific estimates, the reduction value indicated by the Σ symbol represents the cumulative emission reduction over all years from 2019 until the respective year comparing to a theoretical scenario, in which the emissions of the year 2019 had continued during these years without any change. Table 4 summarizes these emission reductions, both year specific and cumulative.

Table 4: Results for the year-specific and cumulative GHG emission reductions for the indicated reference year compared to 2019

Year	Year-specific GHG emission reductions	Cumulative GHG emission reductions (2019 – indicated year)
2030	-5.3%	-1.3%
2040	-48.1%	-12.3%
2050	-60.0%	-26.3%

One highly relevant aspect, that becomes evident here again, is the significant delay between the registration of new vehicles and the related consequential effect on the GHG emissions: although no new ICE vehicles are registered in 2035 and beyond, the GHG emissions from their fuel use disappear not before 2044 when no more ICE vehicles are on the road. For this reason, the improvement on the cumulative GHG emissions until 2040 is just slightly above 12% even for such a consequent fade-in scenario of BEV into the vehicle fleet as assumed in our analysis.

3.1 The relevance of GHG emissions from electricity supply

As mentioned above, the GHG emissions resulting from the production of electricity is an important factor for the overall results. For this reason, we want to provide two scenarios of our assessment. The first assumes that the GHG emissions related to electricity production would stay on the same level as they were in 2019 (i.e. 479 gCO2-eq./kWh) for the entire time period until 2050. The second scenario assumes that the electricity production was completely green with no GHG emissions at all starting already in 2019 and continuing like that until 2050. Table 5 summarizes the results of both scenarios for the GHG emissions from electricity production.

Table 5: Results for the year-specific and cumulative GHG emission reductions assuming alternative GHG emissions from electricity production for the indicated reference year compared to 2019.

Year	GHG emissions from electricity like in 2019 until 2050		No GHG emissions at all from electricity production during 2019- 2050	
	Year-specific GHG emission reductions	Cumulative GHG emission reductions (2019 – indicated year)	Year-specific GHG emission reductions	Cumulative GHG emission reductions (2019 – indicated year)
2030	-2.0%	-0.4%	-11.2%	-4.0%
2040	-27.4%	-6.3%	-60.3%	-18.3%
2050	-31.5%	-14.1%	-68.1%	-33.6%

The results show that even if the GHG emissions stay on the 2019 level until the year 2050, we could see a reduction of the GHG emissions. The size of the GHG emission reductions is, however, significantly smaller than those determined in our baseline scenario (Table 4). In contrast, if only completely green electricity, without any GHG emissions, was used to charge the BEV, we could see larger reductions of the overall GHG emissions. Yet, even for this extreme scenario, the cumulative GHG emission reduction is “only” about 34%, which means that we need to investigate other effective ways to reduce the GHG emissions until 2050.

3.2 The relevance of GHG emissions from BEV production

The second largest contributor to the overall GHG emission (see Figure 6) is the production of BEV. As mentioned earlier, this is mostly caused by the production of the vehicle battery. The emissions related to the vehicle battery can be reduced mainly by two measures. The first is by lower GHG emissions from the production of a certain battery capacity and the second is by installing batteries of smaller sizes into the BEV. For assessing the effect of such measures, we assume that the GHG emissions were limited to 10.5 tCO2-eq./vehicle, which is 50% more than the emissions caused by the production of an ICE vehicle. In an even more ambitious scenario, we also assume that the emissions related to the production of a BEV were limited to 9 tCO2-eq./vehicle, which is about 30% more than an ICE vehicle. Table 6 summarizes the results for both scenarios on the BEV production.

Table 6: Results for the year-specific and cumulative GHG emission reductions assuming reduced GHG emissions from BEV production for the indicated reference year compared to 2019.

Year	GHG from BEV production at max 10.5 tCO2-eq./vehicle		GHG from BEV production at 9 tCO2-eq./vehicle	
	Year-specific GHG emission reductions	Cumulative GHG emission reductions (2019 – indicated year)	Year-specific GHG emission reductions	Cumulative GHG emission reductions (2019 – indicated year)
2030	-8.5%	-2.7%	-10.5%	-3.7%
2040	-48.1%	-14.0%	-52.1%	-16.4%
2050	-60.0%	-27.5%	-64.0%	-30.4%

A limitation of the GHG emissions from BEV production would help especially on the short-term. Such an emission limitation would reduce the emissions in 2030 by around 10% compared to 2019 which is a reduction twice as high as in our baseline scenario with higher GHG emissions from BEV production. For the cumulative GHG reductions until 2030 this results in a reduction twice or almost three times as high as in our baseline scenario. On long-term, however, the limitation of the emissions from BEV production appears less effective, both for the year specific and cumulative emissions.

3.3 The relevance of an effective vehicle turnover

As described in section 2, we assumed an annual turnover ratio of 10% of the existing vehicle fleet, since the average age of passenger vehicles in Germany is 10 years, which is slightly below the average vehicle age in the European Union of 12.5 years. This simplification, however, does not reflect the fact that more than 40% of the vehicle fleet in Germany is 10 years old or even older and approximately 10% of the existing fleet is older than 20 years [5]. We find a similar age distribution in other European countries, e.g. in the UK where about 50% of the fleet is up to 9 years old and about a third is older than 12 years [23]. Actually, the average age in both countries is increasing [4, 5, 23] and the ratio of new registered vehicles to the existing car fleet is at 5.8% in Germany, 5.0% in the UK and at an average of 4.2% in the entire European Union [4, 24], so significantly below the simplified 10% that we assumed in this assessment.

If we change the number of new vehicles registered each year to the current level in Germany of approximately 2.85 million vehicles per year and leave the rest of the assessment unchanged, we see that even though the new car registrations in 2035 and beyond are only BEV, there is still a significant share of ICE vehicles that keeps operating within the existing fleet far beyond 2035 (Figure 7)

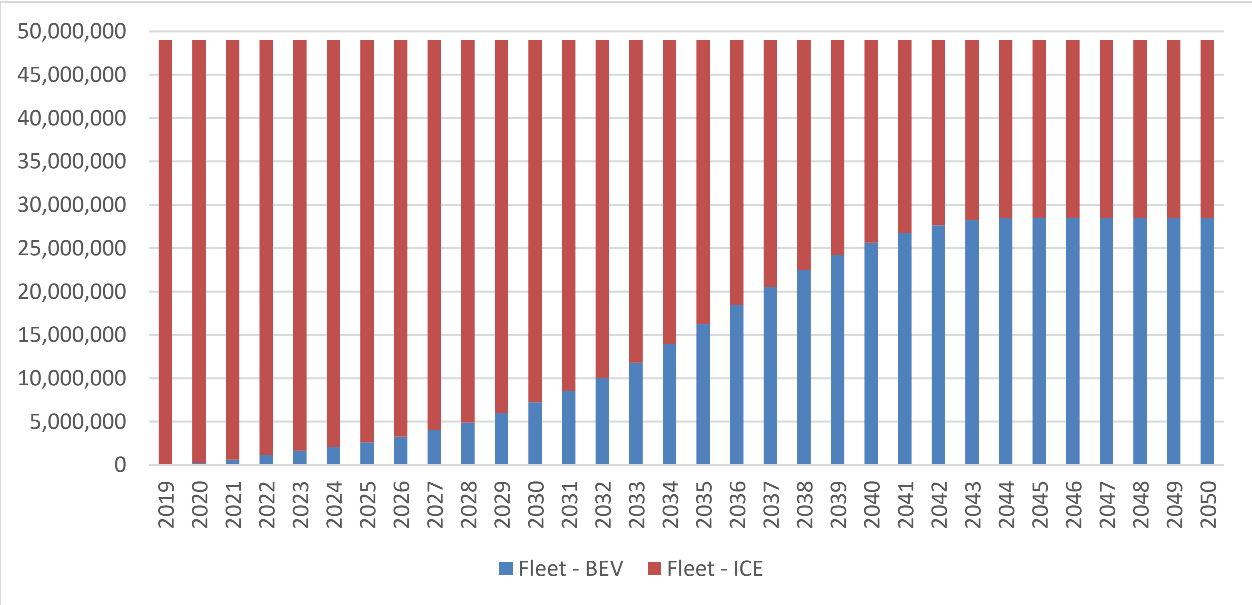


Figure 7: Development of the BEV and ICE vehicle fleet in Germany between 2019 and 2050 for reduced volume of new vehicle registrations per year

The results for this scenario are summarized in Table 7.

Table 7: Results for the year-specific and cumulative GHG emission reductions for the indicated reference year compared to 2019 for a reduced volume of new vehicle registrations per year

Year	Year-specific GHG emission reductions	Cumulative GHG emission reductions (2019 – indicated year)
2030	-3.4%	-0.8%
2040	-30.8%	-7.9%
2050	-38.4%	-16.8%

Even in this scenario the overall GHG emissions can be reduced. The reductions, however, are significantly smaller than in our baseline scenario, which is especially evident for the long-term perspective. Here the reductions are cut by about one third, both for the year specific and the cumulative estimates.

4 Conclusions and Recommendations

Even though it could be confirmed in this assessment that switching from ICE vehicles to BEV provides the opportunity to reduce the GHG emissions caused by transport, it is highly interesting to investigate the related effects over time. First of all, one needs to acknowledge the significant delay that such a transformation has, since changes in new vehicle registrations show their effect significantly later when the effect on the existing fleet materializes. This also implies that we will hardly see a significant GHG reduction effect before 2030 if we consider both vehicle production and use. The biggest change in GHG emissions is going to take place between 2030 and 2040 if the turnover of vehicles occurs in the anticipated way. The developments assumed in this assessment reduce the cumulative GHG emissions caused between 2019 and 2050 by about 26% which seems rather small considering the big changes necessary in industry, policy-making, infrastructure deployment and of course for the end-users. For that reason, it is essential that we use as many levers as possible to support and enlarge the emission reduction effect that comes from using BEV instead of ICE vehicles.

In our scenario analyses we could show that, greening the electricity supply as much and as early as possible of course helps to reduce GHG emissions from the future vehicle fleet. However, the related effect is smaller than one might have intuitively thought. Even if we had electricity without any GHG emissions this would decrease the cumulative GHG emissions between 2019 and 2050 in our baseline scenario by only 8 % points additionally, i.e. from -26% to -34%.

This emphasizes the importance of reducing the GHG emissions resulting from BEV production. Currently, the battery sizes in BEV increase over time and battery production that takes place to a large extend in China relates with high levels of GHG emissions. If it is not possible to increase the battery production in Europe, using local green electricity, it is essential to at least provide clear and traceable transparency on the GHG emissions related to a vehicle battery or the BEV as a whole. But it’s even more important that policies do not favor BEV with large batteries and high GHG emissions. Vehicles with smaller GHG impact could be favored in tax schemes, through subsidies or beneficial depreciation periods or – if necessary – by a clear regulatory cap on the allowed GHG emissions for the production of a BEV. Needless to say, that an effective fast charging infrastructure is necessary to provide the expected usability and flexibility even for a vehicle with a smaller battery.

Last but not least, it is crucial that the turnover of vehicles in the existing fleet is high enough to adopt the emission reductions from switching from ICE to BEV vehicles. It might not be sufficient to ban registrations of ICE vehicles by 2035. If too many users keep their old ICE vehicles, e.g. due to nostalgia, due to ideology or due to purely financial constraints, we might not be able to harvest the GHG reduction potentials that switching from ICE vehicles to BEV could actually provide. Policy-makers need to find ways to ensure the required throughput in a socially acceptable manner.

It is clear that one needs to look not only at the GHG emissions caused during the use of vehicles. Instead, for taking holistically ideal decisions, it is essential to also include the production of vehicles and to monitor the developments of GHG emissions over time. Only by this approach one can truly optimize the GHG emission reductions and take the most effective and the most efficient measures for a greener transport system in the future.

References

[1] European Parliament, EU ban on the sale of new petrol and diesel cars from 2035 explained, 2023 Link

[2] European Alternative Fuels Observatory, Directorate-General for Mobility and Transport, 2025, Link

[3] Kraftfahrtbundesamt, Bestand an Kraftfahrzeugen nach Umwelt-Merkmalen, 1. Januar 2024 (FZ 13), Link

[4] ACEA, Vehicles on European Roads, January 2025, Link

[5] Kraftfahrtbundesamt, Durchschnittsalter der Personenkraftwagen wächst, Link

[6] Kraftfahrtbundesamt, Jahresbilanz 2023, Link

[7] ADAC, Treibhausgas-Bilanz: Welcher Antrieb kann das Klima retten?, 2022, Link.

[8] VDI, CO2-Bilanz von E-Fahrzeugen, Gastbeitrag Volkswagen AG, 2020, Link

[9] IEA, Comparative life-cycle greenhouse gas emissions of a mid-size BEV and ICE vehicle, 2021, Link

[10] M. Wietschel, Ein Update zur Klimabilanz von Elektrofahrzeugen, Working Paper Sustainability and Innovation No. S 01/2020, Fraunhofer ISI, Link

[11] ICCT, Five things you know about electric vehicles that aren't exactly true, 19 Jul 2021, Link

[12] Green NCAP/Joanneaum Research, LCA Methodology and Data, December 2022, Link

[13] IEA, Comparative life-cycle greenhouse gas emissions of a mid-size BEV and ICE vehicle, 2021, Link

[14] J. Figgener et al., The development of battery storage systems in Germany: A market review (status 2023), https://doi.org/10.48550/arXiv.2203.06762

[15] ACEA, Fact Sheet - EU Battery Supply Chain & Import Reliance, 2025, Link

[16] DAT, Jahresfahrleistung, 2023, Link

[17] Destatis, Fahrleistung und Kraftstoffverbrauch inländischer Personenkraftwagen, Sep 2024, Link

[18] Fisch und Fischl GmbH, Spritmonitor.de, Link

[19] M. Wietschel et al., Die aktuelle Treibhausgasemissionsbilanz von Elektrofahrzeugen in Deutschland, Working Paper Sustainability and Innovation No. S 02/2019, Fraunhofer ISI, Link

[20] VDI, VDI-Analyse der CO2-äq-Emissionen von Pkw mit verschiedenen Antriebssystemen, Dezember 2023, Link

[21] UBA, CO_2-Emissionen pro Kilowattstunde Strom steigen 2021 wieder an, 2022, Link

[22] UBA, Entwicklung der spezifischen Treibhausgas-Emissionen des deutschen Strommix in den Jahren 1990 - 2024, 2025, Link

[23] SMMT, More than a million EVs on UK roads as vehicle ownership reaches new high, April 2025, Link

[24] ACEA, New car registrations in 2023, January 2024, Link

Presenter Biography

Benjamin Reuter has a background in energy engineering and did his PhD on sustainability aspects related to electric vehicles. He was working as a sustainability consultant with thinkstep/Sphera and on infrastructure for battery electric and hydrogen vehicles at Daimler Trucks. Now he is a professor at the Stuttgart University of Applied Sciences giving lectures on energy related topics.