

Durability and Convenience of Electric Vehicles

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Climate Change Calculated 9

New channel chatbot

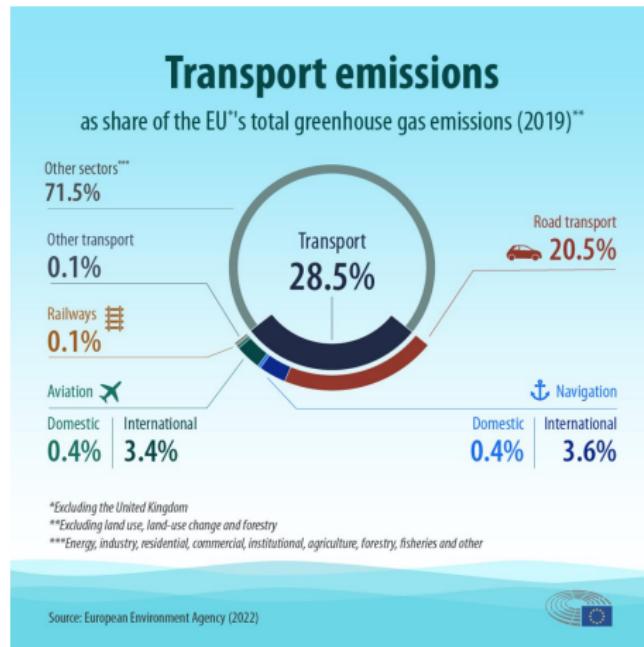
- We have a new channel chatbot: "**Climate Change Assistant**" :
Chatbot: <https://chatgpt.com/g/g-6829ff3e69cc81918c917c75c6925b35-climate-change-assistant>



- I made a new specialized channel chatbot, whom I gave the knowledge context of this channel.
- Hence it gives more targeted and precise answers than general chatbots,
- it can answer basic questions, and more advanced ones,
- or in which episode a topic was treated.
- It is based on OpenAI's ChatGPT.
- Asking questions in the comments is also possible :-)

Introduction

- Transportation sector significantly contributes to global CO₂ emissions.



What can we do?

- Create demand for renewable energy technologies,
- to stimulate the economic and political processes of energy transition,
- because only these technologies can achieve the necessary CO₂ reductions of at least 80%. ¹
- Those who buy new cars determine the composition of the “nation’s vehicle fleet” for that year.



¹ Climate Change Calculated 1

Electric Vehicles (EV's)

Electric cars are an important building block in the transition to renewable energies:

- They do not require any fossil fuels,
- are three times more energy-efficient than combustion engines (and therefore correspondingly cheaper to operate),
- and are already practical and convenient.

My Personal EV Experience

- 2018 Tesla Model S, over 200,000 km.
- At the time, it was probably the only practical long-range electric car in Germany; the Model 3 did not arrive in Germany until a year later.
- Tesla was and remains a global leader in technology and sales.
- Chinese manufacturers are catching up quickly.
- Hopefully, this diversity will lead to a faster increase in the share of electric cars in sales.
- Although, that was already said 2018 :-)

My Personal EV Experience

- No noticeable battery degradation.
- Hardly any maintenance required.
- No noticeable range reduction from heating or air conditioning.
- Convenient and practical charging.
- With all its active and passive safety systems, it is probably the safest car on the road (brakes before I can react, steering correction to avoid collision, ignoring accidental engagement of parking gear on the highway). ²

²<https://www.tesla.com/impact>

Battery Longevity: Research Findings

- TUM Dissertation: Aging of 18650 cells (e.g., Tesla or power tools)
- After 2000 full cycles, 80% capacity remains (Figure 88). ³
- One cycle \approx 500 km (range) \rightarrow 1 million km lifespan!
- Data suggests many packs *outlive the rest of the car*
- Second-life storage markets extend usefulness further

³TUM Dissertation "Aging of Lithium-Ion Batteries in Electric Vehicles", 2017

Calendar Life of Batteries

- Prediction: 90% capacity after 20 years (medium charge level). ⁴
- Minimal degradation if kept between 10%–90% charge.

⁴TUM Dissertation "Aging of Lithium-Ion Batteries in Electric Vehicles", 2017,
Figure 44

Estimation using our new channel chatbot

- Chatbot: <https://chatgpt.com/g/g-6829ff3e69cc81918c917c75c6925b35-climate-change-assistant>



- We can ask it: “*How long does the Tesla drive battery last?*”
- Its answer gives a very good idea.

Mechanical Durability

- Fewer moving parts, no high pressures or temperatures → less wear and tear.
- Lower maintenance costs.
- Longer service life than ICE vehicles.⁵

⁵Wired, <https://www.wired.com/story/electric-cars-could-last-much-longer-than-most-think/>

Used EV Market Trends

- EVs last 20+ years, vs. 15 years for ICE cars.
- EVClinic guide: what to check before buying.

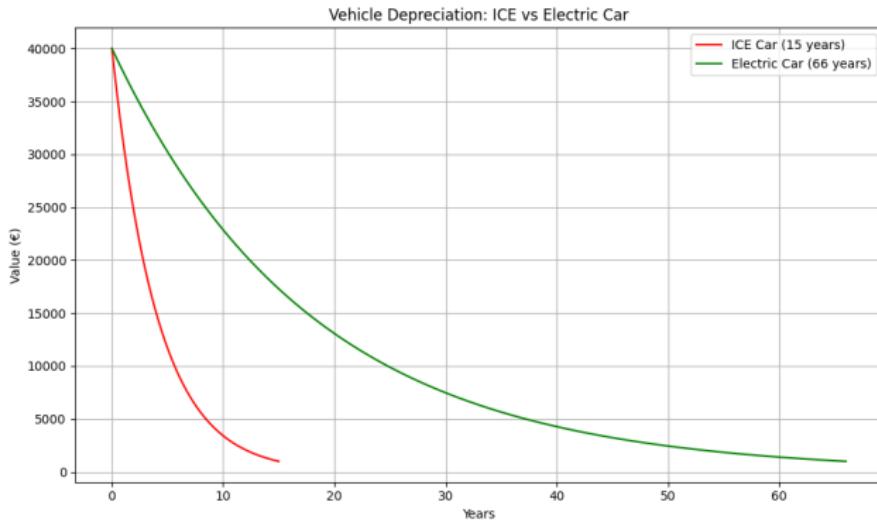
Sources: [Wired](#), [EVClinic](#)

Future resale value

- The used car market still lacks long-term experience with electric cars.
It could settle at the following levels:
- Economic service life: Service life of the most expensive unit, combustion engine or battery.
- Combustion engine car: Average service life approx. 15 years.
- Electric car battery service life: approx. 1 million km; at an average of 15,000 km per year, the service life would be 66 years!
- A theoretical but entirely possible value.

Future resale value

- Assumed new value: 40,000 €. Assumed residual value at end of life: 1,000 €.
- With a typical exponential decline in value, we get the following time curve for the resale value.
- This shows that the loss in value of electric cars over time should slow down significantly.



Charging Convenience

- Home/work charging is simple and clean.
- \approx 150-200 km overnight via 230 V outlet, or keep connected at 80-90% state of charge



Estimation using our new channel chatbot

- Chatbot: <https://chatgpt.com/g/g-6829ff3e69cc81918c917c75c6925b35-climate-change-assistant>



- We ask: *"My electric Tesla consumes about 16 kWh per 100 kilometers. If I plug it into my power outlet at 7 p.m. and drive off again at 8 a.m. the next morning, how many kilometers will it have recharged in that time?"*
- Its answer gives a very good idea.

Charging Convenience

- Otherwise: 1 time per week public fast-charging for 20-40 minutes during shopping or meals usually sufficient.
- Low cost: at $\approx 16 \text{ kWh}/100\text{km}$ and 0.40 eur/kWh this is $\approx 6.4 \text{ eur}/100\text{km}$, about $1/3 - 1/2$ of comparable gasoline cost.⁶



⁶Tagesschau E-Auto Stromkosten

Charging Infrastructure

- More charging stations than gas stations in Germany.
- Fast-chargers (≈ 100 kW) add 300 km in ≈ 30 min.
- Superchargers about every 10 - 50 km on highways, number increasing.
- Fast chargers are less conspicuous than gas stations, but are listed in the cars navigation systems and Google Maps.
- The car navigation system has an integrated Supercharger occupancy display, allowing it to automatically navigate to the most convenient ones.
- Tesla has an automatic charging authentication: You simply plug in, and it automatically starts charging! Others are working on "Plug&Charge".

Sources: [BMW](#), [Wikipedia](#), [Tesla Supercharger](#) [Tesla Supercharger](#) , [Tagesschau](#) [E-Auto Ladenetz](#)

Better User Experience

- Driving an electric car is relaxing and fun.
- Silent and smooth driving.
- Instant torque.
- Lower running costs.

New Tesla Impact Report

- The new Tesla Impact Report was recently published ⁷
- It states (page 12): CO2 savings over time:
- The CO2 emissions caused by manufacturing are offset after only about 3.5 years of the car's lifetime.
- In Germany, it could be even less, because "Gigafactory Berlin-Brandenburg has been powered by 100% renewable electricity for 2 years."

⁷ <https://www.tesla.com/impact>

Further Example Channel Chatbot Questions

- How many people die per year in a city like Berlin from the consequences of air pollution and the effects of climate change?
- How many lives can my electric Tesla save, per year, compared to a car with an internal combustion engine?

Conclusion

- Don't be discouraged by media or politics.
- EVs offer better experience, lower cost, higher durability.
- A sustainable and economical transport solution.
- New Climate Change Calculated YouTube Channel chatbot:
<https://chatgpt.com/g/g-6829ff3e69cc81918c917c75c6925b35-climate-change-assistant>



References

- ① Climate Change Calculated 1: <https://www.youtube.com/watch?v=wxSEdI-QEkA>
- ② Climate Change channel repository
- ③ TUM Dissertation, <https://mediatum.ub.tum.de/doc/1355829/file.pdf>
- ④ Wired, <https://www.wired.com/story/electric-cars-could-last-much-longer-than-most-think/>
- ⑤ EVClinic Guide, <https://evclinic.eu/2024/11/03/which-used-ev-to-buy-a-beginners-guide/>
- ⑥ BMWK, <https://www.bmwk-energiewende.de>
- ⑦ Wikipedia - EV Charging Stations, [https://de.wikipedia.org/wiki/Ladestation_\(Elektrofahrzeug\)](https://de.wikipedia.org/wiki/Ladestation_(Elektrofahrzeug))
- ⑧ Tesla Supercharger, https://www.tesla.com/de_de/supercharger
- ⑨ Chatbot: <https://chatgpt.com/g/g-6829ff3e69cc81918c917c75c6925b35-climate-change-assistant>
- ⑩ Tagesschau E-Auto Stromkosten
- ⑪ Tagesschau E-Auto Ladenetz
- ⑫ <https://www.tesla.com/impact>