Claims Carbon

Navigating Car Carbon Trends

Embodied carbon emissions in the automotive industry 2020-2022

claimscarbon.com

Executive summary

Claims Carbon has collected data from public sources and annual sustainability reports from various car manufacturers. The goal has been to analyze embodied carbon emissions in cars stemming from the entire production process. The results showed that:

- The **total embodied carbon emissions have risen** during 2020-2022.
- The rise has been driven both by **increased production volumes** and by **increased weight of new cars.**
- There have been only **minor changes** in embodied **emissions per kilogram** of produced cars.
- There are **significant variations between car manufacturers**, which could result both from differences in production processes and from differences in reporting methodologies.
- Monetized embodied carbon emissions represent **2,5% of the total value of all sold cars**, highlighting the importance of carbon management for car manufacturers.
- Thus far, **actions** taken by the automotive industry to reduce carbon emissions in manufacturing processes **have not had a major positive impact** on the actual numbers reported.

Claims Carbon

Table of content

Introduction

Claims Carbon's mission is to decarbonize the insurance industry by enabling carbon conscious underwriting and claims settlement tools for insurers.

For motor insurance, carbon emissions stem from repairing and replacing cars or their parts. As such, we are interested in understanding the emissions linked to production of cars, known as embodied carbon emissions. Insurers are significant purchasers from the automotive industry and have a major opportunity to impact the net-zero trajectory of that industry.

We believe our findings are of broader interest, and we will highlight the latest developments in embodied carbon emissions from the automotive industry annually.

Embodied carbon emissions are the greenhouse gas (GHG) emissions released during the production of a car, including the extraction and processing of raw materials, the manufacturing of parts and components, and the assembly of the vehicle.

This research is limited to public data available and reports published by car manufacturers. Results can be expected to change as data availability and accuracy increases.

Data and methodology

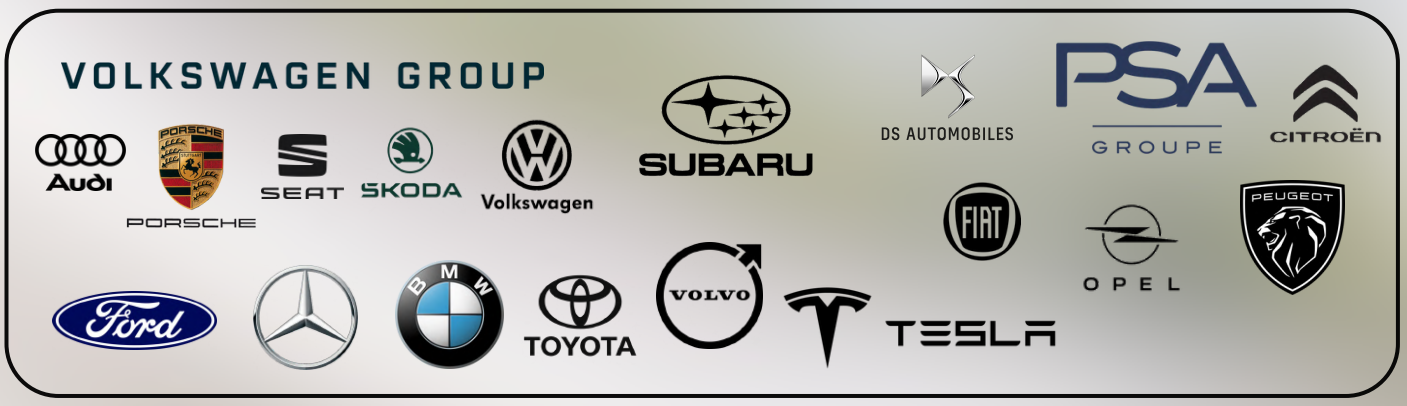
Data on embodied carbon emissions for each car manufacturer has been gathered from public sources and annual sustainability reports. Data has been collected and analyzed for the years 2020, 2021, and 2022.

The total embodied carbon emissions from car manufacturing include scope 1, scope 2, and upstream scope 3 emissions as per the GHG Protocol.

The car manufacturers included in the study are:

For Tesla Motors, total embodied carbon emissions data is available for 2022, but estimates for 2020 and 2021 have been derived based on production volumes from those years and embodied emissions from cars produced in 2022.

Average weight per car manufactured for the various car brands has been collected from public data sources and data available from the car manufacturers.



Results of the study

The embodied carbon emissions of all sold cars rose by 23.7% from 2020 to 2021 and by 13.3% from 2021 to 2022. As Figure 1 indicates, the total embodied carbon emissions of all sold cars from all included manufacturers exhibited an increasing trend from 2020 to 2022.

It is also notable that the total production volume rose 12.2% from 2020 to 2021, and by 7.3% from 2021 to 2022. Therefore, both embodied carbon emissions and car production volumes have been increasing proportionally from 2020 to 2022.

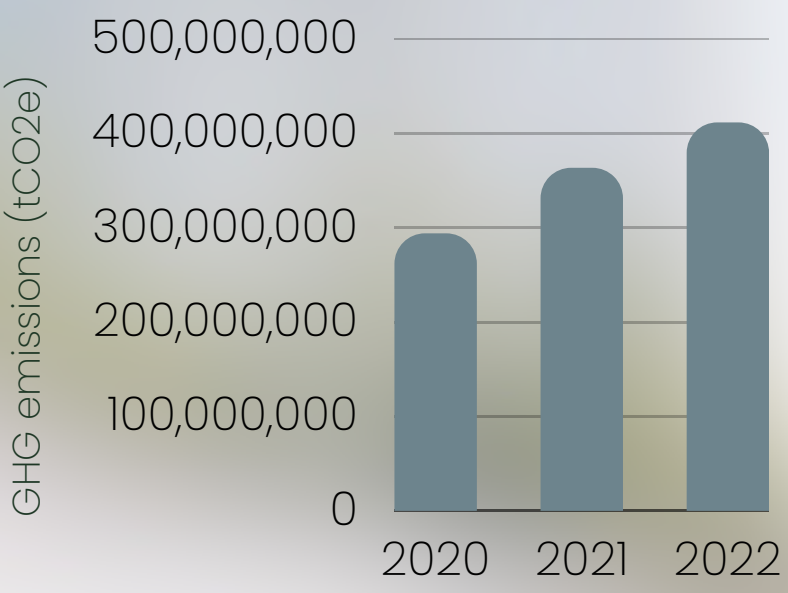


Figure 1: Total embodied carbon emissions for studied car manufacturers 2020-2022

Similarly, as illustrated in Figure 2, the embodied carbon emissions per sold car increased by 4.6% from 2020 to 2021, and by 4.1% from 2021 to 2022.

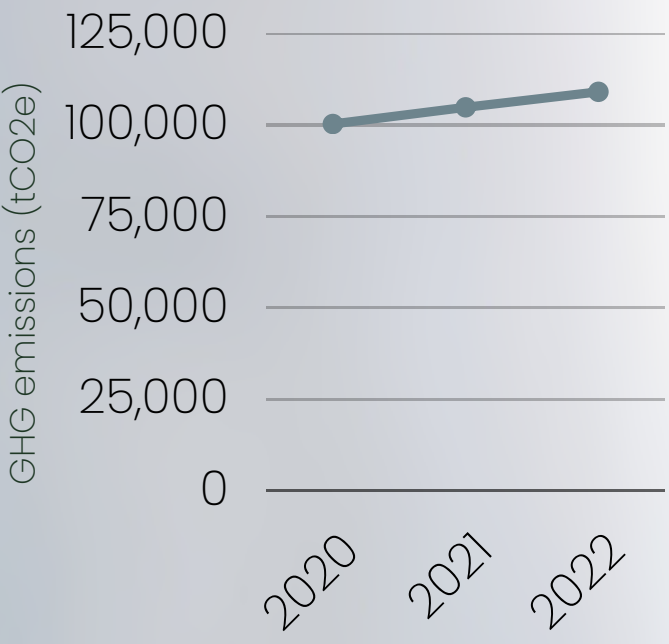


Figure 2: Embodied carbon emissions per sold car, cumulatively for all car manufacturers studied (2020-2022)

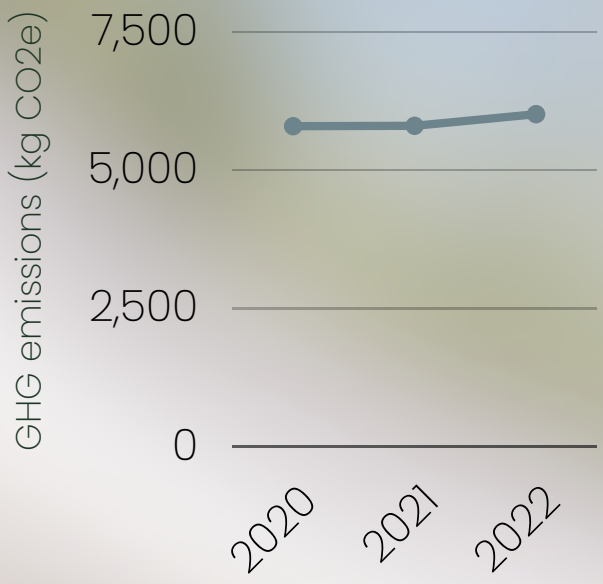


Figure 3: Embodied carbon emissions per kilogram of sold cars cumulatively for all car manufacturers studied (2020-2022)

Figure 3 shows that the embodied carbon emissions per kilogram of sold cars have remained relatively stable with a minor increasing trend over the years. There is a slight increase of 0.12% from 2020 to 2021 followed by a 3.6% increase from 2021 to 2022.

.

Figure 4 presents an overview of the embodied carbon emissions per kilogram of weight for the studied car brands in 2022. Subaru Group stands out with the lowest embodied emissions per kilogram of car weight, while Toyota Motor Corporation, Tesla Motors, and Volvo Car Group exhibit higher emissions compared to other brands.

Scope 3 upstream GHG emissions, particularly purchased goods and services, account for a significant portion of the total embodied carbon emissions, and is the main driver of higher emissions for Volvo and Toyota.

Tesla Motors exclusively manufactures fully electric cars, which could explain its higher embodied carbon emissions. Again, scope 3 upstream emissions account for the lion's share of total emissions, and it's worth pointing out that production of electric vehicles (EVs) often results in higher embodied carbon emissions due to the fact that manufacturing of batteries can be emission-intensive.

Both Figure 3 and Figure 4 show that the total embodied carbon emissions per kilogram of cars sold from 2020 to 2022 have remained relatively stable with a minor increase in values. However, when we analyze the embodied carbon emissions per kilogram of each car sold, noticeable variations are apparent between different car manufacturers.

Figure 4: Embodied carbon emissions per kilogram of each car sold for the studied car manufacturers in 2022

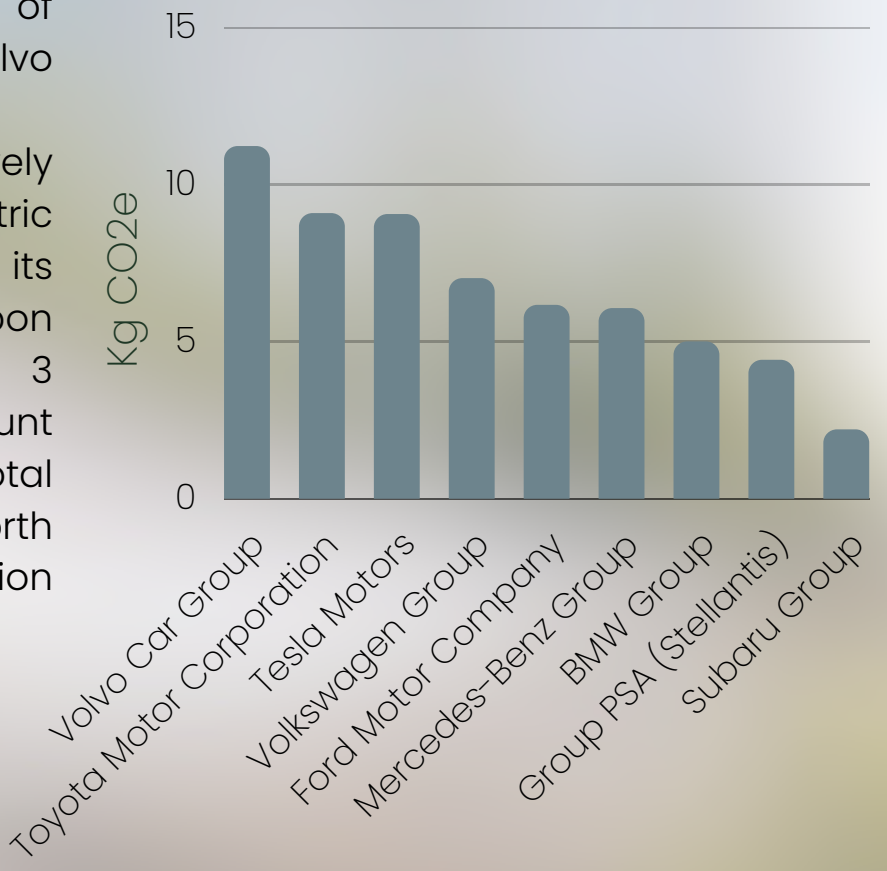


Figure 5 shows the sum of the average curb weights of all studied car brands. The average weight of cars shows an increasing trend, with 4.8% increase from 2020 to 2021, followed by 1.1% increase from 2021 and 2022. Overall, between 2020 and 2022, the average curb weight of cars has risen by 6%. This weight increase can primarily be attributed to the fact that there has been a surge in the manufacturing of hybrid and electric cars.

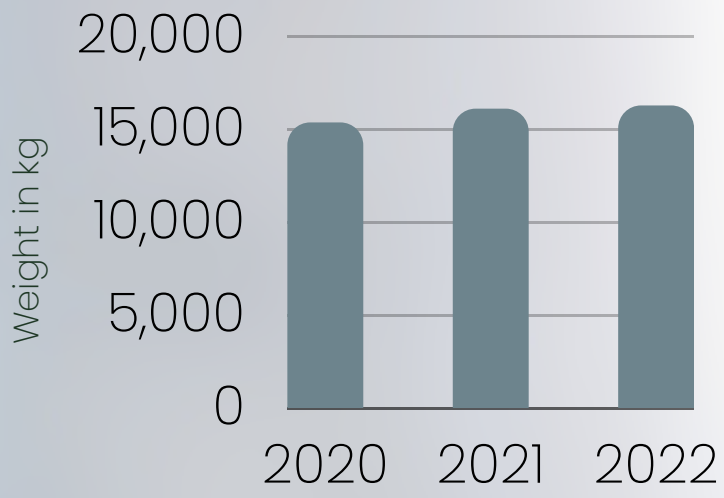


Figure 5: Cumulative of the average curb weights of all studied car manufacturers (2020-2022)

Financial value

The financial value of the total embodied carbon emissions of all studied car brands was 41 billion euros (BEUR) in 2022, accounting for 2.3% of the value of all cars sold during the same period. In 2021, the financial value of total embodied carbon emissions was 36 BEUR, representing 2.53% of the value of all cars sold that year, and 29 BEUR in 2020 (2.52%).

Year of Car manufacturing	Total embodied emissions (MmtCO2e)	Financial value (BnEUR)*	Total value of all sold cars (BnEUR)	% cost of CO2 emissions out of sold cars value
2020	293	29	1256	2.33
2021	362	36	1429	2.53
2022	411	41	1627	2.52

**Carbon cost assumed: 100 EUR/tCO2e*

Key takeaways

1. Total embodied carbon emissions have been increasing between 2020-2022, primarily due to higher car production volumes, but also due to cars becoming larger and heavier. A key driver of increased car size and weight is the increased production of EVs.

2. The total embodied carbon emissions per kilogram of produced cars across all studied car manufacturers shows slight increase from 2020 to 2022. There are not significant changes and can be considered relatively stable over the years.

3. There are notable variations in embodied carbon emissions per kilogram of sold cars for each car brand. These variations could be attributed to differences in reporting methodologies or differences in the average weight of cars produced.

4. Monetized embodied emissions account for 2% of the total value of all sold cars, indicating a significant financial impact relative to the prices of the sold cars.

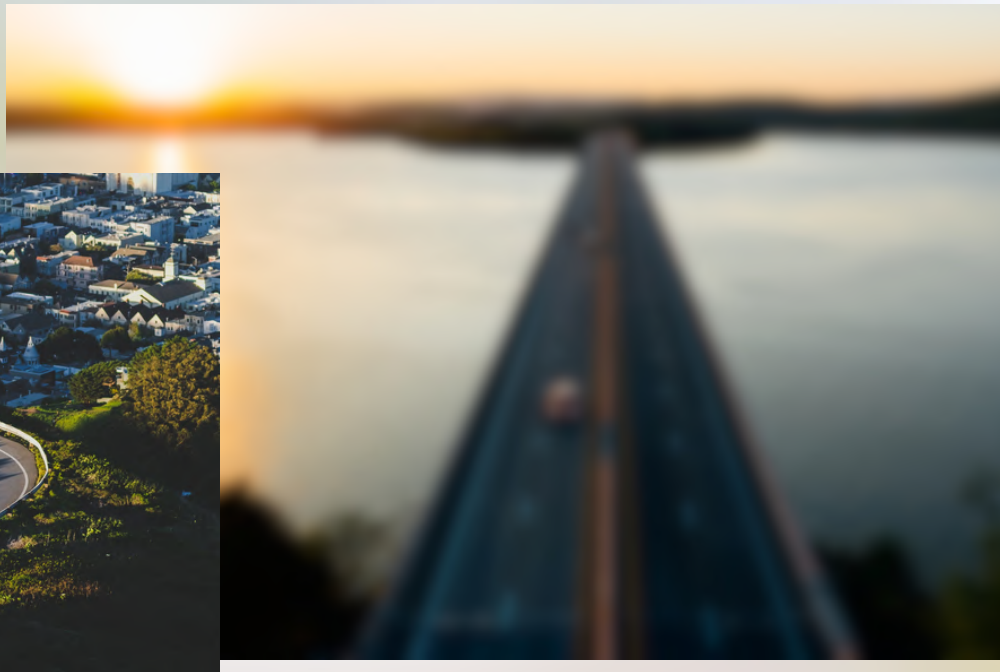
5. It's worthwhile considering the dual-sided nature of EVs. While it is true that the carbon footprint of the manufacturing process is higher compared to internal combustion engine vehicles, the overall benefits of EVs cannot be overstated.

Final remarks

The automotive industry is one of the largest and most energy intensive industries in the world. In our global journey toward net-zero, the automotive industry will play a crucial part.

Measuring and reducing the embodied carbon emissions is vital. Collaboration among car manufacturers, suppliers, and other stakeholders will become increasingly important for driving these changes.

This report serves as **a call to action**, fueling a discussion about addressing the carbon footprint of the entire value chain.



Claims Carbon

Questions?

Reach out to us

Vartika Gokhale

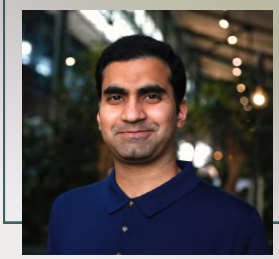
Carbon Data Analyst

Markko Waas

CEO

Niklas Rosenberg

CPO



Shahab Zafar

Product and Delivery Specialist

Espen Husstad

Chairman and Co-Founder

Solomiia Pereviznyk

Marketing manager

Learn more:

claimscarbon.com