

The new Audi R8

Life Cycle Assessment



Vorsprung durch Technik

Audi



Audi R8 – the life cycle assessment



Audi has compiled a detailed life cycle assessment for the Audi R8 Coupé V10 plus 5.2 FSI quattro 449 kW S tronic** (hereinafter: new Audi R8). One of the bestselling models of the previous model series, the Audi R8 Coupé V10 plus 5.2 FSI quattro 404 kW S tronic* (hereinafter: predecessor) was compared with the new Audi R8.

Thanks to new lightweight construction measures, the new Audi R8 weighs 40 kg less than its predecessor. This weight reduction is attributable above all to the increased use of carbon fibre reinforced polymers (CFRP).

What effect the changes in weight – and also in the material mix and engine efficiency – have on the life cycle assessment is described and explained in more detail on the following pages.

fuel consumption and emission values:

* Audi R8 Coupé V10 plus 5.2 FSI quattro 404 kW S tronic (predecessor): fuel consumption: urban: 19,9l/100km, country: 8,6l/100km, combiend: 12,9l/100km; CO₂ emissions combiend: 299 g/km; efficiency category G

** Audi R8 Coupé V10 plus 5.2 FSI quattro 449 kW S tronic (new model): fuel consumption: urban: 17,5l/100km, country: 9,3l/100km, combiend: 12,3l/100km; CO₂ emissions combiend: 287 g/km; efficiency category G



Audi R8 – the body

Lightweight construction is one of Audi's main areas of expertise. The decisive factor in this systematic lightweight construction concept is the Audi Space Frame (ASF), which weighs only 200kg thanks to an innovative multi-material construction principle. The body of the new Audi R8 is made from aluminium and CFRP using an intelligent material mix, so is absolutely in keeping with the Audi principle of "the right amount of the right material in the right place".

The front and rear sections of the new R8 are made entirely of aluminium castings, profiles and sheeting. CFRP material is used wherever it yields even better results than aluminium – the rear panel, the centre tunnel and the three-part B-posts are made of CFRP. These large components, which are manufactured using the efficient resin transfer moulding (RTM) method, form an ultra-high-strength, virtually torsion-free backbone for the ASF. They account for 13 percent of the ASF. The outer skin of the new Audi R8 complete with doors and lids is made entirely of aluminium.

All in all, Audi's engineers have succeeded in cutting the unladen weight of the car by quite a few kilograms. The predecessor had an unladen weight of 1,670kg whereas the unladen weight of the new Audi R8 is now 1,630kg. The low overall weight demonstrates Audi's lightweight construction expertise. It also especially benefits acceleration, handling, fuel consumption and, last but not least, life cycle assessment.

Audi R8 Coupé**

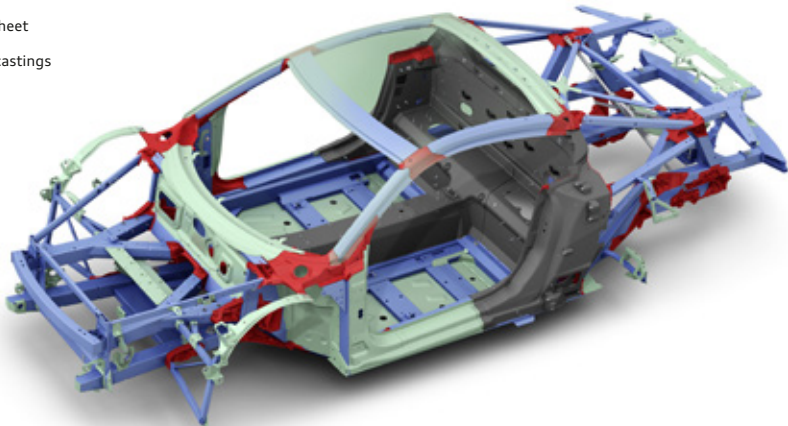
Audi space frame in multimaterial construction

■ Carbon fiber-reinforced plastic (CFRP)

■ Aluminum section

■ Aluminum sheet

■ Aluminium castings



fuel consumption and emission values:

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Audi R8 – the materials

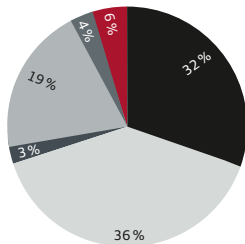
The materials that are used have a major influence on the results of the life cycle assessment. For example: Polymer materials such as carbon fibre reinforced polymers (CFRP) are more energy-intensive to produce than steel so their production process has a bigger impact on greenhouse gas emissions, but thanks to their superiority for lightweight construction and thus their contribution to cutting fuel consumption, they can have a positive impact in the use phase.

The inventory of materials was determined for the models under consideration and summarised according to VDA classification 231- 106.

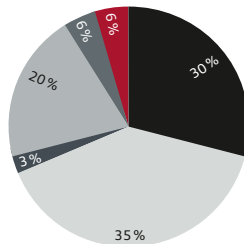
The weight reduction of 40 kg compared to the predecessor was achieved mainly by the increased use of CFRP. In the inventory of materials, this measure is evidenced by a decrease in iron and steel materials of around two percentage points and of light alloys of around one percentage point. Meanwhile the use of CFRP has increased the other materials content by about two percentage points. The proportion of polymer materials, too, has risen by about one percentage point. On the new Audi R8 the tunnel, rear wall and B-posts are made of CFRP; these parts were still mainly of aluminium in the predecessor.

Material inventory of the analysed models

Audi R8 Coupé V10 plus 5.2 FSI quattro 404 kW S tronic* (predecessor)



Audi R8 Coupé V10 plus 5.2 FSI quattro 449 kW S tronic (new Audi R8)**



- 1. steel/iron
- 2. Light metals
- 3. Non ferrous
- 4. Special purpose metals
- 5. Polymers
- 6. Process polymers
- 7. Other materials
- 8. Electronics/electrics
- 9. Fuels and auxiliary means

fuel consumption and emission values:

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Audi R8 – the results of the life cycle assessment

Thanks to weight reduction due to the increased use of CFRP and more efficient engines, the new Audi R8 cuts greenhouse gas emissions by 2.6 t over its entire life cycle compared with its predecessor. This figure represents a reduction of about three percent.

Even though more extensive use of CFRP increases the global warming potential in the production phase compared with the predecessor, the break-even point is reached at just under 56,000 km. From that point on, the global warming potential improves with every kilometre thanks to more efficient engines, the greater use of lightweight construction and the lower fuel consumption that this translates into.

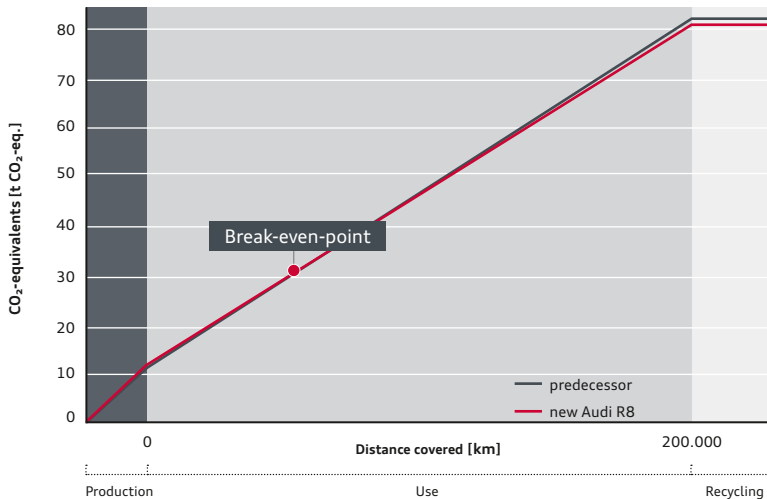
Over the entire life cycle of 200,000 km, the new Audi R8 consequently generates 81.6 t of greenhouse gas emissions, whereas its predecessor generated 83.8 t of greenhouse gas emissions.

The new Audi R8 also achieved a slight improvement with regard to photochemical ozone creation potential and acidification potential.

Reduction in more than half of categories

Greenhouse gas potential	- 3 %
Eutrophication potential	0 %
Ozone depletion potential	+1 %
Photochemical ozone creation potential	- 1 %
Acidification potential	- 1 %

Greenhouse gas emission values for the entire life cycle of the Audi R8



The additional burden caused by more lightweight construction during the production phase of the new Audi R8 is written of just under 56.000 km.

Special focus:

recycling of carbon fibre reinforced polymers

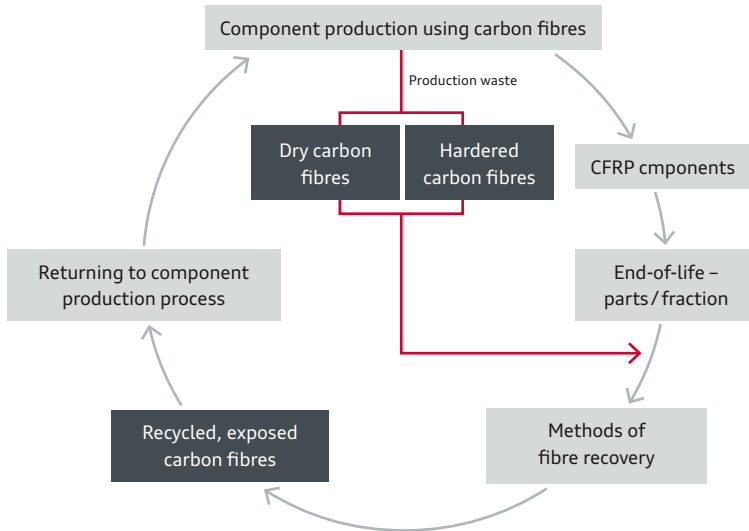
Lightweight materials such as carbon fibre reinforced polymers (CFRP) are very energy-intensive to produce, so they have a high impact on the life cycle assessment. Thanks to their good mechanical properties and low density, this material has a high lightweight potential. Recycling and reuse of carbon fibres in Audi products are interesting prospects from both an ecological and an economic viewpoint. Environmental impacts can thus be reduced and resources protected.

Audi already collects waste from dry and hardened carbon fibres generated during the production phase in order to recover the fibres and return them again to the production cycle.

The aim is to keep optimising the recycling methods for dry and hardened fibres, as well as develop methods of reusing fibres recovered in this way. It is important to obtain reproducible quantities and a consistent, tested standard of quality of recycled carbon fibre semi-finished products.

Creating intact material cycles, as illustrated in the following diagram, is an important task in vehicle development that makes a valuable contribution to the efficient use of resources.

Cycle management of carbon fibre reinforced polymers



Conclusion

The public today tends to judge vehicles to a large extent by their fuel consumption. Here too, Audi looks one step ahead. Its life cycle assessment analyzes effects on the environment for the vehicle's entire lifetime. The use of sustainable materials and manufacturing processes can greatly reduce these effects.

The life cycle assessment that Audi has compiled for the new Audi R8 shows that the new model has improved in key environmental categories. For example it already could compensate for the increased emissions in the production phase from energy-intensive lightweight materials early on in the use phase.

At Audi, the assessment of a car over its entire life cycle is crucially important. The same approach applies whatever the model, and forms part of the fundamental strategic drive for sustainable, resource-conserving mobility.



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Further information on official fuel consumption figures and the official specific CO₂ emissions of new passenger cars can be found in the “Guide on the fuel economy, CO₂ emissions and power consumption of all new passenger car models,” which is available free of charge at all sales dealerships and from DAT Deutsche Automobil Treuhand GmbH, Hellmuth-Hirth-Str. 1, 73760 Ostfildern-Scharnhausen, Germany (www.dat.de)