Avoided emission calculations: Autocirc Group methodology description

Avoided emission methodology

Avoided emissions are a visualisation of emissions avoided when using a less emission-intensive solution than the baseline. In contrast to carbon footprint, which refers to the negative environmental impact throughout the life cycle of a product, the term avoided emissions refers to the positive impact of a product throughout its life cycle.

Our avoided emission calculations are based on the following equation:

$$Footprint_{Baseline} - Footprint_{Offered\ solution} = Avoided\ emissions_{Product}$$

Where:

Footprint Baseline = production of a new car part

Footprint Offered solution = harvesting of reused car part (aka the "Autocirc's solution).

Calculations

Life-cycle assessment is a quantitative analysis of the environmental aspects of a product over its entire life cycle, from raw material extraction (cradle) to end-of-life (grave). Accordingly, a full life-cycle assessment is called cradle-to-grave.

To calculate our avoided emissions, we first had to conduct a partial LCA (cardel-to-gate) for the production of a new car part, as this information was not publicly available. In order to calculate avoided emissions, we also need to conduct a partial LCA for our reused car parts to determine the climate impact of harvesting car parts for reuse.

We choose to do a partial LCA, which excludes phases that are considered to be equivalent when comparing the life-cycle impact of two alternative solutions. This is done since the transport to customer, use phase and disposal/ recycling for baseline solution and Autocirc solution can be assumed to have equal climate impact, including them in the calculation would not influence the outcome of the avoided emission calculation.

System boundaries for baseline solution calculation:

Given that we use partial LCA in our calculations, the calculations will not include the entire LCA scope. The parts that lie outside are visualized below in the description of system boundaries.

A cardle-to-gate (incl. emissions until the point of sale) perspective was used for these calculations. Life cycle stages starting from manufacturing and ending before transport to the customer. Considering the assumed functional equivalence of car parts in both scenarios, transport to customer, packaging materials, use phase, transport to EOL, and EOL processing are considered identical in both solutions and thus can be left out of the equation as they do not affect the comparison.

Baseline solution

The carbon footprint CF of a component is calculated as:

$$CF = (\sum_{i=1}^{n}(W_{total} \times f_i \times EF_i)) + (W_{total} \times pw)$$

where:

- CF = Total carbon footprint of the component (kg CO_2e)
- W_{total} = Total weight of the component (kg)
- f_i = Weight fraction of material *i* in the component (dimensionless, e.g. 0.3 for 30%)
- EF_i = Emission factor for material *i* (kg CO_2e per kg material)
- n = Number of materials in the component
- pw = production waste emission factor

For each material in the part, the weight share is multiplied by the material's emission factor. The sum of all materials' contributions gives the total carbon footprint of the component.

Information source

W_{total} = We use internally collected data to identify the average weight for parts, which are categorized by part code.

f_i & n = Identified through data sources and internal examination by harvested parts.

EF_i = Identified using LCA data source (Ecoinvent) (cardle-to-gate).

pw = identified using LCA data source (Ecoinvent) (total climate change) from waste that occurs during the production process

Limitations

Ideally, we would also have included manufacturing emissions (Scope 1 and 2) as well as production-related transport in the calculation of the baseline solution scenario. However, since these data points cannot be identified in either the cradle-to-grave LCA dataset or through publicly available sources suitable for a desktop analysis, we have chosen to exclude them from our calculations. Consequently, we adopt a conservative approach and acknowledge that our estimation of the baseline solution scenario does not fully represent the complete picture.

Autocirc solution

Emission categories included within system boundaries are:

- Sourcing of cars (inbound transport) (kg CO_2e)
- Harvesting of parts (including relevant emissions from scope 1, scope 2, scope 3 categories: 3.1, 3.2, 3.3, 3.4) (kg CO_2e)

Following emissions within these relevant emission categories) are excluded:

- 3.1 – Packaging (since it is assumed to be the same for baseline solution)
- 3.4 – Outbound transport (since it is assumed to be the same for baseline solution)

Data to calculate carbon footprint of the offered (Autocirc) solution was gathered from an average Autocirc harvesting process (such as transport of cars to the dismantler, electricity and heat use, and the use of consumables and capital goods). The data is based on ESG and sales data from Autocirc Group 2024.

Visualisation of Autocirc solution calculations in kg CO2e:

$$\frac{(Scope\ 1 + Scope\ 2 + 3.1 + 3.2 + 3.3 + 3.4)}{Total\ number\ of\ sold\ parts} = CF/part$$

OR

$$\frac{(Total\ emissions)}{minutes\ worked} \times minutes\ spend\ on\ dismantling\ a\ part = CF/part$$

Avoided emission calculations

Avoided emissions are thereby calculated as follows at a part code level:

$$\left(CF = \sum_{i=1}^{n} (W_{total} \times f_i \times EF_i) \right) - \left(\frac{(Scope\ 1 + Scope\ 2 + 3.1 + 3.2 + 3.3 + 3.4)}{Total\ number\ of\ sold\ parts} \right)$$
$$= Avoided\ emissions_{Product}$$