

Avoided Emissions

Methodology

Definitions

On-platform sales/transactions are defined as cases of product sale where the marketplace managed the payment through a payment service offered by the marketplace.

Off-platform sales are defined as cases of product sale where the buyer and seller connected through the marketplace (classifieds), but managed the sale outside of the platform.

Scope

Re-Commerce marketplaces assessed:

[willhaben](#)

The analysis was based on data from more than 8,1 million items sold¹ on Willhaben, further enriched by insights gathered from 23.399 users about their purchasing and selling behaviours.

Product categories included in the analysis:

- Baby / Kind
- Beauty / Gesundheit / Wellness
- Bücher / Filme / Musik
- Computer / Software
- Freizeit / Instrumente / Kulinarik
- Games / Konsolen
- Haus / Garten / Werkstatt
- Kameras / TV / Multimedia
- Mode / Accessoires
- Smartphones / Telefonie
- Spielen / Spielzeug

¹ Sold products are the total amount of products sold on the marketplaces. This is the sum of known sales (i.e. on-platform transactions) and assumed sales of classifieds, the latter based on an indicator provided by the marketplaces.

- Sport / Sportgeräte
- Uhren / Schmuck
- Wohnen / Haushalt / Gastronomie

The total number of different product categories accounted for in the calculations: 1.971

Exclusions

Real-Estate and Motorised Vehicles (including Parts and Accessories) were not considered due to the current challenges in developing a reliable life cycle analysis (LCA) methodology to measure the emissions savings accurately, specifically the significant variability in emissions, influenced by factors such as driving habits, maintenance, and fuel efficiency. This remains an area of future research and improvement, with the objective of contributing to and eventually including the measurement of impact from second-hand vehicles in the future.

Similarly, Services or Tickets and Arts & Antiques are omitted from the scope as they are deemed not to contribute to emissions avoidance — with Arts & Antiques regarded as unique items that do not replace new purchases.

Methodology

Here is a deep dive into the scientific LCA methodology used by Vaayu.

Approach

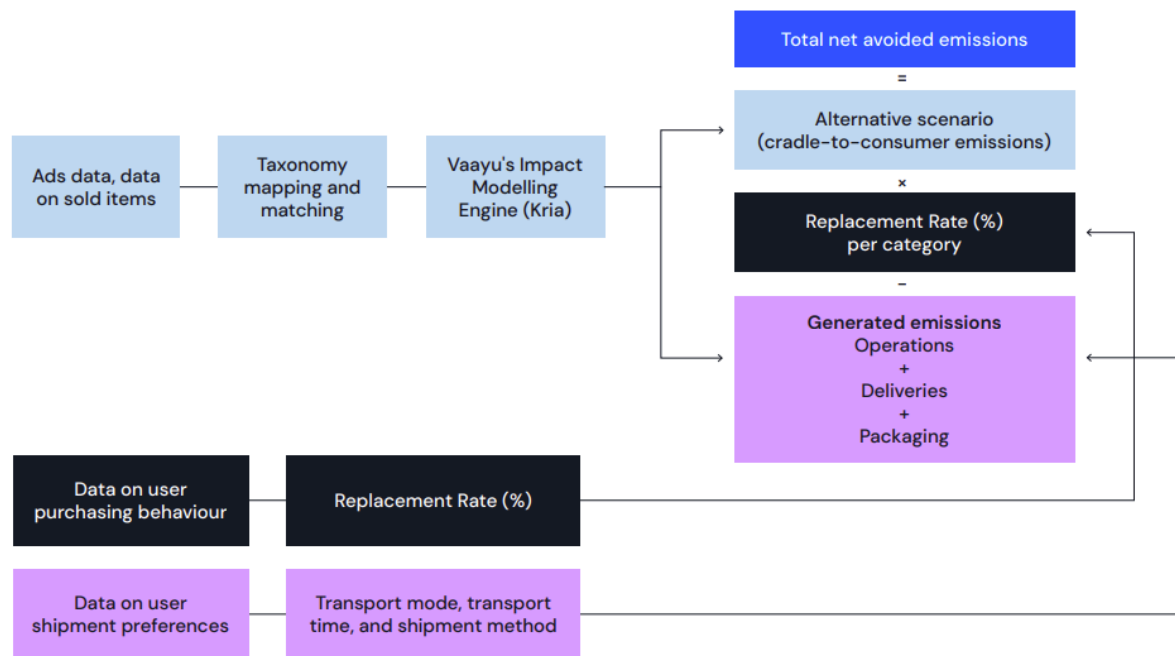
Vaayu's approach used consequential LCA to calculate avoided emissions, extending beyond examining individual product sales and aiming to evaluate the broader systemic impacts:

- Avoided emissions: the potential reduction in emissions resulting from users buying second-hand items instead of buying new products elsewhere
- Consequential LCA: a comprehensive method recognised globally for its robustness in calculating avoided emissions

The methodology closely followed the World Resource Institute² guidelines, which focused on comparative product emissions analysis.

² World Resources Institute (WRI), [Estimating and reporting the comparative emissions impacts of products](#), Russell, S., 2019.

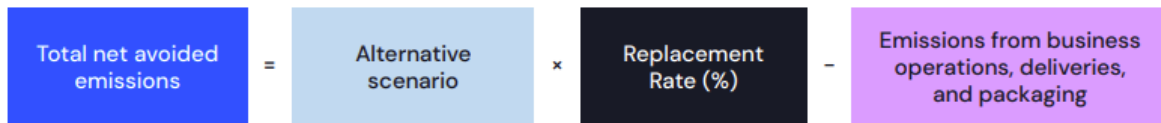
Chart: Our approach to calculating the avoided emissions of willhaben



Several factors influenced the potential to reduce emissions through second-hand purchases on willhaben:

- **Alternative scenario:** the emissions from producing and distributing a comparable new item (see more in the Product Carbon Footprint section below) which second-hand shopping on willhaben may “avoid” to a certain extent (the Replacement Rate)
- **The Replacement Rate:** the metric that assessed whether a second-hand item was a suitable substitute for a new one, indicating how likely it is that a second-hand purchase via willhaben replaced a new purchase (see more in the Replacement Rate section below)
- **Generated emissions:** included the emissions generated by second-hand purchases on willhaben in scope via their delivery and packaging, as well as the associated business operations from the overall management and maintenance of willhaben.

Chart: Calculating avoided emissions



LCA Methodology

To calculate the avoided emissions, Vaayu analysed more than 8.1 million second-hand transactions on willhaben across all relevant product categories. The information was processed using Kria, Vaayu's proprietary LCA Impact Modelling Engine and database.

To accurately quantify the total net impact, emissions from on-platform deliveries³ and packaging associated with all successfully sold items were also incorporated into the GHG inventory and emissions assessment.

Items from private sellers labeled as "new" were also considered to contribute to avoided emissions. While this marks a shift from the more conservative approach taken last year, it reflects the reality that these products are being re-circulated on Recommerce platforms. This decision is backed by key insights from our marketplace partners, indicating that these items are actively supporting circularity, rather than being treated as traditional first-time retail purchases.

Consumer Survey

To deepen the understanding of user behaviour, willhaben commissioned the following surveys in February-March 2026 :

- Two surveys per marketplace (one for buyers and one for sellers)
- Buyers responses 10.354
- Sellers responses 13.045

The purpose of the surveys was to gather essential data for calculating the Replacement Rate and the potential avoided emissions from the sale of second-hand items. They also collected additional delivery logistics data, including the types of packaging and packaging materials.

The survey size ensured a representative sample by considering factors such as market specifics, product category, and user activity levels on the marketplaces in the prior 6-12 months.

³ On-platform sales are defined as cases of product sale where the marketplace managed the payment through a payment service offered by the marketplace.

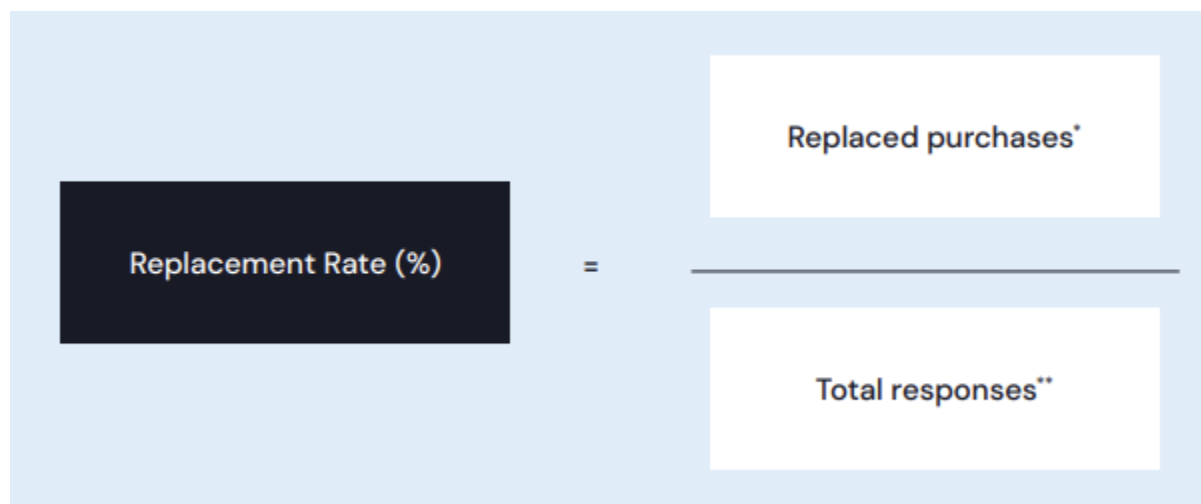
Replacement Rate

Calculating a perfect like-for-like replacement of new products with second-hand items is not straightforward. To account for this challenge, the Replacement Rate is:

- A key metric driven by consumer behaviour, measuring the substitution ratio and clarifying how effectively second-hand items can replace new ones
- Pivotal in evaluating the environmental advantages of reuse
- An influencer in calculating the extent to which carbon emissions from the production and distribution of similar new products are “offset” by purchases on Recommerce marketplace

In this analysis, users were surveyed on their rate of avoided purchases within the product categories specified. The Replacement Rate was derived from responses of close 10.354 buyers to the survey question: *“If you had not found this product on the platform, would you have bought this, or a similar product, brand new?”*

Chart: Calculating the Replacement Rate



* Replaced purchases = 100% of ‘Yes’ and ‘Likely’ responses and 50% of ‘Maybe’ responses while excluding all unplanned purchases. 50% of the users who responded “Unlikely” and “No, definitely not” for the reason *“I choose to always buy second-hand items whenever possible”* were additionally counted towards the replaced purchases this year.

** Total responses = total number of responses to the above core question. All replies from professional sellers or businesses were omitted from the calculations of the Replacement Rate. It is assumed that their engagement is primarily for economic benefits rather than sustainability-driven motivations. Additionally, their responses do not accurately represent the purchasing patterns of typical users, hence their exclusion.

In comparison to last year, this year’s methodology additionally accounted for respondents who claim to purchase second-hand exclusively. To address potential social desirability bias—and drawing on external research regarding the proportion of consumers who truly buy only

second-hand—we have conservatively included only 50% of these respondents in the avoided emissions calculation. This adjustment ensures a more realistic estimation of substitution effects while still recognizing the impact of dedicated second-hand buyers.

Alternative Scenario

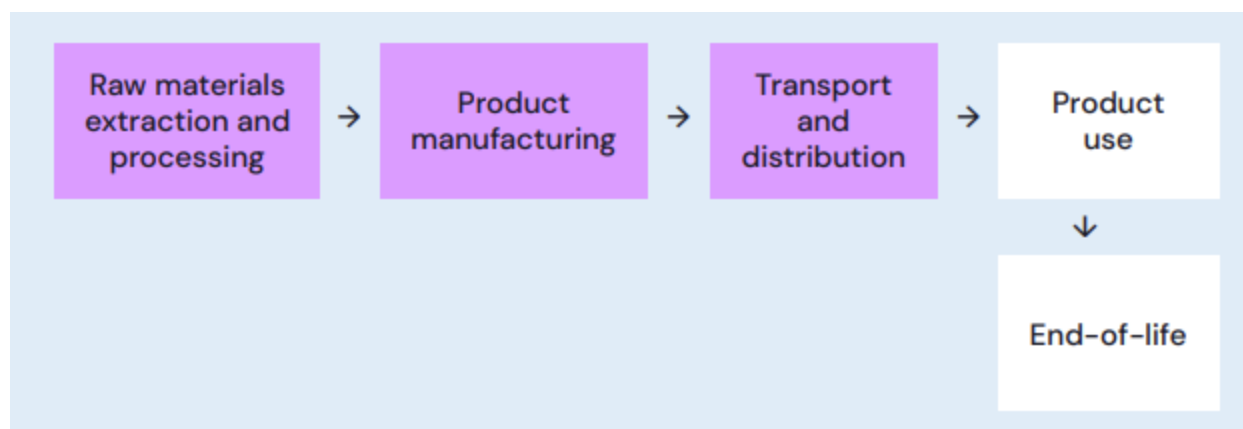
To estimate the carbon emissions avoided by purchasing second-hand items on a Recommerce marketplace instead of their comparable new ones, it was necessary to account for the emissions from producing new products through their distribution.

Vaayu evaluated this impact using a cradle-to-consumer life cycle assessment approach. This approach includes the calculation of energy and material usage, transportation, extraction of natural resources and waste management at each stage of the product life cycle.

Emissions from the product use and end-of-life stages were excluded from the avoided emissions calculations because the impacts from using both new and second-hand products are considered equivalent in the comparative analysis.

This means that the emissions generated during the use and disposal of products have been assumed to be the same for both second-hand and new products, and so neutralised each other when comparing the two scenarios (i.e., purchasing a second-hand product versus buying a similar new product).

Chart: The product life cycle considered (both second-hand and new products)



It is important to note that the product carbon footprint assessment for calculating potentially avoided cradle-to-consumer emissions, as well as the assessment of emissions from deliveries and packaging of second-hand items, was performed at the product category level. This approach accounted for the Recommerce marketplace-specific taxonomy tree.

The data analysed were available only at the product category level, meaning different product types can be listed under a single category. LCA data were therefore used by assuming certain reference products for specific product categories.

Consequently, the calculated emissions should be interpreted as representative of the entire category rather than individual transactions or specific product models.

In cases where a direct correspondence in Vaayu's taxonomy⁴ could not be established for a product category, a proxy or average emissions figure was applied to ensure comprehensive assessment (for example a remote controlled car might be mapped to a drone).

Update 2025

For this assessment the majority of the underlying product carbon footprints are unchanged from the previous year's research. A limited number of new representative products have been added where a single footprint previously stood in for items with materially different impacts, improving the granularity of the mapping. Holding all other inputs constant, these additions changed the result by 4.18% relative to the previous year's product carbon footprint set.

Here is a deep dive into the scientific LCA methodology used by Vaayu:

 [Vaayu | Representative Product Footprint Methodology_for external use](#)

Generated Emissions

Deliveries

Emissions associated with deliveries were analysed using Vaayu's unique logistics model, integrating data from consumer surveys to enhance accuracy.

This model calculates the carbon emissions associated with various delivery methods, including meet-ups, pick-up drop-off (PUDO) points, and home deliveries, employing a fuel-based calculation approach based on the total distance travelled during delivery.

Logistics calculations for on-platform sales:

- Primary data regarding seller and buyer locations (home or PUDO points), carrier and delivery methods was used where available
- When the cities, localities or postal codes of both the buyer and seller were available, the distance between the two was calculated

⁴ The classification system within Vaayu's database that is used to categorise and store emissions and impact data.

- Where both the buyer and seller locations could not be geolocated (e.g. only having postal code data for the seller), a country-specific, population-weighted average distance was used
- In the absence of explicit delivery methods, multiple approaches were taken:
 - Where carrier was used and carrier name was provided: Research was conducted by Vaayu to determine the delivery methods offered by the carrier partners
 - Where other delivery methods were used: Delivery method distributions for both origin and destination were taken from the seller and buyer surveys, respectively
 - Where there was not a statistically adequate sample size: Europe-market average delivery method distributions, derived from the 2024 user survey, were used instead
- The package mass and volume of each delivery were estimated based on the mapped category to account for the variance in categories being sold across the marketplace

Logistics calculations for off-platform sales⁵:

- The distribution among meet-up, PUDO, and home delivery methods was derived from the buyer and seller surveys and then used to calculate a weighted average delivery impact per category
- The proportion of meet-ups was determined by averaging the responses from both sellers and buyers
- Where there was not a statistically adequate sample size, Europe-market average delivery method distributions, derived from the 2024 user survey, were used instead
- Meet-up distances per marketplace and category were estimated using the seller and buyer survey responses
- Transport times were multiplied by average vehicle speeds to determine distance per time frame and vehicle type
- A weighted average distance for each vehicle type was then calculated, and a further weighted average was computed based on the distribution of vehicle types as indicated by the survey
- Where there was not a statistically adequate sample size, the European market meet-up distance, derived from the 2024 user survey, was used instead

Packaging

Emissions attributed to secondary packaging were calculated using Vaayu's Logistics Calculation Engine, where the secondary packaging distribution on a per-category basis was derived from the survey data.

⁵ **Off-platform sales** are defined as cases of product sale where the buyer and seller connected through the marketplace (classifieds), but managed the sale outside of the platform.

Each packaging element type was estimated by calculating volume or mass using quality LCA data in Vaayu's taxonomy.

The emissions impact of each element was multiplied by its distribution within a product category, so the emissions contributions from secondary packaging could then be calculated on a per-sale basis.

Where there was not a statistically adequate sample size, a Europe-market packaging distribution (from the surveys performed in 2024) was used instead.

Reused packaging elements were presumed to have zero emissions since they are designed for single use only and were therefore excluded from these calculations.

Business Operations

The calculation of willhabens operational footprint encompassed a comprehensive inventory of Scope 1-3 emissions related to business operations in line with the minimum boundaries defined in the technical guidance by the GHG Protocol⁶.

The organisational boundary for the report was set using the operational control approach, including all operations under willhabens control or its subsidiaries.

The emissions per Scope were calculated as follows:

- Scope 1, emissions from fuel combustion in leased or owned company vehicles;
 - Quantified using primary data on fuel consumption
- Scope 2, emissions from electricity, heating and cooling for leased offices, electric company vehicles and on-premise data centres;
 - Calculated and tracked using market-based and location-based methods, in line with the GHG Protocol Scope 2 technical guidance
- Scope 3, emissions from purchased goods and services, capital goods, energy (not covered by Scope 1 or 2), upstream transportation, waste, business travel, employee commuting and use of sold products
 - Employee commute, waste generated in operations, digital platform use, hosting services and business travel were calculated using activity-based methodology
 - For categories including purchased goods and services and capital goods, a mixture of activity-based and spend-based methodologies were applied

Updates 2025

- Upstream Transportation & Distribution calculation methodology has slightly changed and improved since last year. Vaayu's updated model aligns more closely with the Product Environmental Footprint (PEF) Category Rules for Apparel & Footwear V3.1

⁶ Greenhouse Gas (GHG) Protocol, [Corporate Standard](#).

(2025), which is primarily mass-based calculation methodology overall and it is entirely mass-based with respect to inbound deliveries.

About

About Vaayu

Vaayu is the world's first automated software empowering brands and businesses within the retail industry to track and cut their carbon and environmental impact in real-time. By leveraging proprietary AI and machine learning technology, Vaayu calculates impacts like emissions, water and waste across product, packaging and logistics using certified⁷ life cycle assessment (LCA)⁸ methodology to provide granular insights and inform data-driven decision-making.

Named one of TIME's Best Inventions⁹ and with more than 100 brand partners, Vaayu has pioneered research into the climate impact potential of circular business models and calculated product footprints at scale for partners including Klarna, New Balance and Redcare Pharmacy.

To find out more, visit vaayu.tech.

⁷ Vaayu's methodology is [certified by TÜV Rheinland](#).

⁸ LCA is a systematic method for evaluating the environmental impacts of a product or service throughout its entire life cycle, from raw material extraction to disposal.

⁹ Vaayu is one of [TIME's Best Inventions 2022](#) in the Sustainability category.