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Reduced impact on climate change from reuse of IT equipment at Atea

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This report has been reviewed and approved in accordance with IVL's audited and approved management system.

Content

Background

In 2019, at the request of Atea, IVL, the Swedish Environmental Research Institute, has assessed the savings in terms of greenhouse gas emissions that reuse of IT equipment can result in. The underlying calculations of the assignment are based on IVL's climate change calculation model and database for reuse of IT equipment. Atea is using the outcome in stakeholder communication to highlight the benefits from reuse of IT equipment.

This report aims to provide a good understanding of how reuse of products can contribute to reduced impact on climate change. It should also provide an overall apprehension of the assumptions and data that underpin the calculations used to assess the benefits reuse have on climate change.

The report does not describe in detail the model, the calculation tool, and database for IT equipment that form the basis for the result. The reader is instead referred to the research project in which these parts were developed and described: *Benefits of reuse: model for database creation and greenhouse gas emissions database for IT products* [1].

Reuse leads to reduced impact on climate change

Reuse means in this assignment that products receive an extended lifetime and come to continued use through change of ownership. This way, the utilization of the product is extended, and another owner can continue to benefit from its features.

The assumption that reuse of products leads to environmental benefits is based on that already produced products gets its lifetime extended and replaces the need for new ones. This leads to a reduced need for material resources and a reduced environmental impact - such as the impact on climate change - by producing fewer products in total. The handling of products that reuse entails has limited environmental impact compared to the potential savings and thus reuse results in reduced overall impact. Consequently, reuse contributes to resource efficiency and circular business models.

This is how the avoided greenhouse gas emissions of reuse are calculated

The model that forms the basis for the calculations can be used for various types of products (see Figure 1). It is based on the assumption that a reusable product replaces the need for a new product. This leads to reduced emissions of greenhouse gases as no new product needs to be manufactured, transported or waste managed. The prerequisite for the model is that reuse of products leads to that there is no need for new products.

The reuse, on the other hand, often means that products, that are to be reused, must be processed and handled in some way. This may involve transportations between different owners or that products need to be processed before its change of ownership, for example through reconditioning. In the model, such processing is assumed to have an environmental impact and therefore entails a negative impact on climate change. Theoretically, this could lead to that the entire benefit of reusing products is eliminated.

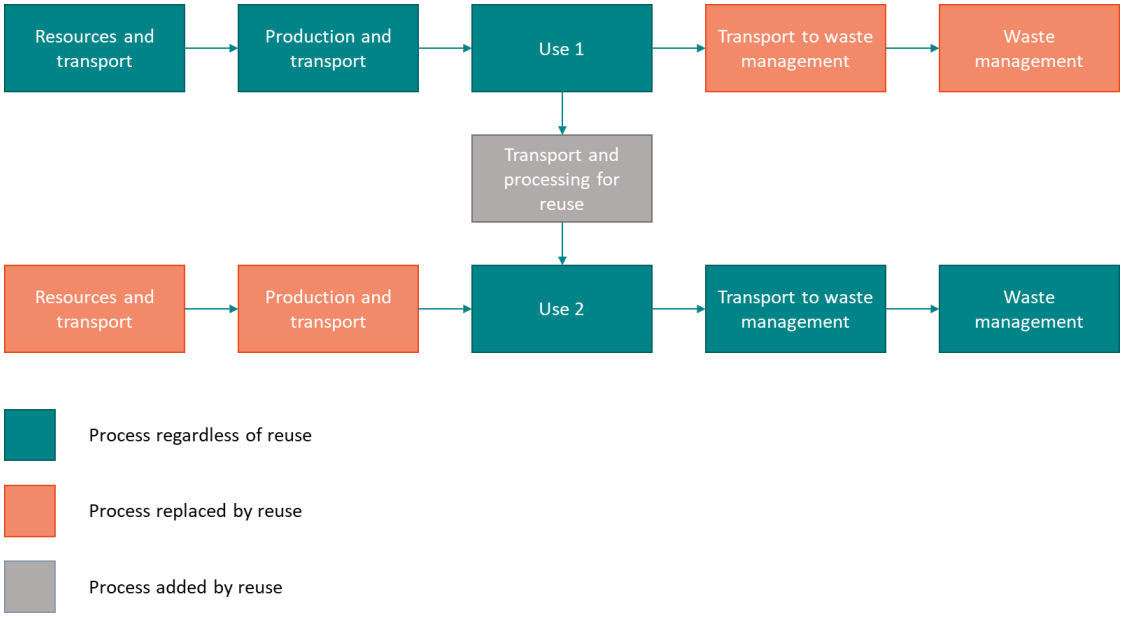

Figure 1. *Processes along the life cycle of a reused product that contribute (positively or negatively) to climate change. The figure also shows that some processes are not affected by the reuse of products.*

The model in Figure 1 can be extended and applied for products which are being reused several times.

To use the model and calculate the environmental benefits - and thereby the avoided greenhouse gas emissions - that reuse of a product can result in, the following equation can be used:

$$Environmental\ benefits = PROD_u + TRP_{up} + AVF_u + TRP_{ua} - TRP_{re} - REKOND \quad (1)$$

- $PROD_u$ = Environmental impact of avoided production.
- TRP_{up} = Environmental impact of avoided transport associated with the production of a new product.
- AVF_u = Environmental impact of avoided waste management (for the product replaced by reuse)
- TRPua = Environmental impact from avoided transport to waste management.
- TRPre = Environmental impact of transportation between the first and the second owner.
- REKOND = Environmental impact from reconditioning (handling processes) of the reused product

How has IVL calculated on Atea's products?

Based on the model of reuse and environmental impact data representing production of IT equipment, IVL has developed a tool that can be used to assess the avoided greenhouse gas emissions as a result of reuse of IT equipment. This tool has been used in conjunction with Atea on reuse to calculate the savings their business model generates.

The calculations have been supplemented with information from Atea about their handling of IT products in concurrence with reuse. The outcome; a database with nine different product categories and associated avoided greenhouse gas emissions (Table 1). The numbers indicate the total avoided greenhouse gas emissions as a result of Atea's business model on reuse of IT products. Figure 2 illustrates the relationship between input data, the calculation tool and results.

Table 1. *Compilation of the product categories included in Atea's database and related savings of greenhouse gas emissions as a result of reuse.*

Product categories Atea	Avoided emissions of carbon dioxide equivalents per product category reused [kg CO2 equivalents / unit]
Notebook	While the methodology has been disclosed, the figures in this table are considered proprietary and confidential company information, and therefore, are not subject to disclosure.
Desktop	
iPhone	
Tablet	
Servers	
TFT-monitors	
Printers	
AV-monitor	
Router/switch	

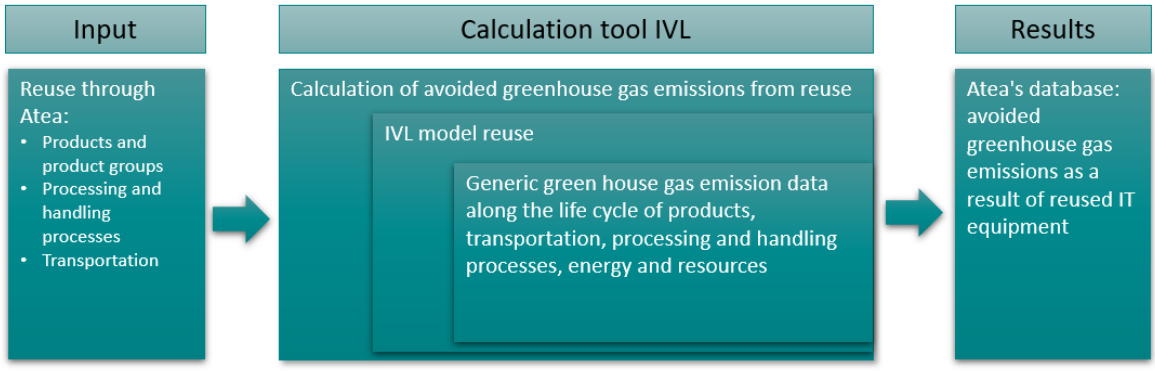

Figure 2. *Information collected by Atea and used as input to the calculation tool. The figure also shows the available information and data in the tool. It further illustrates that IVL's model for avoided environmental impact from reuse is used. Lastly, the figure shows that the result generated from the tool is a database of current product categories and the climate benefit that reuse at Atea generates.*

This is how the calculations are performed

The greenhouse gas data, on which the result is based, are taken from environmental impact data sheets published by manufacturers of IT equipment. These datasheets represent, in most cases, specific IT products and their carbon dioxide equivalent emissions throughout their life cycle. The environmental datasheets are publicly published by IT producers and can be downloaded on several different platforms [2], [3], [4], [5], [6]. The producers publish new and updated datasheets as new products are introduced to the market and as their product portfolio changes. In fact, this leads to that users, like Atea, are able to identify trends of improvement which can be used to track their own performance over time. In the current calculations, two types of data have been collected from the environmental datasheet published by IT producers:

- Avoided emissions from production of new products
- Avoided emissions from waste management

The savings as a result of avoiding transportation of manufactured products to customers and disposed products for waste management are calculated by using general transportation data in conjunction with the weight of the product.

In addition, the greenhouse gas emissions caused by handling of products for reuse is calculated. Emissions occur at:

- Processing and handling of products for reuse, such as reconditioning
- Transportation of products when collected and sent to and from reuse

Based on the information in the product environmental impact datasheets, an average value of greenhouse gas emissions for a specific product group can be calculated. In Atea's case, such averages have been created for a number of product groups, which are then grouped into product categories. With the help of information from Atea, regarding the product groups and volumes the company handles in reuse, total savings on climate change have been calculated. The figures for the different product categories represent weighted averages of product groups handled by Atea.

To calculate the emissions generated by Atea through their processing and handling of IT products for reuse, the tool uses data that represents specific process models for reuse of IT equipment [1]. The handling is expected to take place in Sweden and under Swedish conditions, for example, the greenhouse gas impact from electricity use is based on Swedish electricity mix. The handling processes do not specifically reflect Atea's reuse facilities but are by IVL considered to represent the company's handling in a good way.

The impact from Atea's logistic handling of products for reuse has been assessed on the basis that they are carried out by truck in Nordic conditions. The assumption is in line with how Atea transport products for reuse.

The environmental data provided by the calculation tool for modes of transport, energy carriers and natural resources are collected from Thinkstep's Gabi-professional database [7] and Ecoinvent's database v3.4 [8].

Less production of new products provides the greatest impact

The results for Atea's product categories show that avoiding the production of new products results in the greatest saving of greenhouse gas emissions - more than 95 percent. The remaining five percent is due to avoidance of transportation and waste management of the products that the reuse replaces.

The result also shows that the handling and transportation processes by Atea only contributes marginally to increased emissions. The overall savings of greenhouse gas emissions are hardly affected by those, which at most increase emissions by a few percentages compared to the savings it contributes to.

How can avoided emissions be accounted for?

Reusing products often involves several stakeholders who may all be interested in knowing how much of the greenhouse gas emission savings they can count as theirs. However, the result for Atea contains no allocation between different users or other stakeholders. The result represents the total avoidance of greenhouse gas emissions that reuse of IT equipment contributes to.

IVL recommends that allocation of the savings of greenhouse gas emissions as a result of reuse should be avoided if possible. This is in line with several standards in life cycle analysis where it is preliminary recommended to avoid allocation of environmental impact. Consequently, the risk for misinterpretation of the result is minimized and it helps the user to avoid incorrect conclusions.

If for some reason, the environmental benefits from reuse need to be allocated among stakeholders, IVL recommends sharing the benefit equally between users, through the 50/50 method [9]. In Atea's case, this means in practice that half of the savings of greenhouse gas emissions is accounted for by the first owner and the remaining half is allocated the second. In this way, potential middlemen, such as Atea, cannot account any of the benefits themselves, even though they contribute to that reuse occurs.

IVL recommends using the 50/50 method for distributing savings of greenhouse gas emissions as a result of reuse since:

1. it is a simple rule of thumb and comprehensible
2. both users must make active choices for reuse to occur
3. it provides both users an incentive to actively seek potentials of reuse

References

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7: Thinkstep 2019, Database 8007 Release date: 2018-07 (Gabi ts, software version 8.7.0.18. Database 8007)

8: Ecoinvent database v3.4

9: Ekvall et al. (2019) Modelling recycling in life cycle assessment.
Swedish Life Cycle Center, Chalmers University of Technology Report XX (Incomplete draft)

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