Principles of product carbon footprint calculation

Fossil emissions
Sandvik Mining and Infrastructure equipment

Sandvik conducts product-specific fossil GHG emissions calculations for mining and infrastructure equipment, following the main principles of ISO standards for life cycle assessment (LCA) and applicable Product Category Rules (PCR).

Sandvik Group GHG reduction targets have been approved by the Science Based Target Initiative. Our company's GHG emission inventories have shown that most of our GHG impact originates from the use of our products, followed by emissions from production of the raw materials used in our products.

We consider transparency important. Therefore, the main principles of relevant standards for life-cycle assessment and product carbon footprint, as well as the most relevant PCR, have been used as guidelines. This ensures that if comparisons are made with other manufacturers' products, it is possible to identify the ways in which the results can be compared.

PCR= Product Category Rules
GHG= Greenhouse Gas
ISO= International organization for standardization

Main calculation principles
We perform the calculation based on the best information available to us at the moment. We acknowledge that the accuracy of these calculations will improve in the coming years, particularly with emissions data from suppliers. We have invested in the further developing product-level emission calculations to enhance their accuracy and lead the industry.

We currently have limited pre-calculated emissions data from our supply chain, and many of the emission factors we use are based on averages.

Calculation method validation
The calculation method and this document have been validated by a third party, Sweco Finland Oy.

The validation was performed on a manually calculated Excel file that includes CO_2e emissions for the entire lifecycle of two products. A more detailed validation statement can be found [here].

Sandvik performs calculations based either on customer-specific machine structures and procurement data from its own data systems or average product data

Sandvik stores the data in its own databank, where it is available for calculations.

To increase the efficiency of its calculation process, Sandvik has developed an automated Power BI emission calculation tool that provides the customer-specific production emission estimates using data from Sandvik's system.

Standards followed
The life cycle is defined in accordance with LCA and product carbon footprint standards, as well as the relevant product category rules (PCR).

Only the life cycle stages from the PCR relevant to the product carbon footprint have been considered. Our calculations include all elements recommended by the PCR; however, we have deliberately chosen to focus on fossil emissions, as we believe these account for the majority of emissions from our equipment. Based on this approach, full alignment with ISO 14067 is not the primary objective. As more supply chain-specific data becomes available, we plan to incorporate missing biogenic contributions and land-use change into our calculations in the future.

Documents guiding the calculation:
Standards ISO 14040, 14044, and 14067
PCR document (by Environdec)
Class 4491 (version 4.0): Other special- and general purpose machinery and parts thereof*

*Our product technically does not fall under this PCR but it was used as a guideline in place of a better one

Life cycle stages and system boundaries

The calculation encompasses the entire life cycle of the product, from raw material extraction to end-of-life. Figure 1 illustrates the product's life cycle, and the elements included in the calculation.

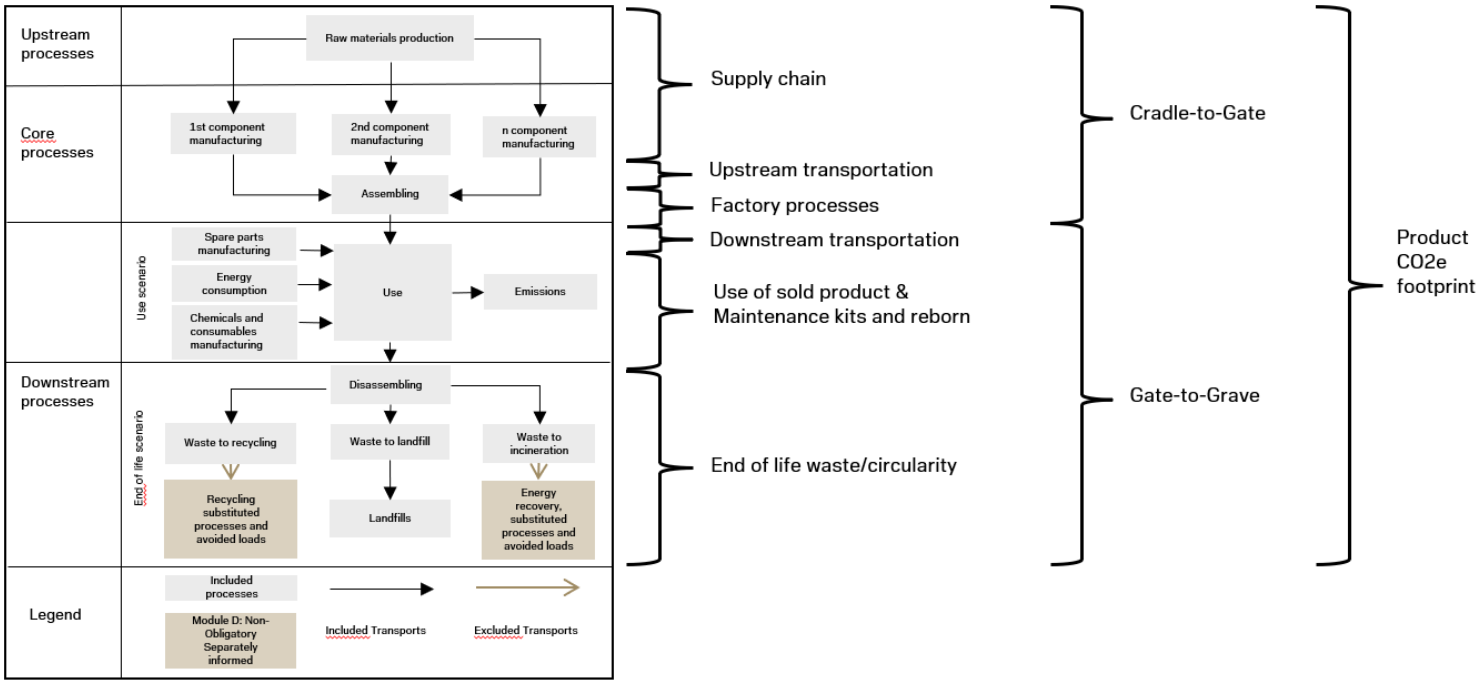

Figure 1: System boundaries according to the followed standards and Product category rules (PCR).

When discussing the fossil carbon footprint of a product, we are referring to the emissions calculated for a single piece of equipment. We acknowledge that customer-specific options can affect manufacturing emissions within the equipment model. Additionally, it is important to note that operating conditions and use profiles have a significant impact on the length of the product’s life cycle.

We use two different functional units to ensure the results are as transparent and comparable as possible. The primary functional unit is a single customer-specific product or an average product within a specific application model. The secondary functional unit is product use for one operating hour. We consider this allocation of emissions per operating hour more relevant, as lifecycle lengths can vary significantly depending on the customer.

Lifecycle phase	Description	Calculation method
Supply chain	Raw materials, machining or other processing carried out by our subcontractors. Includes also packaging materials.	Our production is primarily assembly-based. We perform emission calculations based on the product design structure of our equipment, and the weight of the components to be purchased are used as the basis for the calculation. We calculate the emissions for each component or material purchased separately and sum the emissions from the purchase level of the components to the emissions of the whole machine. Packaging materials, if any, are calculated same way. The contribution is currently calculated using Sandvik component category-specific average emission factors for various component groups. **Emission factor list for material and components:** In collaboration with the Technical Research Centre of Finland Ltd (VTT) in 2022, information and emission factors have been gathered for each component category in Sandvik's equipment supply chain. The emission factor for each component category consists of two parts: raw material production and processing, which together form the total GWP factor for all component categories. These emission factors have been primarily generated using data from the global Ecoinvent database. We will replace these average emission factors with emission data directly from suppliers as soon as it becomes available.
Upstream transportation	Transportation from our supplier to our factory	When we are using customer-specific structure, then the distance and transportation mode are determined with actual distances from suppliers to calculate the emissions for each material or component separately. In an average level calculation, we use average upstream transportation emissions calculated from customer-specific calculations. The assumption in both levels is that upstream transport is by road, and the emission factor is set accordingly.
Factory processes	Factory consumptions: Energy, fuels, water, waste, and other utility use of Sandvik's own production.	Emissions calculated based on annual production facility consumption are allocated to individual products. Factory consumptions is divided to product level as a mass-based share. To calculate emissions, we are using marked based emission factors for electricity and district heating etc.
Downstream transportation	Transportation from our factory to the customer's site	The distance and mode of transportation are determined with actual distances to customer to individually calculate the emissions for each product. In an average level calculation, we use average downstream transportation emissions calculated from customer-specific calculations. In both levels our system tells us which equipment is transported by land and which by sea. We select the emission factor according to the mode of transport.
Use of sold product	Emissions from diesel and/or electricity when using our product	The operating hours under lifespan are estimated based on average customer data, but can also be calculated using more detailed information from the customer if available. Both well-to-tank and tank-to-wheel emissions are considered. Operational emissions during the customer use phase are a significant contributor to overall emissions. Most drill rigs use electricity for drilling and rely on diesel or electricity for tramming. World average emission factor is used as a default value. Country specific location-based emission factors from IEA is used if we calculate emissions in a customer specific product level. If a customer-specific market-based emission factor is available to calculate emissions for a customer-specific product, we will use it.
Maintenance kits and reborn	Emissions from components and/or liquids that are changed during the product lifecycle	Life-cycle emissions from the manufacturing of maintenance components and fluids are calculated, taking into account the waste fraction of discarded components. Background data is a product-specific estimation from spare parts needed during the lifecycle. The weight of the components to be purchased are used as the basis for the calculation. We calculate the emissions for each purchased component or material separately and sum the emissions from the purchase of the components to the emissions of all maintenance components during lifecycle. The contribution is currently calculated using average emission factors for various component groups in the same way as the supply chain part. We will replace these average emission factors with data directly from suppliers as soon as it becomes available.
End of life waste / circularity	Emissions from final disposal based on material shares of product	At the end of the product's lifetime, it will be transported and disassembled for waste treatment. The assumption is that all components will eventually be transported to the final treatment. Each component category is divided to different recycling groups with category specific emission factors: material recycling, general non-hazardous waste, general hazardous waste, and energy waste.