

Greenline Print life cycle carbon footprint according to PAS 2050

Kroonpress Ltd.

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Scope

This life cycle greenhouse gas emissions quantification for printed products determines the cradle-to-gate carbon footprints of all print products that are printed and processed entirely in Kroonpress. The method described here is also applicable to other printing companies.

System boundary

This life cycle greenhouse gas emissions quantification for printed products is a cradle-to-gate assessment, which includes the GHG emissions and removals arising up to the point at which the product has reached the gate of the intermediate customer (publisher). This is an advancement compared to ordinary cradle-to-gate analyses where emissions accounting ends at the gate of the factory. However, the publisher can be regarded as the last step in the pipeline, even though its „production“ is outsourced to printers.

Emissions and removals

All emissions within this quantification are accounted for as carbon dioxide equivalent emissions.

Removals

This life cycle GHG quantification does not include removals from the atmosphere because the biomass contained in paper material will likely be recycled back into the atmosphere within a hundred years, which is the limit set by the PAS 2050 criteria. It should be noted that in some cases (books, notably), this threshold will be reached and a removal of CO₂ from the atmosphere will also be sustained for many print products for a considerable amount of time. However, within the scope of this quantification, this is not accounted for.

Carbon-neutral emissions

These are emissions that are neither accounted for as emissions nor removals but remain carbon neutral. Within this quantification project, these emissions occurred in three production steps:

- biomass incineration at paper factories to produce energy
- biomass incineration at district heat provider Fortum Tartu to provide central heating for Kroonpress Ltd.
- biomass incineration and wind energy generation at Eesti Energia to provide electricity for Kroonpress Ltd.

Emissions

Paper

Paper emissions were obtained either directly or, where available, through online services directly from paper manufacturers. The obtained paper manufacturers' carbon footprint data has been calculated according to the Framework for the Development of Carbon Footprints for Paper and Board Products (2007) by CEPI (Confederation of European Paper Industries) and toes 3 to 7 of the ten elements were incorporated into the calculations:

1. Carbon sequestration in forests
2. Carbon stored in forest products

- 3. Greenhouse gas emissions from forest product manufacturing facilities**
- 4. Greenhouse gas emissions associated with producing fibre¹**
- 5. Greenhouse gas emissions associated with producing other raw materials/fuels**
- 6. Greenhouse gas emissions associated with purchased electricity, steam and heat and hot and cold water²**
- 7. Transport-related greenhouse gas emissions³**
8. Emissions associated with product use
9. Emissions associated with product end-of-life
10. Avoided emissions and offsets

¹Forest management and harvesting, transport emissions are not included.

²Scope 3 indirect emissions arising from production and extraction of fuel may or may not be included.

³Includes transport emissions of all steps within toes 3-6. Transport from paper mill to customer is assumed to be not included by default. If average delivery is included within the footprint value and cannot be adequately subtracted from the footprint, a value for transportation from the mill to the Kroonpress facility is added. Scope 3 indirect emissions from fuel extraction and processing are not required by the framework.

None of the toes require the inclusion of biogenic emissions, therefore these are not included in this carbon footprinting.

The framework can be found at

<http://www.cepi.org/content/default.asp?PageID=558&DocID=13681>

The carbon footprints of the papers are calculated on a product or similar product group and mill base. The results are mostly not verified by a third party and are self-claimed to conform to the CEPI framework. This has been taken into account in the data quality assessment calculations. All values are carbon dioxide equivalents. The framework allows a certain amount of freedom in what to include in the carbon life cycles, such as whether to include purchased electricity scope 3 indirect emissions or not. However, the framework specifically encourages to include at least 90% of all life cycle emissions in the quantification. If this best practice has been followed by the paper companies, then the overall accuracy should not vary by more than 10%.

In December of 2011 CEPI, in collaboration with the European Commission's DG Environment, development of pilot Product Footprint Category Rules (PFCR) for paper was completed. The PFCR is linked to the forthcoming European methodology for the calculation of environmental footprint, currently being developed by the European Commission. These rules provide more stringent guidelines for accounting the life cycle emissions of paper products but paper manufacturers have not yet had time to adapt their calculations to this. Once they do, this data will then be used.

The paper manufacturers that provided us with data for toes 3 through 7 separately were SCA (mills Ortviken and Laakirchen), UPM (mills Rauma, Kymi, Kaukas, Jämsänkoski and Kaipola), Stora Enso (mills Oulu and Varkaus), Kotkamills (Kotka mill), Sappi (mills Husum and Kirkniemi), Norske Skog (Saugbrugs mill), Burgo Group (Villorba mill), Steinbeis Papier (Steinbeis mill) and Mondi SCP (Ružomberok mill).

Data for toes 3-7 of the guidelines were provided as a summed value by Stora Enso (mills Kvarnsveden, Veitsiluoto, Hylte and Anjala), Holmen (mills Hallsta and Braviken) Arjowiggins (Dalum mill), Leipa (Schwedt mill) and Lenzing Papier (Lenzing mill).

Paper manufacturer Arctic Paper only had toes 3 and 7 but was missing data for 4 to 6. To compensate, these toes were assigned average values based on the relevant data from toes of all other manufacturers (averaged by unique carbon footprints, not by number of paper brands). The relatively high estimation level is compensated with a lower grade of data quality.

The complete Greenline Print database is available for third-party verification only, due to restrictions set by paper manufacturers on data confidentiality.

Transport emissions from the supplying mills to Kroonpress premises were calculated and added to the total emissions for each paper.

Ink

Carbon footprint data for ink was acquired from our purveyor of ink, Sun Chemical, through their Carbon Footprint Report 2010 (distributed by Sun Chemical on request), which lists the carbon footprints of their various product lines. This footprint is a gate-to-gate calculation and incorporates emissions from average distribution, natural gas, steam, electricity and other fuels. Due to the fact that average distribution emissions were incorporated into the footprint and could not be subtracted from the whole footprint, the transport emissions from ink transportation to Kroonpress were not added and data quality was graded accordingly.

Sun Chemical also conducted a pilot full life cycle assessment, which concluded that 88% of the heatset ink's cradle-to-gate life cycle emissions arise from raw materials extraction and production (Sustainability Report 2010, distributed by Sun Chemical on request). The life cycle emissions from ink were thus calculated from the gate-to-gate carbon footprint, which was assumed to comprise 12% of the total cradle-to-gate life cycle.

Printing plates

Printing plates are not part of the final product but are part of a key step in the printing process. The emissions are estimated based on the Environmental Profile Report for the European Aluminium Industry (2008) for producing ingots and then sheets. The processes and emissions included:

- Direct process: Direct material consumption/use or direct emissions associated with the aluminium processes. The following processes are considered as aluminium processes:
 - Primary production: bauxite mining, alumina production, anode/paste production, electrolysis, casting.
 - Semi-production: ingot homogenisation, ingot scalping, hot rolling, cold rolling, annealing, finishing & packaging, extrusion, foil rolling, scrap remelting, dross recycling.
 - Recycling: scrap preparation (shredding, baling, etc.), scrap remelting, scrap refining, dross recycling, salt slag treatment.
- Electricity: all the processes and materials needed to produce the electricity directly used by the aluminium processes. It includes fuel extraction and preparation.

- Thermal energy: all the processes and materials needed to produce the thermal energy directly used in the aluminium processes, excluding pitch and coke used for the anode production
- Auxiliary: all ancillary processes and materials used in the aluminium processes. It concerns mainly caustic soda, lime and aluminium fluoride.
- Transport: Only sea transport for bauxite and alumina.
- Sheet production from ingots

The transport of sheets or ingots to the printing plate manufacturer is not included in the calculation. Our printing plate manufacturer AGFA's share for producing the printing plates has been estimated at 5% of the raw material extraction and processing emissions. Transport emissions from the supplying factory to Kroonpress premises were calculated and added to the total emissions.

Printing plant - Kroonpress

The emissions accounted for were from the consumption of gas, electricity and central heating.

Annual gas consumption at Kroonpress was converted into carbon dioxide equivalents using the method assigned by the Estonian Ministry of Environment (Regulation no. 94 of 16.07.2004, available in Estonian here ([link](#))).

As of 2013, all base electricity provided by Eesti Energia to Kroonpress is from renewable resources, granted by the Rohelise Energia (Green Energy) certificate. Peak electricity consumption is from mixed sources, but due to difficulties in forecasting electricity consumption, we have created an electricity database for all our orders to ensure that all Greenline Print orders are allocated 100% carbon-neutral base electricity.

Emissions from annual district heating consumption were calculated using information from inquiries from our heating provider Fortum Tartu. The annual fossil emissions were divided by annual heat and electricity production (including from biomass) to achieve an emissions value per kilowatt-hour (before distribution, thus gross energy). The emissions were corrected to account for transmission losses from distribution. Transmission losses in heat production were estimated at 10% ([link](#)). Emissions from energy generation from biomass (66.7% of total district heating energy output) were calculated but not included in the carbon footprint due to their being carbon neutral, according to the PAS 2050 specification.

Transport

Transport emissions are calculated based on most probable route estimation by using Google Maps and emissions are calculated per tonne kilometer basis. There were two distinctions for emissions – transport by sea and by land. The data for emissions was obtained from the 2011 Guidelines to Defra /DECC's GHG Conversion Factors for Company Reporting ([link](#)) from Table 7e of Annex 7 for articulated trucks (vehicle gross weight 3.5-33 tonnes, 45% weight laden, empty trips included), scopes 1 and 3 included (direct emissions from combustion and indirect emissions from fuel extraction and transport); Table 7g of Annex 7 for Ro-Ro ferries (average loading 70%), scopes 1 and 3 included. Neither ferries nor trucks generate scope 2 emissions.

The determination of using ferry emissions was completed by assuming that all transports from Denmark, Norway and Sweden ship from Kapellskär or Stockholm in Sweden and all Finnish

deliveries ship through Helsinki. The receiving port in Estonia is Tallinn for all transports from Helsinki and Paldiski for transports coming from Kapellskär or Stockholm.

All mainland-Europe transports were considered to be hauled by trucks.

The following transport emissions are autonomously included in the carbon footprinting in addition to the transports already calculated by upstream manufacturers:

- transport of paper from the respective paper mill to Kroonpress Ltd. premises
- transport of printing plates from Belgium (Edegem) to Kroonpress Ltd. premises
- transport of final products from Kroonpress Ltd. premises to the respective customer

Publisher

Before anything can be printed, images and texts must be created by the customer. This is regarded as a part of the cradle-to-gate quantification because the process precedes delivery of the products to the customer, rendering it effectively a part of the production process. However, the office emissions along with the amount of time and resources (electricity, office paper, employee travel, etc.) allocated to a given print order are very difficult to determine accurately for all publishers. To account for the emissions from publishing and creating content, we allocated 1% of the total life cycle emissions to this step. This percentage was adopted from a life cycle carbon footprint case study of the National Geographic magazine ([link](#)). This fixed value is graded accordingly and is more likely to overestimate than underestimate the actual publishing emissions.

Other chemicals

The emissions from the production of varnishes, fountain solutions, cleaning agents and other chemicals used in the printing process were not included in this life cycle carbon footprint quantification due to an expected total share of below 1% of total life cycle emissions. This assumption is based on the low amount of chemicals used compared to the weight of the final products. The consumption of the chemicals does not create additional greenhouse gas emissions.

Data quality

All emissions data is graded independently on a scale of 1 to 4 according to the following criteria:

1=appropriate and best possible data (CEPI-guidelined + 3rd party verified)

2=Typical LCI data sets (CEPI-guidelined or equivalent)

3=estimates made using limited, but high quality data (life cycle assessments and related literature)

4=estimates made using data known to be uncertain (data is based on assumption)

Data renewal

Newest available data is used, where possible. Average figures are usually generated after the fiscal year ends, which means that calculations are based on figures from the previous year. Since these averages tend to improve over time, this lag provides a decent buffer zone for any fluctuations in the short-term timespan.

Calculating emissions of an order at Kroonpress

The process of calculating cradle-to-gate emissions for a print order at Kroonpress Ltd. involves several steps. Emissions and resource consumption is calculated per weight of final order, but all emissions from material consumption during printing (excess paper, misprints, ink waste, printing plates) is accounted for in the emissions figure. The following criteria were adopted:

The weight of the total print order

- The weight of the content paper for heatset prints is calculated by multiplying the requested format dimensions with the number of pages, dividing by two to get sheets and multiplying with the gsm (grammes per square metre) value. To this, the average weighted percentage of waste paper generated during the last fiscal year by the heatset printing presses KBA Compacta 618 and Goss Baker G15 is added. For newspaper orders (coldset), the same calculation applies but the waste paper percentage of the Goss Universal 45 printing press is added.
- The weight of the covers paper is calculated by multiplying the requested format dimensions with two, adding 5mm extra width for the average spine, multiplying with the gsm value, and adding the average percentage of waste paper generated during the last fiscal year by the sheetfed offset printing press Heidelberg Speedmaster 102-9-P+LX, which is used for printing covers. This calculation does not apply to newspaper printing, where covers are not printed separately.
- The weight of the ink is calculated as an average per tonne of all products at Kroonpress, dividing annual paper consumption by annual ink consumption and multiplying this with the total weight of the order (waste included).
- The shipment weight consists of the ink and paper weight of the requested order only, thus excluding ink and paper waste. The weight of the covers is calculated with the additional 5mm average width of the spine of the print product included.

Gas, electricity and central heating consumption

- Consumption is calculated per tonne of produce by dividing the total annual ink and paper consumption by total electricity consumption at the Kroonpress facility. Thus an order will have the same electricity per tonne value, regardless of how much it is processed and which presses and machines are used for it. This is the most adequate method of accounting emissions because the exact number of processes and which exact machines or presses are used is not foreseeable for a given order.