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Life Cycle Assessment of Packaging Systems for Beer and Soft Drinks

Steel Cans

Ministry of Environment and Energy, Denmark
Danish Environmental Protection Agency

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Technical Report 4

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Technical report 4: Steel cans

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Summary

This report

This report is part of a life cycle assessment comparing the potential environmental impacts associated with different packaging systems for beer and carbonated soft drinks filled and sold in Denmark. This report contains a short introduction, system descriptions, inventory analysis, impact assessment, and interpretation for packaging systems using steel cans.

Function / Functional unit

The function of the packaging systems is to facilitate distribution of beer and carbonated soft drinks from the brewery via retailers to the consumers. The functional unit in this report is the packaging of 1000 litres of beverage and the distribution of this beverage.

Processes included

The process tree is illustrated in Figure A.1 in annex A. Production of steel and steel cans is included in the assessment. Production of corrugated board, cardboard, low density polyethylene (LDPE) and planks used in secondary packaging and pallets is also included in the assessment. The system also includes the filling and distribution of the beverage, as well as the cooling of the packaging in the refrigerator of the consumer. Finally, it includes waste management and recycling processes. Excluded processes and flows are described in the Main report.

Inventory

A quantitative description of the investigated systems and the results from the inventory analysis is given in Chapter 3. Data and calculations on the environmental inputs and outputs of the processes in the process tree are presented in annex A and B. For data on the environmental inputs and outputs of electricity production and of transports, we refer to Technical report 7.

Impact assessment

The impact assessment method applied is the EDIP method (Wenzel *et al.* 1997). A short description can be found in the main report. Work environment and impacts from use and misuse of the products are not included in the study. This means also that the possible effects of littering and migration from the packaging to the beverage are not included. Impacts from noise, visual impacts and bodily harm due to accidents are not included in the study. Chapter 4 includes results from the impact assessment.

Interpretation

The interpretation of the LCA results includes a dominance analysis, sensitivity analyses, an assessment of data gaps and data quality, and conclusions from the LCA. It is reported in Chapter 5.

Important impacts

The packaging systems with steel cans contribute most to the following environmental impacts:

- Ecotoxicity, terrestrial, chronic (ETSC)
- Human toxicity, soil (HTS)
- Human toxicity, water (HTW)

Waste and resources

The steel can systems contribute a relatively large share (>100 mPET) of the target levels for generation of bulk waste, hazardous waste and nuclear waste. They also contribute significantly (more than approximately 1 mPR) to the depletion of coal, natural gas, aluminium and tin resources.

Important processes

The most important processes for the steel can system are:

- Steel can production
- Primary aluminium production
- Distribution of beverage
- Avoided steel production

Sensitivity analyses

The following sensitivity analyses were performed:

- Can weight: +20 %
- Distribution of beverage (light truck)
- Allocation methods (steel recycling)
- Amount of inside coatings
- Electricity production (natural gas marginal, fragmented markets and European base-load)

The results from the sensitivity analysis shows that the weight of the can is not very significant, especially since an increase of the can weight by 20 % is excessive.

It is clear from the results that the assumption regarding the mode of conveyance at the distribution is of minor importance, especially for CO_2 and SO_2.

In the recycling of used steel cans it is assumed that the steel replaces the same amount of virgin steel in new products. This assumption is important for the LCA results.

The amount of inside coatings is of minor importance.

The electricity data used in the base case represent coal marginal. Three sensitivity analyses were performed for electricity production (natural gas marginal, long term base-load at fragmented markets and European base-load average). It is clear from the results that the assumption regarding the electricity production is important.

Data gaps and omissions

There are no known significant data gaps in the inventory analysis of this study. The most important omissions are:

- The most important non-elementary inflows are alloys (other than tin) used at tinplate production and sulphur used at sulphuric acid (H_2SO_4) production.
- Production of materials for secondary packagings and wooden pallets is included in the LCA, but the actual packaging production - conversion, nailing etc. - is not included.

- There are important data gaps in the characterisation of human toxicity in air and soil, as well as of chronic terrestrial and aquatic ecotoxicity.

Uncertainties

The most important processes in this LCA (the processes that gives the highest (positive or negative) contributions to the environmental loadings) are steel can production, primary aluminium production, distribution of the beverage and avoided steel production. The data used for steel can production are aggregated data for a group of processes, of which tinplate production and can production are the most important ones. Altogether, we estimate these data to be fairly representative and complete. The uncertainty of these data is estimated to be medium. The data used for primary aluminium production are EAA data, with fair representativity, good completeness and medium uncertainty. The data used for (avoided) steel production are APEAL data, with fair representativity and completeness and medium uncertainty. The data used for distribution of the beverage are assessed to have medium uncertainty and good completeness and representativity.

The uncertainties in the normalisation of toxicity impacts are large. However, this does not affect the comparisons between the systems.

1 Introduction

The study

This report is part of a series of 8 reports from a life cycle assessment (LCA) comparing the potential environmental impacts associated with different packaging systems for beer and carbonated soft drinks filled and sold in Denmark.

Main report

Main report: Goal and scope definition, including description and discussions on methodology. Summary of the LCA of the different packaging systems. Comparisons of the different packaging systems. Comparison of the previous and the updated study.

Individual systems

Technical report 1: Refillable glass bottles: including description of the system, data, inventory analysis, impact assessment, and interpretation.

Technical report 2: Disposable glass bottles: including description of the system, data, inventory analysis, impact assessment, and interpretation.

Technical report 3: Aluminium cans: including description of the system, data, inventory analysis, impact assessment, and interpretation.

Technical report 4: Steel cans: including description of the system, data, inventory analysis, impact assessment, and interpretation.

Technical report 5: Refillable PET bottles: including description of the system, data, inventory analysis, impact assessment, and interpretation.

Technical report 6: Disposable PET bottles: including description of the system, data, inventory analysis, impact assessment, and interpretation.

Energy and transports

Technical report 7: Energy and transport scenarios, including energy and transport data, sensitivity analysis and data quality assessment.

Commissioner and practitioner

The study was financed by the Danish Environmental Protection Agency (DEPA). It was performed by Chalmers Industriteknik (CIT), Göteborg, Sweden and Institute for Product Development (IPU), Lyngby, Denmark.

Critical review

This report has been peer reviewed following the procedure outlined in the Main report, section 2.15.

Project framework

This report was produced during the period December 1997 to May 1998. The entire project was scheduled for May 1997 to May 1998.

Adherence to ISO

We adhere to the requirements of the standards ISO 14040 and ISO 14041. Several of the requirements and recommendations presented in the ISO documents need to be interpreted. We present our interpretations where applicable.

2 System descriptions

2.1 The systems investigated

The packaging systems

In this report we present the LCA of packaging systems with 33 cl and 50 cl steel cans. The packaging systems include the life cycles of the primary packaging - the steel cans - and secondary packaging: corrugated board boxes and trays, cardboard boxes and LDPE foil and hi-cones. The systems also include the life cycle of wooden pallets. The discussion below refers to the detailed process tree illustrated in annex A. In Figure 3.1 a simplified process tree is presented.

Raw materials production

The production of all raw materials (lime, limestone, tin, sulphuric acid, iron ore and steel scrap) are included.

Primary packaging

The production of primary packaging includes tinplate production, production of base- and inside coatings and can production.

Lid production

Lid production includes primary aluminium production, strip rolling and the actual lid production. All these processes are included in this LCA. The primary aluminium production includes bauxite mining, salt mining, NaOH production, limestone mining, lime calcination, alumina (Al_2O_3) production, petroleum coke production, pitch production, anode production, cathode production, AlF_3 production, electrolysis, and casting.

Washing and filling

The cans are washed with water and filled at the brewery.

Secondary packaging

The secondary packaging consists of corrugated board boxes and trays, cardboard boxes and LDPE foil and hi-cones. The production of boxes, trays, foil, and hi-cones is not included in the study. The production of cardboard and corrugated board covers all processes from wood harvesting to the board mill. The production of LDPE include all process steps from extraction of feedstock resources (crude oil and natural gas) to polymerisation.

Wooden pallets

The production of wooden pallets is not included in the study, but the production of wood is included.

Cardboard and corrugated board recycling

The system investigated was expanded to include the parts of other life cycles affected by the outflow of recycled cardboard and corrugated board from the packaging system. It was also expanded to include processes affected by the inflow of recycled fibres into corrugated board production (for further details, see Main report).

Steel recycling

90 % of the used steel cans are collected for recycling. They are recycled in a basic oxygen furnace (BOF). It has been assumed that the recycled steel replaces the same amount of virgin steel.

Aluminium oxidizing

The aluminium lid is oxidizied in the BOF, thereby releasing energy that can be used to melt steel scrap.

Distribution of beverage

The distribution of the beverage covers the transport of all packaging (incl. beverage) from the brewery to the retailer, and the return transport of empty packagings.

Retailer

The handling of the steel cans at the retailer is not included in the study.

Use

The study does not include the consumption of the beverage, but only the cooling of bottles in the refrigerator of the consumer.

Waste management

The waste management includes incineration of wooden pallets and corrugated board layer pads discarded at the brewery as well as consumer waste (steel cans, aluminium lids, corrugated board boxes and trays, cardboard boxes and LDPE foil and hi-cones).

The systems are expanded to include parts of other life cycles that are affected by the energy recovery at waste incineration. The recovered energy is assumed to replace a mix of light fuel oil and natural gas. This is represented by the processes "Energy production" and "Alternative energy production" in the detailed process tree.

2.2 Allocation procedures

Adherence to ISO

For a general description of the allocation procedure used in this project, see Main report.

Avoiding allocation

As indicated above, we avoided allocation by system expansion in the following cases:

- Waste incineration with energy recovery
- Use of recycled steel in tinplate production
- Recycling of steel cans and steel production scrap from the packaging system
- Recycling of scrap from the production of aluminium lids
- Use of recycled fibres in production of corrugated board
- Recycling of cardboard boxes and corrugated board boxes and trays after use

Cut-off at recycling

Corrugated board spacer and LDPE ligature are recycled in smaller amounts (less than 1% of the weight of the steel can). These outflows are non-elementary outflows from the system. We have not credited the investigated systems any benefits for delivering these materials to recycling, nor have the investigated systems been allocated any part of the final waste handling. The effects of this on the total LCA results are clearly small. First, these non-elementary outflows are very small. Second, the system investigated does include primary production of corrugated board and LDPE. As stated above, it also includes recycling (incl.

system expansion) of the larger amounts of corrugated board used in boxes and trays.

Aggregated data

Data on production of LDPE is literature data from Association of Plastics Manufacturers in Europe (APME; Boustead 1993). These are given as allocated data using allocation based on physical properties of the products (Boustead 1992) and not adequately disaggregated to allow recalculation according to the ISO procedure. In spite of this, we find it preferable to use these data than to use older, disaggregated data from other sources. The effects on the total LCA results are also likely to be small since the weight of the LDPE used in the system is less than 3% of the weight of the steel can.

2.3 Reporting

The report series

As stated above (chapter 1), this report is one out of a series of 8 from the LCA project.

Structure of this report

Each of the subsequent chapters deals with one of the LCA phases. Chapter 3 includes a quantitative description of the systems investigated and results from the inventory analysis. Data and calculations on the environmental inputs and outputs of the processes in the process tree are presented in annex A and B. For data on the environmental inputs and outputs of electricity production and transports, we refer to Technical report 7. Chapter 4 includes results from the impact assessment. Chapter 5, finally, includes an interpretation of the results and conclusions from the LCA.

Limitations for other applications

While some of the data in this study may also be useful for other purposes, the nature of the data needed when making a comparison is not necessarily identical to that needed for other applications such as environmental declarations or for identifying improvements options within the studied systems. In particular, it can be noted that the calculations on the distribution takes not only the packagings but also the beverage into account. Consequently, the results for the individual packaging systems should not be used to identify the main impacts in the life cycle of the packaging, without adjusting for the included beverage. In general, any conclusions of this study outside its original context should be avoided.

3 Inventory analysis

3.1 33 cl steel cans

The life cycle

The process tree of the packaging system is illustrated in Figure A.1 in annex A. A simplified process tree is presented in Figure 3.1. The 33 cl steel can is produced from tinplate sheets. The sheets are rolled from ingots, out of which 82% are made of primary tin-steel and 18% of secondary steel. To distribute 1000 litres of beverage 3030.3 (1000/0.33) 33 cl steel cans are needed. The weight of one 33 cl steel can is 28.2 grams.

90% of the used steel cans are collected for recycling due to the scope of this study (see table 3.1 and Main report, section 2.5). The remaining 10% end up in waste incineration where energy is recovered.

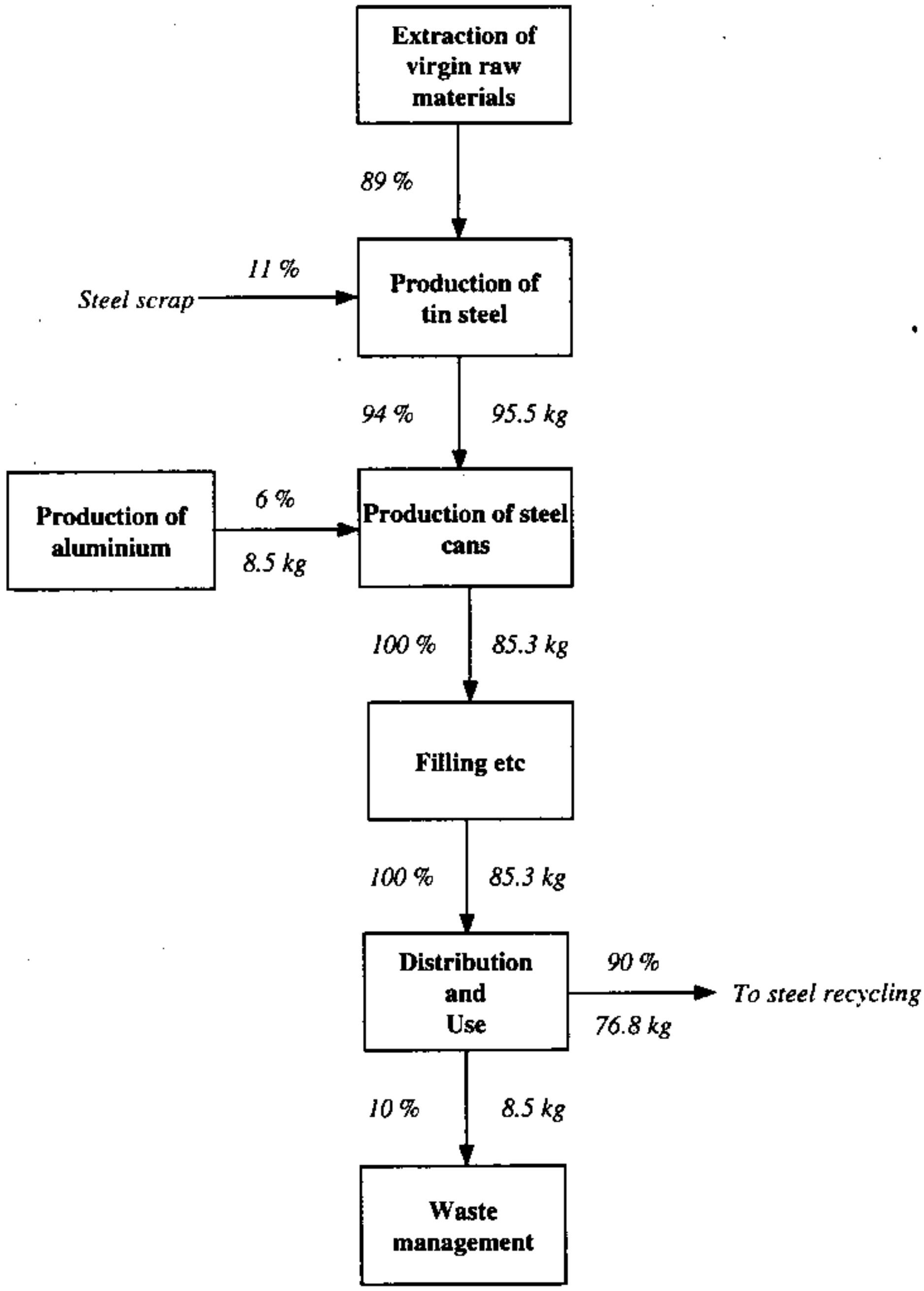

Figure 3.1.
Flows of 33 cl steel cans per 1000 litres of beverage. (Flows of secondary packaging and pallets are not included).

Input data

The secondary packagings and transport packagings are quantitatively described by the system parameters in Table 3.1. Data and calculations on the environmental inputs and outputs of the processes in the process tree are presented in annex A. Data on the environmental inputs and outputs of transports and on the production of fuels and electricity are presented in Technical report 7.

Table 3.1

System parameters for the packaging system with 33 cl steel cans. The mass presented refers to the weight of a single item, i.e., one bottle or one tray. The market shares of the secondary packaging do not add up to 100% as they may be combined in different ways.

	Name	Mass [g]	Market share	Material	Degree of reuse	Material to recycling	Degree of disposal
Primary packaging	Steel can (33 cl)	28.16	100 %	Steel/Al	0 %	90 %	10 %
Secondary packaging	Tray (24 cans)	120	50 %	Corrugated board	0 %	20 %	80 %
	Foil for tray (24 cans)	20	33 %	LDPE	0 %	0 %	100 %
	Box (24 cans)	200	17 %	Corrugated board	0 %	20 %	80 %
	Box (6 cans)	50	25 %	Cardboard	0 %	20 %	80 %
	Hi-cone	3.4	25 %	LDPE	0 %	0 %	100 %
Transport packaging	Pallet (2376 cans)	22000	100 %	Wood	95 %	0 %	5 %
	Plastic ligature (2376 cans)	20	75 %	LDPE	0 %	70 %	30 %
	Glue	2	25 %	Casein/urea/H_2O	0 %	0 %	100 %

Table 3.2
Energy demand at final use for the packaging system with 33 cl steel cans. These energy flows are not flows across the system boundary but internal flows within the system. Functional unit: packaging and distribution of 1000 litres.

	Unit	Packaging system	Effects on other life cycles	Total
Electricity, total	kWh	3.44E+02	-3.91E+01	3.06E+02
Electricity	*kWh*	*1.42*	*0*	*1.42*
Electricity, coal marginal	*kWh*	*3.43E+02*	*-3.91E+01*	*3.04E+02*
Hydro power	*kWh*	*1.88E-01*	*0*	*1.88E-01*
Fossil fuel, total	MJ	3.88E+03	-2.16E+03	1.72E+03
Coal	*MJ*	*5.58*	*0*	*5.58*
Coal, feedstock	*MJ*	*3.31E-02*	*-1.65E+03*	*-1.65E+03*
Diesel, heavy & medium truck (highway)	*MJ*	*1.81E+02*	*2.83E+01*	*2.09E+02*
Diesel, heavy & medium truck (rural)	*MJ*	*8.63E+01*	*0*	*8.63E+01*
Diesel, heavy & medium truck (urban)	*MJ*	*8.67E+01*	*-2.97*	*8.37E+01*
Diesel, ship (4-stroke)	*MJ*	*2.74E+01*	*-3.66*	*2.38E+01*
Fuel oil, ship (2-stroke)	*MJ*	*1.71E+02*	*-9.41E+01*	*7.71E+01*
Fuel, unspecified	*MJ*	*2.74E-03*	*-2.87E-04*	*2.45E-03*
Hard coal	*MJ*	*5.06E+01*	*-5.29E+01*	*-2.25*
Hard coal, feedstock	*MJ*	*1.80E+03*	*-2.81E+01*	*1.77E+03*
LPG, forklift	*MJ*	*-5.80E-02*	*7.98E-02*	*2.18E-02*
LPG, thermal	*MJ*	*0*	*1.22*	*1.22*
Natural gas (<100 kW)	*MJ*	*0*	*1.78E+01*	*1.78E+01*
Natural gas (>100 kW)	*MJ*	*9.54E+02*	*-1.10E+02*	*8.44E+02*
Natural gas	*MJ*	*3.77E+01*	*0*	*3.77E+01*
Natural gas, feedstock	*MJ*	*1.08E+02*	*0*	*1.08E+02*
Oil	*MJ*	*1.57E+01*	*0*	*1.57E+01*
Oil, feedstock	*MJ*	*1.11E+02*	*0*	*1.11E+02*
Oil, heavy fuel	*MJ*	*1.13E+02*	*-3.03E+01*	*8.28E+01*
Oil, heavy, feedstock	*MJ*	*9.06E+01*	*-4.76E+01*	*4.30E+01*
Oil, light fuel	*MJ*	*3.46E+01*	*-1.93E+02*	*-1.59E+02*
Peat	*MJ*	*7.09*	*-2.93E-01*	*6.79*
Renewable fuel, total	MJ	1.67E+01	-2.18	1.45E+01
Bark	*MJ*	*1.67E+01*	*-2.18*	*1.45E+01*
Heat etc., total	MJ	-6.07	1.30E+02	1.24E+02
BF-gas	*MJ*	*0*	*4.91E+01*	*4.91E+01*
Coke oven gas	*MJ*	*0*	*8.02E+01*	*8.02E+01*
Heat	*MJ*	*-6.07*	*9.04E-01*	*-5.17*

Table 3.3
Inventory results for the packaging system with 33 cl steel cans. Functional unit: packaging and distribution of 1000 litres.

	Unit	Packaging system	Effects on other life cycles	Total
Resources				
Al	g	3.59E-01	-3.25E-02	3.27E-01
Bauxite	g	3.87E+04	-6.76E+03	3.19E+04
Biomass	g	1.15E+01	-5.22	6.25
Brown coal	g	2.99E+03	-4.06E+02	2.58E+03
$CaCO_3$	g	6.30E-01	-5.67E-02	5.73E-01
Clay	g	2.01E-01	-1.22E-02	1.88E-01
Coal	g	3.04E+02	-1.79E+01	2.86E+02
Coal, feedstock	g	9.89E+02	-1.72E+02	8.17E+02
Crude oil	g	3.30E+04	-1.09E+04	2.21E+04
Crude oil, feedstock	g	7.54E+03	-8.34E+02	6.70E+03
Fe	g	3.73E-01	-3.37E-02	3.40E-01
Ferromanganese	g	3.31E-03	0	3.31E-03
Ground water	g	8.24E-03	-7.37E-04	7.50E-03
Hard coal	g	3.02E+05	-2.71E+04	2.75E+05
Hydro power-water	g	3.97E+10	-8.20E+09	3.15E+10
Iron ore	g	7.04E-01	0	7.04E-01
Iron ore, 10% Fe	g	8.25E+05	-7.71E+05	5.44E+04
Land use	m^2*year	3.39E+02	4.81E+01	3.87E+02
Limestone	g	2.84E+04	-2.49E+04	3.52E+03
Mn	g	2.16E-03	-1.93E-04	1.97E-03
NaCl	g	2.73E+01	-5.67E-02	2.72E+01
Natural gas	g	2.33E+04	-2.60E+03	2.07E+04
Natural gas, feedstock	g	2.26E+03	0	2.26E+03
Salt	g	5.72E+02	-9.96E+01	4.73E+02
Softwood	g	8.74E+01	-7.64	7.98E+01
Surface water	g	1.68E-04	-1.51E-05	1.53E-04
Tin	g	2.00E+02	0	2.00E+02
Uranium (as pure U)	g	2.22E-01	-2.89E-02	1.93E-01
Water	g	6.17E+07	-5.29E+06	5.64E+07
Wood	g	1.05E+01	-4.34	6.18
Non-elementary inflows				
Alloys	g	4.76E+02	1.49E+01	4.91E+02
Alum	g	6.11E+01	-9.84	5.12E+01
Aluminium hydroxide	g	1.24E+02	-2.16E+01	1.02E+02
Argon	g	3.68	0	3.68

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	Unit	Packaging system	Effects on other life cycles	Total
Auxiliary materials	g	3.44E-01	0	3.44E-01
Bark	g	9.82E+02	-1.28E+02	8.53E+02
BF-additives	g	3.05E+03	-2.85E+03	2.03E+02
Biocides	g	3.89E-01	-2.67E-02	3.62E-01
Bottom coat	g	5.26E+01	0	5.26E+01
$Ca(OH)_2$	g	4.64E+02	0	4.64E+02
$CaCO_3$	g	5.12E+01	-8.25	4.29E+01
Calcium fluoride	g	2.69E+02	-4.69E+01	2.22E+02
CaO	g	8.04E+02	-6.46E+02	1.58E+02
Carbon	g	3.25E+02	-5.67E+01	2.68E+02
Chlorine	g	2.21	0	2.21
Coke	g	6.76E+02	-6.32E+02	4.43E+01
Colorants	g	-3.24	3.70	4.53E-01
Cupper-lubricant	g	1.11E+01	0	1.11E+01
Defoamer	g	2.05E+01	-2.93	1.76E+01
Explosives	g	5.91	-5.52	3.92E-01
Glue	g	6.28E+01	0	6.28E+01
H_2	g	6.84	0	6.84
H_2SO_4	g	2.18E+02	-3.51E+01	1.83E+02
HCl	g	1.17	3.72E-01	1.54
Lubricants	g	5.23	-2.39E-01	4.99
MgO	g	1.26	0	1.26
Mobility enhance	g	6.36E+01	0	6.36E+01
Na_2SO_4	g	8.09E+01	-1.30E+01	6.79E+01
Na_2CO_3	g	3.22E+01	-4.52	2.77E+01
NaOH	g	2.62E+02	-1.94E+01	2.43E+02
NH_3	g	1.40E+01	0	1.40E+01
Oil	g	3.17E+02	0	3.17E+02
Other additives	g	5.78	-7.98E-01	4.98
Oxygen	m^3	0	-3.14E+02	-3.14E+02
Packaging	g	3.50E+02	0	3.50E+02
Paper	g	-1.97E+02	0	1.97E+02
Peat	g	3.37E+02	-1.39E+01	3.24E+02
Phosphoric acid	g	-3.29E-01	3.72E-01	4.29E-02
Plastic ligature	g	1.91E+01	0	1.91E+01
Polyester for strips	g	2.49E+01	0	2.49E+01
Printing ink	g	1.05E+02	0	1.05E+02
Refractory materials	g	9.10E+01	-1.59E+01	7.51E+01
Retention agents	g	3.45E+01	-4.52	2.99E+01
Rubber for tightening	g	2.19E+02	0	2.19E+02

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	Unit	Packaging system	Effects on other life cycles	Total
Sizing agents	g	8.97E+01	-6.91	8.28E+01
SO_2	g	1.38	0	1.38
Starch	g	1.20E+02	6.57E+01	1.86E+02
Steel	g	6.45E+01	-1.13E+01	5.33E+01
Sulphur	g	3.84E+02	-5.32E-01	3.83E+02
Sulphuric acid	g	3.11E+02	-5.43E+01	2.57E+02
Urea	g	-2.80E-01	3.19E-01	3.92E-02
Washing chemicals	g	5.54	0	5.54
Wim-lubricant	g	8.30E+01	0	8.30E+01
Wood for pallets and frames	g	1.52E+02	0	1.52E+02
Emissions to air				
Acetaldehyde	g	2.53E-04	-1.04E-04	1.48E-04
Acetylene	g	2.58E-02	-3.04E-02	-4.59E-03
Al_2O_3	g	1.69E-01	0	1.69E-01
Aldehydes	g	6.07E-03	-5.28E-04	5.54E-03
Alkanes	g	1.04E-01	-2.31E-01	-1.27E-01
Alkenes	g	2.95E-02	-3.89E-02	-9.37E-03
Aromates (C9-C10)	g	1.02E-01	-2.68E-02	7.55E-02
As	g	7.83E-03	-3.59E-03	4.24E-03
B	g	4.49E-01	-5.12E-02	3.98E-01
Be	g	3.44E-04	-3.17E-04	2.61E-05
Benzo(a)pyrene	g	1.29E-05	-2.92E-06	9.94E-06
Benzene	g	4.33E-01	-2.23E-01	2.10E-01
Butane	g	1.76E-01	-7.31E-02	1.03E-01
C_2F_6	g	4.23E-01	-7.38E-02	3.49E-01
Ca	g	6.37E-03	-1.99E-03	4.38E-03
Cd	g	7.26E-03	-4.32E-03	2.94E-03
CF_4	g	3.81	-6.65E-01	3.14
CH_4	g	2.33E+03	-1.87E+02	2.14E+03
Cl^-	g	-3.37	-3.16E-01	-3.68
CN^-	g	2.96E-03	-1.35E-03	1.61E-03
CO	g	2.41E+03	-1.52E+03	8.87E+02
Co	g	9.23E-03	-5.82E-03	3.41E-03
CO_2 (bio)	g	4.84E+04	-3.20E+03	4.52E+04
CO_2	g	6.26E+05	-2.28E+05	3.99E+05
COS	g	4.23E+01	-7.38	3.49E+01
Cr	g	3.52E-02	-3.11E-02	4.05E-03
Cr^{3+}	g	2.93E-03	-5.05E-04	2.42E-03
Cu	g	6.94E-02	-4.06E-02	2.88E-02
Dioxin	g	3.59E-07	-3.79E-08	3.21E-07

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	Unit	Packaging system	Effects on other life cycles	Total
Dust	g	1.73E+02	-3.01E+01	1.43E+02
Ethane	g	7.62E-02	-8.34E-02	-7.23E-03
Ethene	g	1.53E-01	-1.75E-01	-2.19E-02
Fe	g	7.81E-01	-4.49E-03	7.77E-01
Fluorides	g	1.02E+01	-1.77	8.38
Formaldehyde	g	6.57E-02	-2.99E-02	3.58E-02
H_2O	g	1.06E+04	0	1.06E+04
H_2S	g	2.82	-1.15	1.68
HC	g	8.08E+01	-2.36	7.84E+01
HCl	g	2.77E+01	-6.77	2.09E+01
Heavy metals	g	1.46E-14	-1.66E-15	1.29E-14
HF	g	7.15E-01	-4.50E-01	2.66E-01
Hg	g	2.25E-02	-2.77E-03	1.97E-02
Hydrogen	g	1.46E-02	0	1.46E-02
Metals	g	1.94E-02	-4.06E-04	1.90E-02
Mg	g	3.15E-01	-3.59E-02	2.79E-01
Mn	g	1.78E-01	-1.58E-01	2.00E-02
Mo	g	7.01E-03	-4.47E-03	2.54E-03
N_2O	g	3.93	-7.84E-01	3.15
Na	g	5.96E-02	-1.87E-02	4.09E-02
NH_3	g	1.37E-01	-2.75E-02	1.09E-01
Ni	g	1.27E-01	-6.23E-02	6.49E-02
NMVOC	g	9.74E+01	-3.54E+01	6.20E+01
NMVOC, diesel engines	g	6.07E+01	-5.10	5.56E+01
NMVOC, el-coal	g	5.73	-6.53E-01	5.07
NMVOC, natural gas combustion	g	0	3.46E-02	3.46E-02
NMVOC, oil combustion	g	8.66E+01	-3.95E+01	4.72E+01
NMVOC, petrol engines	g	1.71E-09	-1.53E-10	1.55E-09
NMVOC, power plants	g	4.44	-3.89E-01	4.05
NO_x	g	1.92E+03	-4.19E+02	1.50E+03
Organics	g	1.21E-02	-1.06E-03	1.11E-02
Other organics	g	6.67E-04	0	6.67E-04
PAH	g	5.32E-01	-9.35E-02	4.38E-01
Particulates	g	2.20E+02	-7.18E+01	1.49E+02
Pb	g	4.34E-01	-3.92E-01	4.26E-02
Pentane	g	3.03E-01	-1.25E-01	1.77E-01
Propane	g	1.06E-01	-9.00E-02	1.56E-02
Propene	g	2.71E-02	-3.81E-02	-1.10E-02
Radioactive emissions	kBq	9.28E+07	-5.13E+08	-4.20E+08
Sb	g	2.81E-03	-2.22E-03	5.90E-04

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	Unit	Packaging system	Effects on other life cycles	Total
Se	g	3.59E-02	-5.81E-03	3.01E-02
Sn	g	5.16E-04	-5.88E-05	4.57E-04
SO_2	g	1.48E+03	-4.36E+02	1.05E+03
SO_3	g	6.68E-01	0	6.68E-01
Sr	g	2.58E-03	-2.95E-04	2.28E-03
Th	g	2.29E-04	-2.61E-05	2.03E-04
Tin	g	8.05	0	8.05
Tl	g	3.73E-03	-3.26E-03	4.71E-04
Toluene	g	5.89E-02	-3.38E-02	2.51E-02
Tot-C	g	6.63	0	6.63
Tot-P	g	2.29E-02	-2.61E-03	2.03E-02
U	g	1.72E-04	-1.95E-05	1.52E-04
V	g	2.27E-01	-8.07E-02	1.46E-01
VOC	g	1.06E+01	-1.22	9.41
VOC, coal combustion	g	2.43E-01	-3.42E-02	2.09E-01
VOC, diesel engines	g	6.32	-5.66E-01	5.75
VOC, natural gas combustion	g	1.79E-08	-1.60E-09	1.63E-08
Xylene	g	4.91E-03	-4.53E-03	3.77E-04
Zn	g	5.12E-02	-2.24E-02	2.88E-02
Emissions to water				
Acid as H^+	g	2.02E-01	0	2.02E-01
Al	g	5.17E-01	-1.37E-01	3.80E-01
AOX	g	4.99E-02	0	4.99E-02
Aromates (C9-C10)	g	2.74E-02	-2.39E-03	2.50E-02
As	g	2.33E-03	-1.01E-03	1.32E-03
B	g	5.99	0	5.99
BOD	g	1.66E+01	-2.01E-03	1.66E+01
BOD-5	g	1.06E+02	-1.56E+01	9.02E+01
Cd	g	1.21E-03	-5.25E-04	6.81E-04
Chloride	g	2.57E+02	-4.92	2.52E+02
Cl^-	g	3.42E+03	-4.99E+02	2.92E+03
ClO_3^-	g	1.00	-1.14E-01	8.89E-01
CN^-	g	2.58E-03	-1.07E-03	1.51E-03
Co	g	4.39E-02	-6.04E-03	3.78E-02
COD	g	3.61E+02	-4.36E+01	3.17E+02
Cr	g	3.57E-02	-3.34E-03	3.24E-02
Cr^{3+}	g	8.96E-03	-4.09E-03	4.87E-03
Cu	g	3.04E-02	-9.14E-04	2.95E-02
Dissolved organics	g	1.07E-01	-1.07E-10	1.07E-01
Dissolved solids	g	1.83E+02	-1.63E+01	1.66E+02

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	Unit	Packaging system	Effects on other life cycles	Total
F^-	g	6.79E-01	-1.10E-01	5.69E-01
Fe	g	4.27	-3.26E-02	4.23
H^+	g	1.34E-01	-1.22E-02	1.22E-01
H_2S	g	8.45E-05	-3.50E-05	4.95E-05
H_2SO_4	g	8.46	-1.48	6.98
HC	g	6.81E-01	-8.11E-03	6.73E-01
Hg	g	1.43E-03	0	1.43E-03
Metals	g	1.44	-2.01E-03	1.43
Mn	g	1.81E-01	-1.62E-02	1.65E-01
NH_3	g	3.26E-02	0	3.26E-02
NH_4^+	g	5.67E-02	0	5.67E-02
NH_4-N	g	1.74E-01	-1.30E-02	1.61E-01
Ni	g	5.36E-02	-4.67E-03	4.89E-02
Nitrates	g	8.35E-03	0	8.35E-03
Nitrogen	g	6.12E-02	-5.37E-03	5.58E-02
NO_3^-	g	2.70E-02	4.84E-02	7.54E-02
NO_3-N	g	1.26E-03	-1.16E-04	1.14E-03
Oil	g	2.20E+01	-8.68	1.33E+01
Organics	g	1.60E+01	-6.92	9.07
Other nitrogen	g	4.03E-02	0	4.03E-02
PAH	g	2.12E-01	-3.69E-02	1.75E-01
Pb	g	1.23E-02	-3.79E-03	8.48E-03
Phenol	g	6.67E-04	-2.68E-12	6.67E-04
Phosphate	g	4.08E-02	-2.35E-03	3.85E-02
PO_4^{3-}	g	3.00E-02	-1.36E-02	1.63E-02
Radioactive emissions	kBq	8.73E+05	-4.81E+06	-3.94E+06
Salt	g	3.00E+01	-2.98	2.70E+01
Sb	g	9.23E-06	-3.80E-06	5.43E-06
Sn	g	1.55	-2.98E-01	1.25
SO_4^{2-}	g	1.49E+02	-1.93E+01	1.29E+02
Sr	g	9.09E-01	-8.14E-02	8.28E-01
Sulphur	g	3.34E-03	0	3.34E-03
Suspended solids	g	5.08E+01	-6.94	4.38E+01
TOC	g	1.32E-01	-4.83E-02	8.37E-02
Tot-F	g	2.96	-1.85E-03	2.96
Tot-N	g	3.50	-1.40	2.10
Tot-P	g	1.43	0	1.43
V	g	2.16E-03	-8.93E-04	1.27E-03
Water to WWTP	g	6.40E+03	0	6.40E+03
Zn	g	6.29E-02	-7.80E-03	5.51E-02

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	Unit	Packaging system	Effects on other life cycles	Total
Waste				
Bulk waste, total	g	2.49E+05	-9.66E+04	1.52E+05
Elementary waste, corrugated board	g	*-8.62E+02*	*3.24E+02*	*-5.38E+02*
Waste	g	*8.32E+04*	*-7.76E+04*	*5.63E+03*
Waste, bulky	g	*9.75E+04*	*-9.55E+03*	*8.79E+04*
Waste, carbon	g	*8.04E+01*	*-1.40E+01*	*6.64E+01*
Waste, combustible	g	*1.96E+02*	*0*	*1.96E+02*
Waste, dross fines	g	*2.22E+01*	*-3.88*	*1.83E+01*
Waste, industrial	g	*5.50E+04*	*-8.04E+03*	*4.70E+04*
Waste, inert residues	g	*1.15E+03*	*-2.01E+02*	*9.49E+02*
Waste, inorganic sludges	g	*2.67E+02*	*-4.18E+01*	*2.25E+02*
Waste, mineral	g	*5.71E+01*	*-8.48E-01*	*5.63E+01*
Waste, non hazardous	g	*1.50E+01*	*3.49E+01*	*4.99E+01*
Waste, non toxic chemicals	g	*1.80E+01*	*0*	*1.80E+01*
Waste, organic sludges	g	*6.10E+01*	*-6.65*	*5.44E+01*
Waste, other rejects	g	*2.28E+02*	*4.76E+01*	*2.75E+02*
Waste, paper related	g	*9.89*	*2.55E+01*	*3.54E+01*
Waste, red mud	g	*1.12E+04*	*-1.96E+03*	*9.24E+03*
Waste, refractory	g	*1.21E+02*	*-2.10E+01*	*9.95E+01*
Waste, rubber	g	*1.11E-01*	*-9.95E-03*	*1.01E-01*
Waste, sludge	g	*3.87E+01*	*4.14E+02*	*4.53E+02*
Waste, wood	g	*7.11E+02*	*0*	*7.11E+02*
Glue to waste water treatment plant	g	6.29E+01	0	6.29E+01
Hazardous waste, total	g	1.06E+04	-9.61E+02	9.66E+03
Waste, chemical	g	*7.33E-01*	*-6.57E-02*	*6.67E-01*
Waste, emulsions	g	*2.47E+02*	*0*	*2.47E+02*
Waste, hazardous	g	*1.02E+04*	*-9.61E+02*	*9.24E+03*
Waste, ink	g	*8.93*	*0*	*8.93*
Waste, oil	g	*4.54E+01*	*-2.66E-01*	*4.52E+01*
Waste, solvent	g	*1.19E+02*	*0*	*1.19E+02*
Waste, toxic chemicals	g	*1.27E-01*	*0*	*1.27E-01*
Slags & ashes, total	g	7.33E+03	2.77E+02	7.61E+03
Waste, ashes (Fe_3O_4)	g	*2.12E+03*	*0*	*2.12E+03*
Waste, ashes	g	*1.39E+02*	*1.91E+02*	*3.30E+02*
Waste, slags & ashes (energy prod.)	g	*1.86E+03*	*-2.00E+02*	*1.66E+03*
Waste, slags & ashes (waste incin.)	g	*1.42E-03*	*-1.27E-04*	*1.29E-03*
Waste, slags & ashes	g	*1.98E+03*	*-1.14E+03*	*8.34E+02*

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	Unit	Packaging system	Effects on other life cycles	Total
Waste, slags	g	*1.23E+03*	*1.43E+03*	*2.66E+03*
Nuclear waste, total	g	1.65E+01	2.39	1.89E+01
Waste, highly radioactive	g	*1.59E+01*	*2.46*	*1.84E+01*
Waste, radioactive	g	*5.74E-01*	*-6.94E-02*	*5.04E-01*
Co-products				
Benzene	g	3.33E+02	-3.14E+02	1.89E+01
Biogas	g	-8.10E+01	3.05E+01	-5.05E+01
Carbon reused as fuel	g	1.76E+02	-3.06E+01	1.45E+02
Compressed air	m^3	0	-5.06	-5.06
Corrugated board (from layer pads)	g	1.64E+02	0	1.64E+02
Dust	g	5.72E+03	6.28E+01	5.78E+03
H_2SO_4	g	1.05E+02	-9.81E+01	6.53
Iron(II)sulphate	g	1.56E+03	0	1.56E+03
Iron oxide	g	1.52E+02	0	1.52E+02
Mill scale	g	0	2.48E+02	2.48E+02
Oil	g	4.76E+01	0	4.76E+01
Oxygen	m^3	0	-1.64E-01	-1.64E-01
Plastic ligature	g	1.33E+01	0	1.33E+01
Recycled lubricants	g	-2.34E-01	2.66E-01	3.15E-02
Refractories	g	0	-4.71E+02	-4.71E+02
Rejects incinerated+energy	g	-2.56	2.93	3.70E-01
Reused lubricants	g	-4.68E-01	5.32E-01	6.40E-02
Skimmings and dross for recycling	g	1.27E+02	-2.22E+01	1.05E+02
Slag	g	3.40E+04	-1.83E+04	1.57E+04
Steel scrap	g	6.45E+01	-1.13E+01	5.33E+01
Tar	g	1.02E+03	-9.81E+02	3.86E+01
Tin ash	g	9.52	0	9.52
Tin hydroxide sludge	g	3.80E+01	0	3.80E+01
Tin, recycling	g	8.05	0	8.05

3.2 50 cl steel cans

The life cycle

The process tree of the packaging system is illustrated in Figure B.1 in annex B. A simplified process tree is presented in Figure 3.2. The 50 cl steel can is produced from tinplate sheets. The sheets are rolled from ingots, out of which 82% are made of primary tin-steel and 18% are made of secondary steel. To distribute 1000 litres of beverage 2000 (1000/0.50) 50 cl steel cans are needed. The weight of one 50 cl steel can is 40.2 grams.

90% of the used steel cans are collected for recycling due to the scope of this study (see table 3.4 and Main report, section 2.5). The remaining 10% end up in waste incineration where energy is recovered.

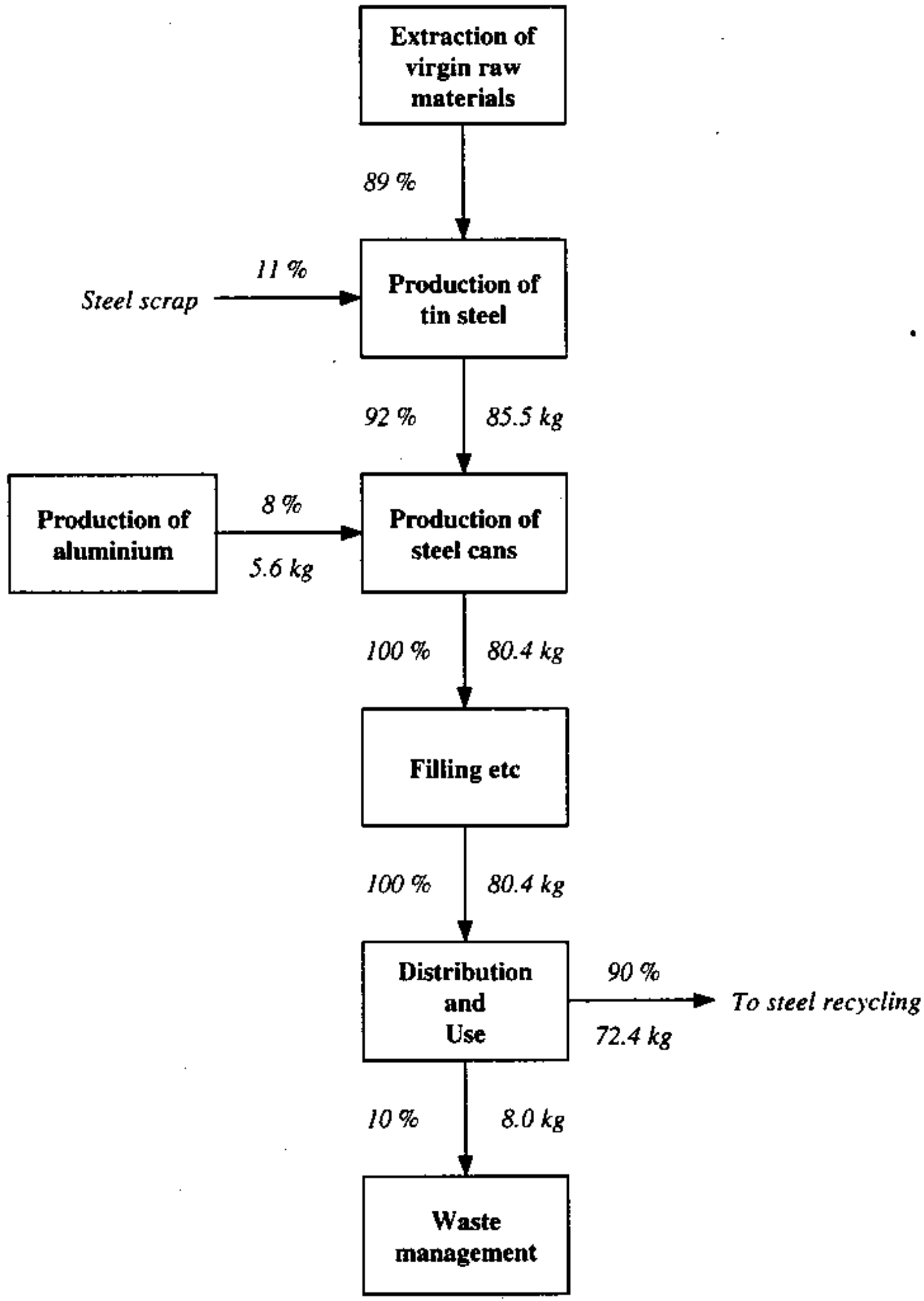

Figure 3.2
Flows of 50 cl steel cans per 1000 litres of beverage. (Flows of secondary packaging and pallets are not included).

Input data

The secondary packagings and transport packagings are quantitatively described by the system parameters in Table 3.3. Data and calculations on the environmental inputs and outputs of the processes in the process tree are presented in annex B. Data on the environmental inputs and outputs of transports and on the production of fuels and electricity are presented in Technical report 7.

Table 3.4

System parameters for the packaging system with 50 cl steel cans. The mass presented refers to the weight of a single item. i.e.. one bottle or one tray. The market shares of the secondary packaging do not add up to 100% as they may be combined in different ways.

	Name	Mass [g]	Market share	Material	Degree of reuse	Material to recycling	Degree of disposal
Primary packaging	Steel can (50 cl)	40.20	100 %	Steel/Al	0 %	90 %	10 %
Secondary packaging	Tray (24 cans)	120	50 %	Corrugated board	0 %	20 %	80 %
	Foil for tray (24 cans)	20	33 %	LDPE	0 %	0 %	100 %
	Box (24 cans)	250	17 %	Corrugated board	0 %	20 %	80 %
	Box (6 cans)	60	25 %	Cardboard	0 %	20 %	80 %
	Hi-cone	3.4	25 %	LDPE	0 %	0 %	100 %
Transport packaging	Pallet (1848 cans)	22000	100 %	Wood	95 %	0 %	5 %
	Plastic ligature (1848 cans)	20	75 %	LDPE	0 %	70 %	30 %
	Glue	2	25 %	Casein/urea/H_2O	0 %	0 %	100 %

Table 3.5
Energy demand at final use for the packaging system with 50 cl steel cans. These energy flows are not flows across the system boundary but internal flows within the system. Functional unit: packaging and distribution of 1000 litres.

	Unit	Packaging system	Effects on other life cycles	Total
Electricity, total	kWh	2.57E+02	-2.20E+01	2.35E+02
Electricity	*kWh*	*1.06*	*0*	*1.06*
Electricity, coal marginal	*kWh*	*2.56E+02*	*-2.20E+01*	*2.33E+02*
Hydro power	*kWh*	*1.25E-01*	*0*	*1.25E-01*
Fossil fuel, total	MJ	3.44E+03	-1.87E+03	1.58E+03
Coal	*MJ*	*4.24*	*0*	*4.24*
Coal, feedstock	*MJ*	*2.94E-02*	*-1.48E+03*	*-1.48E+03*
Diesel, heavy & medium truck (highway)	*MJ*	*1.65E+02*	*1.55E+01*	*1.81E+02*
Diesel, heavy & medium truck (rural)	*MJ*	*8.43E+01*	*0*	*8.43E+01*
Diesel, heavy & medium truck (urban)	*MJ*	*8.19E+01*	*-2.94*	*7.89E+01*
Diesel, ship (4-stroke)	*MJ*	*2.06E+01*	*-2.74*	*1.78E+01*
Fuel oil, ship (2-stroke)	*MJ*	*1.34E+02*	*-8.07E+01*	*5.29E+01*
Fuel, unspecified	*MJ*	*2.09E-03*	*-1.66E-04*	*1.93E-03*
Hard coal	*MJ*	*4.52E+01*	*-3.85E+01*	*6.71*
Hard coal, feedstock	*MJ*	*1.62E+03*	*-2.53E+01*	*1.59E+03*
LPG, forklift	*MJ*	*-4.20E-02*	*5.97E-02*	*1.77E-02*
LPG, thermal	*MJ*	*0*	*8.07E-01*	*8.07E-01*
Natural gas (<100 kW)	*MJ*	*0*	*1.31E+01*	*1.31E+01*
Natural gas (>100 kW)	*MJ*	*8.28E+02*	*-6.83E+01*	*7.60E+02*
Natural gas	*MJ*	*3.31E+01*	*0*	*3.31E+01*
Natural gas, feedstock	*MJ*	*9.59E+01*	*0*	*9.59E+01*
Oil	*MJ*	*1.44E+01*	*0*	*1.44E+01*
Oil, feedstock	*MJ*	*9.85E+01*	*0*	*9.85E+01*
Oil, heavy fuel	*MJ*	*9.67E+01*	*-2.63E+01*	*7.04E+01*
Oil, heavy, feedstock	*MJ*	*8.65E+01*	*-4.25E+01*	*4.41E+01*
Oil, light fuel	*MJ*	*3.11E+01*	*-1.34E+02*	*-1.03E+02*
Peat	*MJ*	*5.15*	*-2.19E-01*	*4.93*
Renewable fuel, total	MJ	1.27E+01	-1.63	1.11E+01
Bark	*MJ*	*1.27E+01*	*-1.63*	*1.11E+01*
Heat etc., total	MJ	-4.53	1.16E+02	1.12E+02
BF-gas	*MJ*	*0*	*4.39E+01*	*4.39E+01*
Coke oven gas	*MJ*	*0*	*7.17E+01*	*7.17E+01*
Heat	*MJ*	*-4.53*	*6.77E-01*	*-3.85*

Table 3.6
Inventory results for the packaging system with 50 cl steel cans. Functional unit: packaging and distribution of 1000 litres.

	Unit	Packaging system	Effects on other life cycles	Total
Resources				
Al	g	2.86E-01	-1.95E-02	2.67E-01
Bauxite	g	2.56E+04	-4.47E+03	2.11E+04
Biomass	g	9.69	-4.55	5.14
Brown coal	g	2.43E+03	-2.83E+02	2.15E+03
$CaCO_3$	g	5.02E-01	-3.41E-02	4.68E-01
Clay	g	1.66E-01	-7.30E-03	1.59E-01
Coal	g	2.21E+02	-1.19E+01	2.09E+02
Coal, feedstock	g	6.55E+02	-1.14E+02	5.41E+02
Crude oil	g	2.74E+04	-8.49E+03	1.89E+04
Crude oil, feedstock	g	5.64E+03	-5.53E+02	5.09E+03
Fe	g	2.97E-01	-2.02E-02	2.77E-01
Ferromanganese	g	2.94E-03	0	2.94E-03
Ground water	g	6.58E-03	-4.44E-04	6.13E-03
Hard coal	g	2.41E+05	-1.63E+04	2.25E+05
Hydro power-water	g	2.70E+10	-5.62E+09	2.13E+10
Iron ore	g	6.31E-01	0	6.31E-01
Iron ore, 10% Fe	g	7.41E+05	-6.88E+05	5.27E+04
Land use	m^2*year	2.56E+02	3.60E+01	2.92E+02
Limestone	g	2.51E+04	-2.23E+04	2.86E+03
Mn	g	1.72E-03	-1.16E-04	1.61E-03
NaCl	g	2.42E+01	-3.40E-02	2.41E+01
Natural gas	g	1.99E+04	-1.67E+03	1.82E+04
Natural gas, feedstock	g	2.04E+03	0	2.04E+03
Salt	g	3.79E+02	-6.60E+01	3.13E+02
Softwood	g	7.02E+01	-4.63	6.55E+01
Surface water	g	1.34E-04	-9.06E-06	1.25E-04
Tin	g	1.80E+02	0	1.80E+02
Uranium (as pure U)	g	1.78E-01	-2.04E-02	1.58E-01
Water	g	4.97E+07	-3.21E+06	4.65E+07
Wood	g	9.69	-3.14	6.55
Non-elementary inflows				
Alloys	g	4.28E+02	1.01E+01	4.38E+02
Alum	g	4.57E+01	-7.36	3.83E+01
Aluminium hydroxide	g	8.19E+01	-1.43E+01	6.76E+01
Argon	g	2.44	0	2.44

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	Unit	Packaging system	Effects on other life cycles	Total
Auxiliary materials	g	2.47E-01	0	2.47E-01
Bark	g	7.46E+02	-9.60E+01	6.51E+02
BF-additives	g	2.74E+03	-2.55E+03	1.92E+02
Biocides	g	2.89E-01	-1.99E-02	2.69E-01
Bottom coat	g	3.56E+01	0	3.56E+01
$Ca(OH)_2$	g	3.76E+02	0	3.76E+02
$CaCO_3$	g	3.83E+01	-6.17	3.21E+01
Calcium fluoride	g	1.78E+02	-3.10E+01	1.47E+02
CaO	g	7.02E+02	-5.74E+02	1.28E+02
Carbon	g	2.15E+02	-3.75E+01	1.77E+02
Chlorine	g	1.46	0	1.46
Coke	g	6.08E+02	-5.64E+02	4.35E+01
Colorants	g	-2.33	2.77	4.33E-01
Cupper-lubricant	g	9.40	0	9.40
Defoamer	g	1.53E+01	-2.19	1.31E+01
Explosives	g	5.31	-4.93	3.84E-01
Glue	g	4.17E+01	0	4.17E+01
H_2	g	6.16	0	6.16
H_2SO_4	g	1.63E+02	-2.63E+01	1.37E+02
HCl	g	8.68E-01	2.80E-01	1.15
Lubricants	g	3.89	-1.79E-01	3.71
MgO	g	9.07E-01	0	9.07E-01
Mobility enhance	g	4.32E+01	0	4.32E+01
Na_2SO_4	g	6.05E+01	-9.75	5.08E+01
Na_2CO_3	g	2.40E+01	-3.38	2.06E+01
NaOH	g	2.14E+02	-1.45E+01	2.00E+02
NH_3	g	1.01E+01	0	1.01E+01
Oil	g	2.57E+02	0	2.57E+02
Other additives	g	4.30	-5.97E-01	3.70
Oxygen	m^3	0	7.90E+01	7.90E+01
Packaging	g	2.32E+02	0	2.32E+02
Paper	g	1.30E+02	0	1.30E+02
Peat	g	2.45E+02	-1.04E+01	2.35E+02
Phosphoric acid	g	-2.37E-01	2.78E-01	4.13E-02
Plastic ligature	g	1.62E+01	0	1.62E+01
Polyester for strips	g	1.69E+01	0	1.69E+01
Printing ink	g	9.56E+01	0	9.56E+01
Refractory materials	g	6.02E+01	-1.05E+01	4.97E+01
Retention agents	g	2.57E+01	-3.38	2.24E+01
Rubber for tightening	g	1.45E+02	0	1.45E+02

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... *Table 3.6 continued from previous page.*

	Unit	Packaging system	Effects on other life cycles	Total
Sizing agents	g	6.73E+01	-5.18	6.22E+01
SO_2	g	9.91E-01	0	9.91E-01
Starch	g	8.72E+01	4.92E+01	1.36E+02
Steel	g	4.27E+01	-7.46	3.53E+01
Sulphur	g	3.42E+02	-3.98E-01	3.42E+02
Sulphuric acid	g	2.06E+02	-3.59E+01	1.70E+02
Urea	g	-2.01E-01	2.39E-01	3.83E-02
Washing chemicals	g	3.74	0	3.74
Wim-lubricant	g	6.00E+01	0	6.00E+01
Wood for pallets and frames	g	1.01E+02	0	1.01E+02
Emissions to air				
Acetaldehyde	g	2.40E-04	-7.05E-05	1.69E-04
Acetylene	g	2.32E-02	-2.56E-02	-2.43E-03
Al_2O_3	g	1.12E-01	0	1.12E-01
Aldehydes	g	4.89E-03	-3.21E-04	4.57E-03
Alkanes	g	9.39E-02	-1.68E-01	-7.40E-02
Alkenes	g	2.65E-02	-3.16E-02	-5.10E-03
Aromates (C9-C10)	g	8.35E-02	-1.87E-02	6.48E-02
As	g	6.52E-03	-3.06E-03	3.45E-03
B	g	3.34E-01	-2.89E-02	3.05E-01
Be	g	3.09E-04	-2.84E-04	2.47E-05
Benzo(a)pyrene	g	1.09E-05	-2.18E-06	8.76E-06
Benzene	g	3.79E-01	-1.84E-01	1.94E-01
Butane	g	1.68E-01	-4.94E-02	1.19E-01
C_2F_6	g	2.80E-01	-4.89E-02	2.31E-01
Ca	g	5.73E-03	-1.78E-03	3.96E-03
Cd	g	6.46E-03	-3.81E-03	2.65E-03
CF_4	g	2.52	-4.40E-01	2.08
CH_4	g	1.89E+03	-1.12E+02	1.78E+03
Cl^-	g	-2.42	-2.37E-01	-2.66
CN^-	g	2.51E-03	-1.17E-03	1.33E-03
CO	g	2.00E+03	-1.31E+03	6.84E+02
Co	g	8.09E-03	-5.14E-03	2.95E-03
CO_2 (bio)	g	3.64E+04	-2.40E+03	3.40E+04
CO_2	g	5.05E+05	-1.86E+05	3.19E+05
COS	g	2.80E+01	-4.89	2.31E+01
Cr	g	3.16E-02	-2.77E-02	3.92E-03
Cr^{3+}	g	2.23E-03	-3.53E-04	1.88E-03
Cu	g	6.16E-02	-3.64E-02	2.52E-02
Dioxin	g	2.97E-07	-3.03E-08	2.66E-07

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... Table 3.6 continued from previous page.

	Unit	Packaging system	Effects on other life cycles	Total
Dust	g	1.14E+02	-2.00E+01	9.44E+01
Ethane	g	6.85E-02	-7.14E-02	-2.84E-03
Ethene	g	1.38E-01	-1.49E-01	-1.05E-02
Fe	g	7.62E-01	-4.01E-03	7.58E-01
Fluorides	g	6.72	-1.17	5.55
Formaldehyde	g	6.04E-02	-2.35E-02	3.69E-02
H_2O	g	7.82E+03	0	7.82E+03
H_2S	g	2.25	-9.82E-01	1.27
HC	g	6.72E+01	-1.43	6.58E+01
HCl	g	2.15E+01	-5.21	1.63E+01
Heavy metals	g	1.08E-14	-9.36E-16	9.91E-15
HF	g	6.33E-01	-3.99E-01	2.34E-01
Hg	g	1.68E-02	-1.62E-03	1.52E-02
Hydrogen	g	1.50E-02	0	1.50E-02
Metals	g	1.66E-02	-2.43E-04	1.64E-02
Mg	g	2.34E-01	-2.03E-02	2.14E-01
Mn	g	1.58E-01	-1.42E-01	1.69E-02
Mo	g	6.07E-03	-3.93E-03	2.14E-03
N_2O	g	3.19	-6.25E-01	2.56
Na	g	5.37E-02	-1.67E-02	3.70E-02
NH_3	g	1.23E-01	-2.61E-02	9.74E-02
Ni	g	1.13E-01	-5.40E-02	5.91E-02
NMVOC	g	8.93E+01	-2.55E+01	6.38E+01
NMVOC, diesel engines	g	5.32E+01	-4.81	4.84E+01
NMVOC, el-coal	g	4.26	-3.68E-01	3.89
NMVOC, natural gas combustion	g	0	2.51E-02	2.51E-02
NMVOC, oil combustion	g	7.32E+01	-3.43E+01	3.89E+01
NMVOC, petrol engines	g	1.36E-09	-9.20E-11	1.27E-09
NMVOC, power plants	g	3.57	-2.36E-01	3.34
NO_x	g	1.55E+03	-3.35E+02	1.21E+03
Organics	g	9.76E-03	-6.41E-04	9.12E-03
Other organics	g	-6.87E-04	0	6.87E-04
PAH	g	3.52E-01	-6.19E-02	2.91E-01
Particulates	g	1.82E+02	-5.97E+01	1.22E+02
Pb	g	3.89E-01	-3.50E-01	3.89E-02
Pentane	g	2.88E-01	-8.47E-02	2.03E-01
Propane	g	9.77E-02	-7.12E-02	2.65E-02
Propene	g	2.43E-02	-3.10E-02	-6.69E-03
Radioactive emissions	kBq	8.35E+07	-3.56E+08	-2.72E+08
Sb	g	2.46E-03	-1.97E-03	4.98E-04

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... Table 3.6 continued from previous page.

	Unit	Packaging system	Effects on other life cycles	Total
Se	g	2.72E-02	-3.94E-03	2.32E-02
Sn	g	3.84E-04	-3.31E-05	3.51E-04
SO_2	g	1.14E+03	-3.45E+02	8.00E+02
SO_3	g	6.00E-01	0	6.00E-01
Sr	g	1.92E-03	-1.66E-04	1.75E-03
Th	g	1.71E-04	-1.48E-05	1.56E-04
Tin	g	7.87	0	7.87
Tl	g	3.33E-03	-2.90E-03	4.32E-04
Toluene	g	5.57E-02	-2.42E-02	3.15E-02
Tot-C	g	4.50	0	4.50
Tot-P	g	1.71E-02	-1.48E-03	1.56E-02
U	g	1.28E-04	-1.10E-05	1.17E-04
V	g	2.04E-01	-7.20E-02	1.32E-01
VOC	g	7.06	-8.27E-01	6.23
VOC, coal combustion	g	1.95E-01	-9.55E-03	1.85E-01
VOC, diesel engines	g	5.05	-3.41E-01	4.71
VOC, natural gas combustion	g	1.42E-08	-9.62E-10	1.33E-08
Xylene	g	4.42E-03	-4.04E-03	3.74E-04
Zn	g	4.34E-02	-1.96E-02	2.38E-02
Emissions to water				
Acid as H^+	g	1.79E-01	0	1.79E-01
Al	g	4.54E-01	-9.86E-02	3.56E-01
AOX	g	4.43E-02	0	4.43E-02
Aromates (C9-C10)	g	2.20E-02	-1.45E-03	2.06E-02
As	g	2.05E-03	-8.17E-04	1.24E-03
B	g	5.39	0	5.39
BOD	g	1.48E+01	-1.21E-03	1.48E+01
BOD-5	g	7.89E+01	-1.17E+01	6.72E+01
Cd	g	1.07E-03	-4.21E-04	6.46E-04
Chloride	g	2.24E+02	-3.26	2.21E+02
Cl^-	g	2.79E+03	-3.52E+02	2.44E+03
ClO_3^-	g	7.48E-01	-6.45E-02	6.83E-01
CN^-	g	2.38E-03	-7.71E-04	1.61E-03
Co	g	3.31E-02	-4.51E-03	2.85E-02
COD	g	2.77E+02	-3.26E+01	2.44E+02
Cr	g	3.23E-02	-2.42E-03	2.98E-02
Cr^{3+}	g	7.57E-03	-3.55E-03	4.02E-03
Cu	g	2.73E-02	-6.57E-04	2.67E-02
Dissolved organics	g	1.01E-01	-6.45E-11	1.01E-01
Dissolved solids	g	1.46E+02	-9.78	1.36E+02

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... Table 3.6 continued from previous page.

	Unit	Packaging system	Effects on other life cycles	Total
F^-	g	5.50E-01	-8.21E-02	4.68E-01
Fe	g	3.80	-1.96E-02	3.78
H^+	g	1.07E-01	-7.30E-03	9.99E-02
H_2S	g	7.78E-05	-2.54E-05	5.25E-05
H_2SO_4	g	5.60	-9.78E-01	4.63
HC	g	6.33E-01	-4.87E-03	6.28E-01
Hg	g	1.28E-03	0	1.28E-03
Metals	g	1.36	-1.21E-03	1.35
Mn	g	1.45E-01	-9.78E-03	1.35E-01
NH_3	g	2.35E-02	0	2.35E-02
NH_4^+	g	5.62E-02	0	5.62E-02
NH_4-N	g	1.42E-01	-7.83E-03	1.34E-01
Ni	g	4.63E-02	-3.42E-03	4.29E-02
Nitrates	g	6.27E-03	0	6.27E-03
Nitrogen	g	4.91E-02	-3.26E-03	4.59E-02
NO_3-	g	1.91E-02	3.62E-02	5.53E-02
NO_3-N	g	9.96E-04	-6.92E-05	9.27E-04
Oil	g	1.94E+01	-6.95	1.24E+01
Organics	g	1.41E+01	-5.52	8.61
Other nitrogen	g	3.71E-02	0	3.71E-02
PAH	g	1.40E-01	-2.44E-02	1.16E-01
Pb	g	1.09E-02	-3.05E-03	7.83E-03
Phenol	g	6.87E-04	-1.61E-12	6.87E-04
Phosphate	g	3.42E-02	-1.52E-03	3.27E-02
PO_4^{3-}	g	2.54E-02	-1.19E-02	1.35E-02
Radioactive emissions	kBq	7.85E+05	-3.34E+06	-2.56E+06
Salt	g	2.33E+01	-1.74	2.15E+01
Sb	g	8.51E-06	-2.76E-06	5.75E-06
Sn	g	1.41	-2.16E-01	1.19
SO_4^{2-}	g	1.21E+02	-1.34E+01	1.07E+02
Sr	g	7.25E-01	-4.89E-02	6.76E-01
Sulphur	g	3.45E-03	0	3.45E-03
Suspended solids	g	3.76E+01	-5.05	3.25E+01
TOC	g	1.19E-01	-3.35E-02	8.57E-02
Tot-F	g	2.66	-1.22E-03	2.65
Tot-N	g	3.13	-1.08	2.05
Tot-P	g	1.28	0	1.28
V	g	1.99E-03	-6.46E-04	1.35E-03
Water to WWTP	g	5.20E+03	0	5.20E+03
Zn	g	5.15E-02	-5.08E-03	4.64E-02

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... Table 3.6 continued from previous page.

	Unit	Packaging system	Effects on other life cycles	Total
Waste				
Bulk waste, total	g	2.47E+05	-8.44E+04	1.63E+05
Elementary waste, corrugated board	g	*-6.20E+02*	*2.43E+02*	*-3.77E+02*
Waste	g	*7.48E+04*	*-6.93E+04*	*5.49E+03*
Waste, bulky	g	*7.80E+04*	*-6.04E+03*	*7.19E+04*
Waste, carbon	g	*5.32E+01*	*-9.29*	*4.39E+01*
Waste, combustible	g	*1.33E+02*	*0*	*1.33E+02*
Waste, dross fines	g	*1.47E+01*	*-2.57*	*1.21E+01*
Waste, industrial	g	*4.77E+04*	*-5.61E+03*	*4.21E+04*
Waste, inert residues	g	*7.63E+02*	*-1.33E+02*	*6.30E+02*
Waste, inorganic sludges	g	*1.99E+02*	*-3.12E+01*	*1.68E+02*
Waste, mineral	g	*4.46E+01*	*-5.10E-01*	*4.41E+01*
Waste, non hazardous	g	*9.97*	*2.31E+01*	*3.31E+01*
Waste, non toxic chemicals	g	*1.83E+01*	*0*	*1.83E+01*
Waste, organic sludges	g	*4.51E+01*	*-4.97*	*4.02E+01*
Waste, other rejects	g	*1.69E+02*	*3.56E+01*	*2.05E+02*
Waste, paper related	g	*7.11*	*1.91E+01*	*2.62E+01*
Waste, red mud	g	*7.42E+03*	*-1.30E+03*	*6.12E+03*
Waste, refractory	g	*7.98E+01*	*-1.39E+01*	*6.59E+01*
Waste, rubber	g	*8.87E-02*	*-5.98E-03*	*8.27E-02*
Waste, sludge	g	*2.63E+01*	*-5.41E+01*	*-2.78E+01*
Waste, wood	g	*4.82E+02*	*0*	*4.82E+02*
Glue to waste water treatment plant	g	4.17E+01	0	4.17E+01
Hazardous waste, total	g	8.94E+03	-5.81E+02	8.36E+03
Waste, chemical	g	*5.85E-01*	*-3.95E-02*	*5.46E-01*
Waste, emulsions	g	*1.68E+02*	*0*	*1.68E+02*
Waste, hazardous	g	*8.66E+03*	*-5.81E+02*	*8.08E+03*
Waste, ink	g	*6.06*	*0*	*6.06*
Waste, oil	g	*3.02E+01*	*-2.38E-01*	*2.99E+01*
Waste, solvent	g	*8.06E+01*	*0*	*8.06E+01*
Waste, toxic chemicals	g	*8.49E-02*	*0*	*8.49E-02*
Slags & ashes, total	g	6.13E+03	-1.94E+01	6.12E+03
Waste, ashes (Fe_3O_4)	g	*2.07E+03*	*0*	*2.07E+03*
Waste, ashes	g	*1.04E+02*	*1.25E+02*	*2.29E+02*
Waste, slags & ashes (energy prod.)	g	*1.42E+03*	*-1.14E+02*	*1.30E+03*
Waste, slags & ashes (waste incin.)	g	*1.13E-03*	*-7.65E-05*	*1.06E-03*
Waste, slags & ashes	g	*1.35E+03*	*-9.81E+02*	*3.64E+02*

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... Table 3.6 continued from previous page.

	Unit	Packaging system	Effects on other life cycles	Total
Waste, slags	g	*1.20E+03*	*9.51E+02*	*2.15E+03*
Nuclear waste, total	g	1.50E+01	1.30	1.63E+01
Waste, highly radioactive	g	*1.45E+01*	*1.35*	*1.59E+01*
Waste, radioactive	g	*4.63E-01*	*-4.85E-02*	*4.15E-01*
Co-products				
Benzene	g	2.99E+02	-2.81E+02	1.89E+01
Biogas	g	-5.82E+01	2.28E+01	-3.54E+01
Carbon reused as fuel	g	1.16E+02	-2.03E+01	9.60E+01
Compressed air	m^3	0	-4.52	-4.52
Corrugated board (from layer pads)	g	1.08E+02	0	1.08E+02
Dust	g	5.14E+03	-6.79E+02	4.46E+03
Glue	g	4.17E+01	0	4.17E+01
H_2SO_4	g	9.42E+01	-8.76E+01	6.53
Iron(II)sulphate	g	1.40E+03	0	1.40E+03
Iron oxide	g	1.37E+02	0	1.37E+02
Mill scale	g	0	-2.98E+01	-2.98E+01
Oil	g	4.28E+01	0	4.28E+01
Oxygen	m^3	0	-1.47E-01	-1.47E-01
Plastic ligature	g	1.14E+01	0	1.14E+01
Refractories	g	0	1.18E+02	1.18E+02
Skimmings and dross for recycling	g	8.40E+01	-1.47E+01	6.94E+01
Slag	g	3.05E+04	-1.74E+04	1.31E+04
Steel scrap	g	4.27E+01	-7.46	3.53E+01
Tar	g	9.16E+02	-8.76E+02	3.91E+01
Tin ash	g	8.56	0	8.56
Tin hydroxide sludge	g	3.42E+01	0	3.42E+01
Tin, recycling		7.87	0	7.87

4 Impact assessment

4.1 Classification and characterisation

Table 4.1

Classification and characterisation for the packaging system with 33 cl steel cans. The unit of the characterisation factor is g equivalent per g emission. Functional unit: packaging and distribution of 1000 litres.

NP [kg NO_3^--equivalents]	Characterisation factor	Packaging system	Effects on other life cycles	Total
Emissions to air				
NH_3	3.64E-03	4.98E-04	-1.00E-04	3.98E-04
NO_x	1.35E-03	2.59	-5.65E-01	2.03
Emissions to water				
CN^-	2.38E-03	6.14E-06	-2.54E-06	3.60E-06
NH_3	3.64E-03	1.19E-04	0	1.19E-04
NH_4^+	3.44E-03	1.95E-04	0	1.95E-04
NH_4-N	4.42E-03	7.71E-04	-5.75E-05	7.13E-04
Nitrates	1.00E-03	8.35E-06	0	8.35E-06
NO_3^-	1.00E-03	2.70E-05	4.84E-05	7.54E-05
NO_3-N	4.43E-03	5.57E-06	-5.14E-07	5.06E-06
Phosphate	3.20E-02	1.31E-03	-7.53E-05	1.23E-03
PO_4^{3-}	1.05E-02	3.13E-04	-1.42E-04	1.71E-04
Tot-N	4.43E-03	1.55E-02	-6.18E-03	9.31E-03
Tot-P	3.20E-02	4.58E-02	0	4.58E-02
Total		**2.66**	**-5.72E-01**	**2.09**

POCP [kg C_2H_4-equivalents]	Characterisation factor	Packaging system	Effects on other life cycles	Total
Emissions to air				
Acetylene	2.00E-04	5.16E-06	-6.08E-06	-9.19E-07
Aldehydes	5.00E-04	3.04E-06	-2.64E-07	2.77E-06
Alkanes	4.00E-04	4.16E-05	-9.24E-05	-5.08E-05
Alkenes	9.00E-04	2.66E-05	-3.50E-05	-8.43E-06
Aromates (C9-C10)	8.00E-04	8.18E-05	-2.15E-05	6.04E-05

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... *Table 4.1 continued from previous page.*

POCP [kg C_2H_4-equivalents]	Charact-erisation factor	Packaging system	Effects on other life cycles	Total
Benzene	2.00E-04	8.47E-05	-4.29E-05	4.18E-05
CH_4	7.00E-06	1.63E-02	-1.31E-03	1.50E-02
CO	3.00E-05	7.22E-02	-4.56E-02	2.66E-02
Co	3.00E-05	2.77E-07	-1.75E-07	1.02E-07
Ethane	1.00E-04	7.62E-06	-8.34E-06	-7.23E-07
Ethene	1.00E-03	1.53E-04	-1.75E-04	-2.19E-05
Formaldehyde	4.00E-04	2.63E-05	-1.20E-05	1.43E-05
HC	6.00E-04	4.85E-02	-1.42E-03	4.70E-02
NMVOC	4.00E-04	3.90E-02	-1.42E-02	2.48E-02
NMVOC, diesel engines	6.00E-04	3.64E-02	-3.06E-03	3.34E-02
NMVOC, el-coal	8.00E-04	4.58E-03	-5.23E-04	4.06E-03
NMVOC, natural gas combustion	4.00E-04	0	1.38E-05	1.38E-05
NMVOC, oil combustion	3.00E-04	2.60E-02	-1.18E-02	1.42E-02
NMVOC, petrol engines	6.00E-04	1.02E-12	-9.17E-14	9.31E-13
NMVOC, power plants	5.00E-04	2.22E-03	-1.94E-04	2.03E-03
Pentane	4.00E-04	1.21E-04	-5.02E-05	7.08E-05
Propane	4.00E-04	4.23E-05	-3.60E-05	6.25E-06
Propene	1.00E-03	2.71E-05	-3.81E-05	-1.10E-05
Toluene	6.00E-04	3.54E-05	-2.03E-05	1.51E-05
VOC, coal combustion	5.00E-04	1.22E-04	-1.71E-05	1.05E-04
VOC, diesel engines	6.00E-04	3.79E-03	-3.40E-04	3.45E-03
VOC, natural gas combustion	2.00E-04	3.57E-12	-3.20E-13	3.25E-12
Xylene	9.00E-04	4.42E-06	-4.08E-06	3.39E-07
Total		**2.50E-01**	**-7.90E-02**	**1.71E-01**

AP [kg SO_2-equivalents]	Charact-erisation factor	Packaging system	Effects on other life cycles	Total
Emissions to air				
H_2S	1.88E-03	5.31E-03	-2.16E-03	3.15E-03
HCl	8.80E-04	2.44E-02	-5.95E-03	1.84E-02
HF	1.60E-03	1.14E-03	-7.19E-04	4.25E-04
NH_3	1.88E-03	2.57E-04	-5.17E-05	2.05E-04
NO_x	7.00E-04	1.34	-2.93E-01	1.05
SO_2	1.00E-03	1.48	-4.36E-01	1.05
SO_3	8.00E-04	5.34E-04	0	5.34E-04

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… Table 4.1 continued from previous page.

AP [kg SO_2-equivalents]	Charact-erisation factor	Packaging system	Effects on other life cycles	Total
Emissions to water				
Acid as H^+	3.20E-02	6.45E-03	0	6.45E-03
H^+	3.20E-02	4.30E-03	-3.89E-04	3.91E-03
H_2S	1.88E-03	1.59E-07	-6.58E-08	9.30E-08
H_2SO_4	6.50E-04	5.50E-03	-9.60E-04	4.54E-03
NH_3	1.88E-03	6.13E-05	0	6.13E-05
NH_4^+	3.56E-03	2.02E-04	0	2.02E-04
NH_4-N	4.58E-03	7.99E-04	-5.96E-05	7.39E-04
Total		**2.88**	**-7.40E-01**	**2.14**

GWP [kg CO_2-equivalents]	Charact-erisation factor	Packaging system	Effects on other life cycles	Total
Emissions to air				
C_2F_6	1.25E-02	5.29E-03	-9.23E-04	4.37E-03
CF_4	6.30E-03	2.40E-02	-4.19E-03	1.98E-02
CH_4	2.50E-02	5.82E+01	-4.68	5.35E+01
CO	2.00E-03	4.82	-3.04	1.77
Co	2.00E-03	1.85E-05	-1.16E-05	6.82E-06
CO_2	1.00E-03	6.26E+02	-2.28E+02	3.99E+02
COS	7.00E-04	2.96E-02	-5.17E-03	2.44E-02
HC	3.00E-03	2.42E-01	-7.09E-03	2.35E-01
N_2O	3.20E-01	1.26	-2.51E-01	1.01
Total		**6.91E+02**	**-2.36E+02**	**4.55E+02**

HTA [m^3 air]	Charact-erisation factor	Packaging system	Effects on other life cycles	Total
Emissions to air				
As	9.50E+06	7.44E+04	-3.41E+04	4.03E+04
Benzo(a)pyrene	5.00E+07	6.43E+02	-1.46E+02	4.97E+02
Benzene	1.00E+07	4.24E+06	-2.15E+06	2.09E+06
Cd	1.10E+08	7.99E+05	-4.75E+05	3.23E+05
CO	8.30E+02	2.00E+06	-1.26E+06	7.36E+05

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... Table 4.1 continued from previous page.

HTA [m^3 air]	Charact-erisation factor	Packaging system	Effects on other life cycles	Total
Co	8.30E+02	7.66	-4.83	2.83
Cr	1.00E+06	3.52E+04	-3.11E+04	4.05E+03
Cr^{3+}	1.00E+06	2.93E+03	-5.05E+02	2.42E+03
Cu	5.70E+02	3.96E+01	-2.32E+01	1.64E+01
Dioxin	2.90E+10	1.04E+04	-1.10E+03	9.32E+03
Fe	3.70E+04	2.89E+04	-1.66E+02	2.87E+04
Fluorides	9.50E+04	9.65E+05	-1.68E+05	7.96E+05
Formaldehyde	1.30E+07	8.54E+05	-3.89E+05	4.65E+05
H_2S	1.10E+06	3.11E+06	-1.26E+06	1.84E+06
Hg	6.70E+06	1.51E+05	-1.85E+04	1.32E+05
Mn	2.50E+06	4.45E+05	-3.95E+05	5.00E+04
Mo	1.00E+05	7.01E+02	-4.47E+02	2.54E+02
N_2O	2.00E+03	7.86E+03	-1.57E+03	6.30E+03
Ni	6.70E+04	8.52E+03	-4.17E+03	4.35E+03
NMVOC, diesel engines	9.80E+05	5.95E+07	-5.00E+06	5.45E+07
NMVOC, el-coal	3.80E+05	2.18E+06	-2.48E+05	1.93E+06
NO_x	8.60E+03	1.65E+07	-3.60E+06	1.29E+07
Pb	1.00E+08	4.34E+07	-3.92E+07	4.26E+06
Sb	2.00E+04	5.62E+01	-4.44E+01	1.18E+01
Se	1.50E+06	5.39E+04	-8.71E+03	4.52E+04
SO_2	1.30E+03	1.93E+06	-5.67E+05	1.36E+06
Tl	5.00E+05	1.86E+03	-1.63E+03	2.35E+02
Toluene	2.50E+03	1.47E+02	-8.46E+01	6.27E+01
V	1.40E+05	3.18E+04	-1.13E+04	2.05E+04
Xylene	6.70E+03	3.29E+01	-3.04E+01	2.53
Emissions to water				
Co	8.30E+02	3.64E+01	-5.01	3.14E+01
Hg	6.70E+06	9.58E+03	0	9.58E+03
Total		**1.36E+08**	**-5.48E+07**	**8.16E+07**

ETWC [m^3 water]	Charact-erisation factor	Packaging system	Effects on other life cycles	Total
Emissions to air				
As	3.80E+02	2.98	-1.36	1.61
Benzene	4.00	1.69	-8.58E-01	8.36E-01
Cd	2.40E+04	1.74E+02	-1.04E+02	7.05E+01

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... Table 4.1 continued from previous page.

ETWC [m^3 water]	Charact-erisation factor	Packaging system	Effects on other life cycles	Total
Cr	1.30E+02	4.57	-4.05	5.26E-01
Cr^{3+}	1.30E+02	3.81E-01	-6.57E-02	3.15E-01
Cu	2.50E+03	1.74E+02	-1.02E+02	7.20E+01
Dioxin	5.60E+08	2.01E+02	-2.12E+01	1.80E+02
Fe	2.00E+01	1.56E+01	-8.98E-02	1.55E+01
Formaldehyde	2.40E+01	1.58	-7.18E-01	8.58E-01
Hg	4.00E+03	9.00E+01	-1.11E+01	7.89E+01
Mn	7.10E+01	1.26E+01	-1.12E+01	1.42
Mo	4.00E+02	2.80	-1.79	1.02
Ni	1.30E+02	1.65E+01	-8.10	8.43
NMVOC, diesel engines	6.20E+01	3.76E+03	-3.16E+02	3.45E+03
NMVOC, el-coal	1.14E+01	6.53E+01	-7.45	5.78E+01
Pb	4.00E+02	1.74E+02	-1.57E+02	1.70E+01
Se	4.00E+03	1.44E+02	-2.32E+01	1.21E+02
Sr	2.00E+03	5.15	-5.89E-01	4.56
Tl	6.70E+02	2.50	-2.18	3.15E-01
Toluene	4.00	2.36E-01	-1.35E-01	1.00E-01
V	4.00E+01	9.09	-3.23	5.86
Xylene	4.00	1.96E-02	-1.81E-02	1.51E-03
Zn	2.00E+02	1.02E+01	-4.48	5.75
Emissions to water				
As	1.90E+03	4.43	-1.93	2.50
Cd	1.20E+05	1.45E+02	-6.30E+01	8.18E+01
Cr	6.70E+02	2.39E+01	-2.24	2.17E+01
Cr^{3+}	6.70E+02	6.00	-2.74	3.26
Cu	1.30E+04	3.95E+02	-1.19E+01	3.83E+02
Fe	1.00E+02	4.27E+02	-3.26	4.23E+02
H_2S	6.70E+03	5.66E-01	-2.34E-01	3.32E-01
Hg	4.00E+03	5.72	0	5.72
Mn	3.60E+02	6.53E+01	-5.84	5.95E+01
Ni	6.70E+02	3.59E+01	-3.13	3.28E+01
Pb	2.00E+03	2.45E+01	-7.58	1.70E+01
Phenol	4.40E+01	2.93E-02	-1.18E-10	2.93E-02
Sr	1.00E+04	9.09E+03	-8.14E+02	8.28E+03
V	2.00E+02	4.32E-01	-1.79E-01	2.54E-01
Zn	1.00E+03	6.29E+01	-7.80	5.51E+01
Total		**1.52E+04**	**-1.70E+03**	**1.35E+04**

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... Table 4.1 continued from previous page.

HTW [m^3 water]	Charact-erisation factor	Packaging system	Effects on other life cycles	Total
Emissions to air				
As	7.40	5.80E-02	-2.66E-02	3.14E-02
Benzene	2.30	9.74E-01	-4.93E-01	4.81E-01
Cd	5.60E+02	4.07	-2.42	1.65
Cr	3.60	1.27E-01	-1.12E-01	1.46E-02
Cr^{3+}	3.60	1.05E-02	-1.82E-03	8.72E-03
Cu	3.40	2.36E-01	-1.38E-01	9.80E-02
Dioxin	2.20E+08	7.91E+01	-8.34	7.07E+01
Fe	9.60E-03	7.50E-03	-4.31E-05	7.46E-03
Formaldehyde	2.20E-05	1.44E-06	-6.58E-07	7.87E-07
H_2S	8.10E-04	2.29E-03	-9.30E-04	1.36E-03
Hg	1.10E+05	2.47E+03	-3.04E+02	2.17E+03
Mn	5.30E-03	9.44E-04	-8.38E-04	1.06E-04
Mo	5.30E-02	3.72E-04	-2.37E-04	1.35E-04
Ni	3.70E-03	4.70E-04	-2.30E-04	2.40E-04
NMVOC, diesel engines	4.60E-02	2.79	-2.34E-01	2.56
NMVOC, el-coal	7.30E-04	4.18E-03	-4.77E-04	3.70E-03
Pb	5.30E+01	2.30E+01	-2.08E+01	2.26
Sb	6.40E+01	1.80E-01	-1.42E-01	3.77E-02
Se	2.80E+01	1.01	-1.63E-01	8.44E-01
Tl	1.30E+04	4.85E+01	-4.23E+01	6.12
Toluene	4.00E-03	2.36E-04	-1.35E-04	1.00E-04
V	3.70E-02	8.40E-03	-2.99E-03	5.42E-03
Xylene	1.10E-03	5.40E-06	-4.98E-06	4.15E-07
Emissions to water				
As	3.70E+01	8.62E-02	-3.75E-02	4.87E-02
Cd	2.80E+03	3.38	-1.47	1.91
Cr	1.80E+01	6.43E-01	-6.01E-02	5.82E-01
Cr^{3+}	1.80E+01	1.61E-01	-7.35E-02	8.77E-02
Cu	1.70E+01	5.17E-01	-1.55E-02	5.01E-01
F^-	1.20E-02	8.15E-03	-1.32E-03	6.82E-03
Fe	4.80E-02	2.05E-01	-1.56E-03	2.03E-01
H_2S	4.10E-03	3.46E-07	-1.43E-07	2.03E-07
Hg	1.10E+05	1.57E+02	0	1.57E+02
Mn	2.70E-02	4.90E-03	-4.38E-04	4.46E-03
Ni	1.90E-02	1.02E-03	-8.87E-05	9.30E-04
Pb	2.60E+02	3.19	-9.85E-01	2.20
Phenol	3.40E-02	2.27E-05	-9.10E-14	2.27E-05

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HTW [m^3 water]	Charact-erisation factor	Packaging system	Effects on other life cycles	Total
Sb	3.20E+02	2.95E-03	-1.22E-03	1.74E-03
V	1.90E-01	4.11E-04	-1.70E-04	2.41E-04
Total		**2.80E+03**	**-3.82E+02**	**2.42E+03**

ETSC [m^3 soil]	Charact-erisation factor	Packaging system	Effects on other life cycles	Total
Emissions to air				
As	2.70E-01	2.12E-03	-9.70E-04	1.15E-03
Benzene	3.60	1.53	-7.72E-01	7.53E-01
Cd	1.80	1.31E-02	-7.78E-03	5.29E-03
Cr	1.00E-02	3.52E-04	-3.11E-04	4.05E-05
Cr^{3+}	1.00E-02	2.93E-05	-5.05E-06	2.42E-05
Cu	2.00E-02	1.39E-03	-8.12E-04	5.76E-04
Dioxin	1.20E+04	4.31E-03	-4.55E-04	3.86E-03
Fe	5.30E-01	4.14E-01	-2.38E-03	4.12E-01
Formaldehyde	2.00E+02	1.31E+01	-5.98	7.15
Hg	5.30	1.19E-01	-1.47E-02	1.05E-01
Mn	1.90	3.38E-01	-3.00E-01	3.80E-02
Mo	3.90	2.73E-02	-1.74E-02	9.92E-03
Ni	5.00E-02	6.36E-03	-3.11E-03	3.24E-03
NMVOC, diesel engines	5.80E+02	3.52E+04	-2.96E+03	3.22E+04
NMVOC, el-coal	9.20E+01	5.27E+02	-6.01E+01	4.67E+02
Pb	1.00E-02	4.34E-03	-3.92E-03	4.26E-04
Se	1.06E+02	3.81	-6.15E-01	3.19
Sr	5.30E+01	1.37E-01	-1.56E-02	1.21E-01
Tl	1.77E+01	6.60E-02	-5.76E-02	8.33E-03
Toluene	9.70E-01	5.72E-02	-3.28E-02	2.43E-02
V	3.40E-01	7.72E-02	-2.75E-02	4.98E-02
Xylene	4.00E-01	1.96E-03	-1.81E-03	1.51E-04
Zn	5.00E-03	2.56E-04	-1.12E-04	1.44E-04
Emissions to water				
Hg	5.30	7.58E-03	0	7.58E-03
Total		**3.57E+04**	**-3.02E+03**	**3.27E+04**

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ETWA [m³ water]	Charact-erisation factor	Packaging system	Effects on other life cycles	Total
Emissions to water				
As	1.90E+02	4.43E-01	-1.93E-01	2.50E-01
Cd	1.20E+04	1.45E+01	-6.30	8.18
Cr	6.70E+01	2.39	-2.24E-01	2.17
Cr^{3+}	6.70E+01	6.00E-01	-2.74E-01	3.26E-01
Cu	1.30E+03	3.95E+01	-1.19	3.83E+01
Fe	1.00E+01	4.27E+01	-3.26E-01	4.23E+01
H_2S	3.30E+03	2.79E-01	-1.15E-01	1.63E-01
Hg	2.00E+03	2.86	0	2.86
Mn	3.60E+01	6.53	-5.84E-01	5.95
Ni	6.70E+01	3.59	-3.13E-01	3.28
Pb	2.00E+02	2.45	-7.58E-01	1.70
Phenol	2.20E+01	1.47E-02	-5.89E-11	1.47E-02
Sr	1.00E+03	9.09E+02	-8.14E+01	8.28E+02
V	2.00E+01	4.32E-02	-1.79E-02	2.54E-02
Zn	1.00E+02	6.29	-7.80E-01	5.51
Total		**1.03E+03**	**-9.25E+01**	**9.39E+02**

HTS [m³ soil]	Charact-erisation factor	Packaging system	Effects on other life cycles	Total
Emissions to air				
As	1.00E+02	7.83E-01	-3.59E-01	4.24E-01
Benzene	1.40E+01	5.93	-3.00	2.93
Cd	4.50	3.27E-02	-1.94E-02	1.32E-02
Cr	1.10	3.87E-02	-3.42E-02	4.45E-03
Cr^{3+}	1.10	3.22E-03	-5.56E-04	2.66E-03
Cu	4.00E-03	2.78E-04	-1.62E-04	1.15E-04
Dioxin	1.40E+04	5.03E-03	-5.31E-04	4.50E-03
Fe	7.70E-01	6.02E-01	-3.46E-03	5.98E-01
Formaldehyde	5.80E-03	3.81E-04	-1.74E-04	2.07E-04
H_2S	2.60E-01	7.34E-01	-2.98E-01	4.36E-01
Hg	8.10E+01	1.82	-2.24E-01	1.60
Mn	4.20E-01	7.48E-02	-6.64E-02	8.40E-03
Mo	1.50	1.05E-02	-6.70E-03	3.81E-03
Ni	1.20E-01	1.53E-02	-7.47E-03	7.78E-03
NMVOC, diesel engines	2.80E-01	1.70E+01	-1.43	1.56E+01

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... Table 4.1 continued from previous page.

HTS [m^3 soil]	Charact-erisation factor	Packaging system	Effects on other life cycles	Total
NMVOC, el-coal	2.50E-04	1.43E-03	-1.63E-04	1.27E-03
Pb	8.30E-02	3.60E-02	-3.25E-02	3.54E-03
Sb	1.70E+01	4.78E-02	-3.78E-02	1.00E,02
Se	4.40E-02	1.58E-03	-2.55E-04	1.33E-03
Tl	1.00E+01	3.73E-02	-3.26E-02	4.71E-03
Toluene	1.00E-03	5.89E-05	-3.38E-05	2.51E-05
V	9.60E-01	2.18E-01	-7.75E-02	1.41E-01
Xylene	6.70E-05	3.29E-07	-3.04E-07	2.53E-08
Emissions to water				
Hg	8.10E+01	1.16E-01	0	1.16E-01
Total		**2.75E+01**	**-5.63**	**2.19E+01**

Table 4.2
Classification and characterisation for the packaging system with 50 cl steel cans. The unit of the characterisation factor is g equivalent per g emission. Functional unit: packaging and distribution of 1000 litres.

NP [kg NO_3^--equivalents]	Charact-erisation factor	Packaging system	Effects on other life cycles	Total
Emissions to air				
NH_3	3.64E-03	4.50E-04	-9.52E-05	3.54E-04
NO_x	1.35E-03	2.09	-4.53E-01	1.64
Emissions to water				
CN^-	2.38E-03	5.67E-06	-1.83E-06	3.83E-06
NH3	3.64E-03	8.55E-05	0	8.55E-05
NH_4^+	3.44E-03	1.93E-04	0	1.93E-04
NH_4-N	4.42E-03	6.26E-04	-3.46E-05	5.92E-04
Nitrates	1.00E-03	6.27E-06	0	6.27E-06
NO_3^-	1.00E-03	1.91E-05	3.62E-05	5.53E-05
NO_3-N	4.43E-03	4.41E-06	-3.07E-07	4.11E-06
Phosphate	3.20E-02	1.10E-03	-4.88E-05	1.05E-03
PO_4^{3-}	1.05E-02	2.65E-04	-1.24E-04	1.41E-04
Tot-N	4.43E-03	1.39E-02	-4.80E-03	9.07E-03
Tot-P	3.20E-02	4.11E-02	0	4.11E-02
Total		**2.15**	**-4.58E-01**	**1.69**

POCP [kg C_2H_4-equivalents]	Charact-erisation factor	Packaging system	Effects on other life cycles	Total
Emissions to air				
Acetylene	2.00E-04	4.64E-06	-5.12E-06	-4.85E-07
Aldehydes	5.00E-04	2.44E-06	-1.60E-07	2.28E-06
Alkanes	4.00E-04	3.75E-05	-6.72E-05	-2.96E-05
Alkenes	9.00E-04	2.38E-05	-2.84E-05	-4.59E-06
Aromates (C9-C10)	8.00E-04	6.68E-05	-1.50E-05	5.19E-05
Benzene	2.00E-04	7.40E-05	-3.53E-05	3.87E-05
CH_4	7.00E-06	1.32E-02	-7.87E-04	1.25E-02
CO	3.00E-05	5.99E-02	-3.93E-02	2.05E-02
Co	3.00E-05	2.43E-07	-1.54E-07	8.84E-08
Ethane	1.00E-04	6.85E-06	-7.14E-06	-2.84E-07
Ethene	1.00E-03	1.38E-04	-1.49E-04	-1.05E-05

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POCP [kg C_2H_4-equivalents]	Charact-erisation factor	Packaging system	Effects on other life cycles	Total
Formaldehyde	4.00E-04	2.42E-05	-9.40E-06	1.48E-05
HC	6.00E-04	4.03E-02	-8.57E-04	3.95E-02
NMVOC	4.00E-04	3.57E-02	-1.02E-02	2.55E-02
NMVOC, diesel engines	6.00E-04	3.19E-02	-2.89E-03	2.90E-02
NMVOC, el-coal	8.00E-04	3.41E-03	-2.94E-04	3.12E-03
NMVOC, natural gas combustion	4.00E-04	0	1.00E-05	1.00E-05
NMVOC, oil combustion	3.00E-04	2.20E-02	-1.03E-02	1.17E-02
NMVOC, petrol engines	6.00E-04	8.16E-13	-5.52E-14	7.61E-13
NMVOC, power plants	5.00E-04	1.79E-03	-1.18E-04	1.67E-03
Pentane	4.00E-04	1.15E-04	-3.39E-05	8.12E-05
Propane	4.00E-04	3.91E-05	-2.85E-05	1.06E-05
Propene	1.00E-03	2.43E-05	-3.10E-05	-6.69E-06
Toluene	6.00E-04	3.34E-05	-1.45E-05	1.89E-05
VOC, coal combustion	5.00E-04	9.75E-05	-4.77E-06	9.27E-05
VOC, diesel engines	6.00E-04	3.03E-03	-2.05E-04	2.83E-03
VOC, natural gas combustion	2.00E-04	2.85E-12	-1.92E-13	2.66E-12
Xylene	9.00E-04	3.98E-06	-3.64E-06	3.37E-07
Total		**2.12E-01**	**-6.54E-02**	**1.47E-01**

AP [kg SO_2-equivalents]	Charact-erisation factor	Packaging system	Effects on other life cycles	Total
Emissions to air				
H_2S	1.88E-03	4.23E-03	-1.85E-03	2.39E-03
HCl	8.80E-04	1.89E-02	-4.59E-03	1.43E-02
HF	1.60E-03	1.01E-03	-6.38E-04	3.74E-04
NH_3	1.88E-03	2.32E-04	-4.92E-05	1.83E-04
NO_x	7.00E-04	1.08	-2.35E-01	8.50E-01
SO_2	1.00E-03	1.14	-3.45E-01	8.00E-01
SO_3	8.00E-04	4.80E-04	0	4.80E-04
Emissions to water				
Acid as H^+	3.20E-02	5.73E-03	0	5.73E-03
H^+	3.20E-02	3.43E-03	-2.34E-04	3.20E-03
H_2S	1.88E-03	1.46E-07	-4.77E-08	9.86E-08
H_2SO_4	6.50E-04	3.64E-03	-6.36E-04	3.01E-03
NH_3	1.88E-03	4.42E-05	0	4.42E-05

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AP [kg SO_2-equivalents]	Charact-erisation factor	Packaging system	Effects on other life cycles	Total
NH_4^+	3.56E-03	2.00E-04	0	2.00E-04
NH_4-N	4.58E-03	6.49E-04	-3.59E-05	6.13E-04
Total		**2.27**	**-5.88E-01**	**1.68**

GWP [kg CO_2-equivalents]	Charact-erisation factor	Packaging system	Effects on other life cycles	Total
Emissions to air				
C_2F_6	1.25E-02	3.50E-03	-6.11E-04	2.89E-03
CF_4	6.30E-03	1.59E-02	-2.77E-03	1.31E-02
CH_4	2.50E-02	4.73E+01	-2.81	4.45E+01
CO	2.00E-03	3.99	-2.62	1.37
Co	2.00E-03	1.62E-05	-1.03E-05	5.90E-06
CO_2	1.00E-03	5.05E+02	-1.86E+02	3.19E+02
COS	7.00E-04	1.96E-02	-3.42E-03	1.62E-02
HC	3.00E-03	2.02E-01	-4.29E-03	1.97E-01
N_2O	3.20E-01	1.02	-2.00E-01	8.19E-01
Total		**5.58E+02**	**-1.92E+02**	**3.66E+02**

HTA [m^3 air]	Charact-erisation factor	Packaging system	Effects on other life cycles	Total
Emissions to air				
As	9.50E+06	6.19E+04	-2.91E+04	3.28E+04
Benzo(a)pyrene	5.00E+07	5.47E+02	-1.09E+02	4.38E+02
Benzene	1.00E+07	3.70E+06	-1.76E+06	1.93E+06
Cd	1.10E+08	7.11E+05	-4.19E+05	2.92E+05
CO	8.30E+02	1.66E+06	-1.09E+06	5.68E+05
Co	8.30E+02	6.71	-4.27	2.45
Cr	1.00E+06	3.16E+04	-2.77E+04	3.92E+03
Cr^{3+}	1.00E+06	2.23E+03	-3.53E+02	1.88E+03
Cu	5.70E+02	3.51E+01	-2.08E+01	1.43E+01
Dioxin	2.90E+10	8.60E+03	-8.79E+02	7.72E+03
Fe	3.70E+04	2.82E+04	-1.48E+02	2.80E+04

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HTA [m^3 air]	Charact-erisation factor	Packaging system	Effects on other life cycles	Total
Fluorides	9.50E+04	6.39E+05	-1.11E+05	5.27E+05
Formaldehyde	1.30E+07	7.85E+05	-3.06E+05	4.79E+05
H_2S	1.10E+06	2.48E+06	-1.08E+06	1.40E+06
Hg	6.70E+06	1.13E+05	-1.08E+04	1.02E+05
Mn	2.50E+06	3.96E+05	-3.54E+05	4.24E+04
Mo	1.00E+05	6.07E+02	-3.93E+02	2.14E+02
N_2O	2.00E+03	6.37E+03	-1.25E+03	5.12E+03
Ni	6.70E+04	7.58E+03	-3.62E+03	3.96E+03
NMVOC, diesel engines	9.80E+05	5.22E+07	-4.72E+06	4.74E+07
NMVOC, el-coal	3.80E+05	1.62E+06	-1.40E+05	1.48E+06
NO_x	8.60E+03	1.33E+07	-2.89E+06	1.04E+07
Pb	1.00E+08	3.89E+07	-3.50E+07	3.89E+06
Sb	2.00E+04	4.93E+01	-3.93E+01	9.95
Se	1.50E+06	4.08E+04	-5.91E+03	3.49E+04
SO_2	1.30E+03	1.49E+06	-4.48E+05	1.04E+06
Tl	5.00E+05	1.67E+03	-1.45E+03	2.16E+02
Toluene	2.50E+03	1.39E+02	-6.05E+01	7.87E+01
V	1.40E+05	2.86E+04	-1.01E+04	1.85E+04
Xylene	6.70E+03	2.96E+01	-2.71E+01	2.51
Emissions to water				
Co	8.30E+02	2.74E+01	-3.75	2.37E+01
Hg	6.70E+06	8.58E+03	0	8.58E+03
Total		**1.18E+08**	**-4.84E+07**	**6.98E+07**

ETWC [m^3 water]	Charact-erisation factor	Packaging system	Effects on other life cycles	Total
Emissions to air				
As	3.80E+02	2.48	-1.16	1.31
Benzene	4.00	1.48	-7.05E-01	7.74E-01
Cd	2.40E+04	1.55E+02	-9.15E+01	6.37E+01
Cr	1.30E+02	4.11	-3.60	5.09E-01
Cr^{3+}	1.30E+02	2.90E-01	-4.59E-02	2.44E-01
Cu	2.50E+03	1.54E+02	-9.11E+01	6.29E+01
Dioxin	5.60E+08	1.66E+02	-1.70E+01	1.49E+02
Fe	2.00E+01	1.52E+01	-8.02E-02	1.52E+01
Formaldehyde	2.40E+01	1.45	-5.64E-01	8.85E-01

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ETWC [m^3 water]	Charact-erisation factor	Packaging system	Effects on other life cycles	Total
Hg	4.00E+03	6.74E+01	-6.48	6.09E+01
Mn	7.10E+01	1.13E+01	-1.00E+01	1.20
Mo	4.00E+02	2.43	-1.57	8.57E-01
Ni	1.30E+02	1.47E+01	-7.02	7.68
NMVOC, diesel engines	6.20E+01	3.30E+03	-2.98E+02	3.00E+03
NMVOC, el-coal	1.14E+01	4.86E+01	-4.20	4.44E+01
Pb	4.00E+02	1.56E+02	-1.40E+02	1.56E+01
Se	4.00E+03	1.09E+02	-1.58E+01	9.30E+01
Sr	2.00E+03	3.84	-3.32E-01	3.51
Tl	6.70E+02	2.23	-1.94	2.89E-01
Toluene	4.00	2.23E-01	-9.68E-02	1.26E-01
V	4.00E+01	8.16	-2.88	5.28
Xylene	4.00	1.77E-02	-1.62E-02	1.50E-03
Zn	2.00E+02	8.67	-3.92	4.75
Emissions to water				
As	1.90E+03	3.90	-1.55	2.35
Cd	1.20E+05	1.28E+02	-5.05E+01	7.75E+01
Cr	6.70E+02	2.16E+01	-1.62	2.00E+01
Cr^{3+}	6.70E+02	5.07	-2.38	2.69
Cu	1.30E+04	3.55E+02	-8.55	3.47E+02
Fe	1.00E+02	3.80E+02	-1.96	3.78E+02
H_2S	6.70E+03	5.21E-01	-1.70E-01	3.51E-01
Hg	4.00E+03	5.12	0	5.12
Mn	3.60E+02	5.21E+01	-3.52	4.86E+01
Ni	6.70E+02	3.10E+01	-2.29	2.87E+01
Pb	2.00E+03	2.18E+01	-6.10	1.57E+01
Phenol	4.40E+01	3.02E-02	-7.07E-11	3.02E-02
Sr	1.00E+04	7.25E+03	-4.89E+02	6.76E+03
V	2.00E+02	3.98E-01	-1.29E-01	2.69E-01
Zn	1.00E+03	5.15E+01	-5.08	4.64E+01
Total		**1.25E+04**	**-1.27E+03**	**1.13E+04**

HTW [m^3 water]	Charact-erisation factor	Packaging system	Effects on other life cycles	Total
Emissions to air				
As	7.40	4.82E-02	-2.27E-02	2.56E-02

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HTW [m^3 water]	Charact-erisation factor	Packaging system	Effects on other life cycles	Total
Benzene	2.30	8.51E-01	-4.06E-01	4.45E-01
Cd	5.60E+02	3.62	-2.13	1.49
Cr	3.60	1.14E-01	-9.98E-02	1.41E-02
Cr^{3+}	3.60	8.04E-03	-1.27E-03	6.77E-03
Cu	3.40	2.09E-01	-1.24E-01	8.55E-02
Dioxin	2.20E+08	6.52E+01	-6.67	5.86E+01
Fe	9.60E-03	7.31E-03	-3.85E-05	7.28E-03
Formaldehyde	2.20E-05	1.33E-06	-5.17E-07	8.11E-07
H_2S	8.10E-04	1.82E-03	-7.95E-04	1.03E-03
Hg	1.10E+05	1.85E+03	-1.78E+02	1.67E+03
Mn	5.30E-03	8.40E-04	-7.50E-04	8.98E-05
Mo	5.30E-02	3.22E-04	-2.08E-04	1.13E-04
Ni	3.70E-03	4.19E-04	-2.00E-04	2.19E-04
NMVOC, diesel engines	4.60E-02	2.45	-2.21E-01	2.23
NMVOC, el-coal	7.30E-04	3.11E-03	-2.69E-04	2.84E-03
Pb	5.30E+01	2.06E+01	-1.86E+01	2.06
Sb	6.40E+01	1.58E-01	-1.26E-01	3.18E-02
Se	2.80E+01	7.61E-01	-1.10E-01	6.51E-01
Tl	1.30E+04	4.33E+01	-3.77E+01	5.61
Toluene	4.00E-03	2.23E-04	-9.68E-05	1.26E-04
V	3.70E-02	7.55E-03	-2.66E-03	4.88E-03
Xylene	1.10E-03	4.86E-06	-4.45E-06	4.12E-07
Emissions to water				
As	3.70E+01	7.60E-02	-3.02E-02	4.58E-02
Cd	2.80E+03	2.99	-1.18	1.81
Cr	1.80E+01	5.81E-01	-4.36E-02	5.37E-01
Cr^{3+}	1.80E+01	1.36E-01	-6.40E-02	7.24E-02
Cu	1.70E+01	4.65E-01	-1.12E-02	4.54E-01
F	1.20E-02	6.60E-03	-9.85E-04	5.62E-03
Fe	4.80E-02	1.82E-01	-9.40E-04	1.81E-01
H_2S	4.10E-03	3.19E-07	-1.04E-07	2.15E-07
Hg	1.10E+05	1.41E+02	0	1.41E+02
Mn	2.70E-02	3.91E-03	-2.64E-04	3.65E-03
Ni	1.90E-02	8.80E-04	-6.50E-05	8.15E-04
Pb	2.60E+02	2.83	-7.93E-01	2.04
Phenol	3.40E-02	2.34E-05	-5.46E-14	2.34E-05
Sb	3.20E+02	2.72E-03	-8.83E-04	1.84E-03

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HTW [m³ water]		Charact-erisation factor	Packaging system	Effects on other life cycles	Total
V		1.90E-01	3.78E-04	-1.23E-04	2.56E-04
	Total		**2.14E+03**	**-2.46E+02**	**1.89E+03**

ETSC [m³ soil]		Charact-erisation factor	Packaging system	Effects on other life cycles	Total
Emissions to air					
As		2.70E-01	1.76E-03	-8.27E-04	9.33E-04
Benzene		3.60	1.33	-6.35E-01	6.96E-01
Cd		1.80	1.16E-02	-6.86E-03	4.77E-03
Cr		1.00E-02	3.16E-04	-2.77E-04	3.92E-05
Cr^{3+}		1.00E-02	2.23E-05	-3.53E-06	1.88E-05
Cu		2.00E-02	1.23E-03	-7.29E-04	5.03E-04
Dioxin		1.20E+04	3.56E-03	-3.64E-04	3.20E-03
Fe		5.30E-01	4.04E-01	-2.12E-03	4.02E-01
Formaldehyde		2.00E+02	1.21E+01	-4.70	7.38
Hg		5.30	8.92E-02	-8.58E-03	8.07E-02
Mn		1.90	3.01E-01	-2.69E-01	3.22E-02
Mo		3.90	2.37E-02	-1.53E-02	8.35E-03
Ni		5.00E-02	5.66E-03	-2.70E-03	2.95E-03
NMVOC, diesel engines		5.80E+02	3.09E+04	-2.79E+03	2.81E+04
NMVOC, el-coal		9.20E+01	3.92E+02	-3.39E+01	3.58E+02
Pb		1.00E-02	3.89E-03	-3.50E-03	3.89E-04
Se		1.06E+02	2.88	-4.18E-01	2.46
Sr		5.30E+01	1.02E-01	-8.80E-03	9.30E-02
Tl		1.77E+01	5.90E-02	-5.14E-02	7.64E-03
Toluene		9.70E-01	5.40E-02	-2.35E-02	3.05E-02
V		3.40E-01	6.93E-02	-2.45E-02	4.49E-02
Xylene		4.00E-01	1.77E-03	-1.62E-03	1.50E-04
Zn		5.00E-03	2.17E-04	-9.80E-05	1.19E-04
Emissions to water					
Hg		5.30	6.78E-03	0	6.78E-03
	Total		**3.13E+04**	**-2.83E+03**	**2.84E+04**

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ETWA [m^3 water]	Charact-erisation factor	Packaging system	Effects on other life cycles	Total
Emissions to water				
As	1.90E+02	3.90E-01	-1.55E-01	2.35E-01
Cd	1.20E+04	1.28E+01	-5.05	7.75
Cr	6.70E+01	2.16	-1.62E-01	2.00
Cr^{3+}	6.70E+01	5.07E-01	-2.38E-01	2.69E-01
Cu	1.30E+03	3.55E+01	-8.55E-01	3.47E+01
Fe	1.00E+01	3.80E+01	-1.96E-01	3.78E+01
H_2S	3.30E+03	2.57E-01	-8.37E-02	1.73E-01
Hg	2.00E+03	2.56	0	2.56
Mn	3.60E+01	5.21	-3.52E-01	4.86
Ni	6.70E+01	3.10	-2.29E-01	2.87
Pb	2.00E+02	2.18	-6.10E-01	1.57
Phenol	2.20E+01	1.51E-02	-3.54E-11	1.51E-02
Sr	1.00E+03	7.25E+02	-4.89E+01	6.76E+02
V	2.00E+01	3.98E-02	-1.29E-02	2.69E-02
Zn	1.00E+02	5.15	-5.08E-01	4.64
Total		**8.32E+02**	**-5.74E+01**	**7.75E+02**

HTS [m^3 soil]	Charact-erisation factor	Packaging system	Effects on other life cycles	Total
Emissions to air				
As	1.00E+02	6.52E-01	-3.06E-01	3.45E-01
Benzene	1.40E+01	5.18	-2.47	2.71
Cd	4.50	2.91E-02	-1.72E-02	1.19E-02
Cr	1.10	3.48E-02	-3.05E-02	4.31E-03
Cr^{3+}	1.10	2.46E-03	-3.89E-04	2.07E-03
Cu	4.00E-03	2.46E-04	-1.46E-04	1.01E-04
Dioxin	1.40E+04	4.15E-03	-4.24E-04	3.73E-03
Fe	7.70E-01	5.87E-01	-3.09E-03	5.84E-01
Formaldehyde	5.80E-03	3.50E-04	-1.36E-04	2.14E-04
H_2S	2.60E-01	5.85E-01	-2.55E-01	3.30E-01
Hg	8.10E+01	1.36	-1.31E-01	1.23
Mn	4.20E-01	6.66E-02	-5.94E-02	7.12E-03
Mo	1.50	9.11E-03	-5.89E-03	3.21E-03
Ni	1.20E-01	1.36E-02	-6.48E-03	7.09E-03
NMVOC, diesel engines	2.80E-01	1.49E+01	-1.35	1.36E+01

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HTS [m³ soil]	Charact-erisation factor	Packaging system	Effects on other life cycles	Total
NMVOC, el-coal	2.50E-04	1.07E-03	-9.20E-05	9.74E-04
Pb	8.30E-02	3.23E-02	-2.91E-02	3.23E-03
Sb	1.70E+01	4.19E-02	-3.34E-02	8.46E-03
Se	4.40E-02	1.20E-03	-1.73E-04	1.02E-03
Tl	1.00E+01	3.33E-02	-2.90E-02	4.32E-03
Toluene	1.00E-03	5.57E-05	-2.42E-05	3.15E-05
V	9.60E-01	1.96E-01	-6.91E-02	1.27E-01
Xylene	6.70E-05	2.96E-07	-2.71E-07	2.51E-08
Emissions to water				
Hg	8.10E+01	1.04E-01	0	1.04E-01
Total		**2.38E+01**	**-4.79**	**1.90E+01**

4.2 Normalisation

Table 4.3

Normalisation results for the packaging system with 33 cl steel cans. Functional unit: packaging and distribution of 1000 litres.

Normalisation: Environmental impact categories	Normalisation reference (1)	Packaging system [PE_{WDK90}] (2)	Effects on other life cycles [PE_{WDK90}] (2)	Total [PE_{WDK90}] (2)
Environmental impacts				
Global warming (GWP)	8700	7.94E-02	-2.71E-02	5.23E-02
Photochemical ozone formation (POCP)	20	1.25E-02	-3.95E-03	8.54E-03
Acidification (AP)	124	2.32E-02	-5.97E-03	1.72E-02
Nutrient enrichment (NP)	298	8.92E-03	-1.92E-03	7.00E-03
Human toxicity, water (HTW)	59000	4.75E-02	-6.48E-03	4.10E-02
Human toxicity, soil (HTS)	310	8.87E-02	-1.82E-02	7.05E-02
Ecotoxicity, aquatic, chronic (ETWC)	470000	3.22E-02	-3.62E-03	2.86E-02
Ecotoxicity, terrestrial, chronic (ETSC)	30000	1.19	-1.01E-01	1.09
Ecotoxicity, aquatic, acute (ETWA)	48000	2.15E-02	-1.93E-03	1.96E-02
Human toxicity, air (HTA)	9.20E+09	1.48E-02	-5.96E-03	8.86E-03
Waste				
Bulk waste (non-hazardous)	1350	1.84E-01	-7.15E-02	1.13E-01
Hazardous waste	20.7	5.13E-01	-4.64E-02	4.67E-01
Slag and ashes	320	2.09E-02	7.91E-04	2.17E-02
Nuclear waste	0.159	1.04E-01	1.50E-02	1.19E-01
Resources				
Oil	590	6.87E-02	-1.99E-02	4.88E-02
Coal	570	3.26E-01	-2.93E-02	2.96E-01
Brown coal	250	1.20E-02	-1.62E-03	1.03E-02
Natural gas	310	8.26E-02	-8.40E-03	7.42E-02
Aluminium	3.1	3.14	-5.48E-01	2.59
Lead	0.64	0	0	0
Iron	100	8.25E-01	-7.71E-01	5.44E-02
Copper	1.7	0	0	0
Manganese	1.8	1.20E-06	-1.07E-07	1.09E-06
Nickel	0.18	0	0	0
Tin	0.04	5.00	0	5.00
Zinc	1.4	0	0	0

(1) The normalisation references have the following units: characterisation equivalent/pers/year (for environmental impacts), kg/pers/year (for waste) m^3/pers/year (for wood) and kg/pers/year (for other resources).

(2) PE_{WDK90}: person equivalent based on emission levels, waste levels and resource demand in the year 1990.

Table 4.4
Normalisation results for the packaging system with 50 cl steel cans.
Functional unit: packaging and distribution of 1000 litres.

Normalisation: Environmental impact categories	Normalisation reference (1)	Packaging system [PE_{WDK90}] (2)	Effects on other life cycles [PE_{WDK90}] (2)	Total [PE_{WDK90}] (2)
Environmental impacts				
Global warming (GWP)	8700	6.41E-02	-2.20E-02	4.21E-02
Photochemical ozone formation (POCP)	20	1.06E-02	-3.27E-03	7.33E-03
Acidification (AP)	124	1.83E-02	-4.74E-03	1.35E-02
Nutrient enrichment (NP)	298	7.21E-03	-1.54E-03	5.68E-03
Human toxicity, water (HTW)	59000	3.62E-02	-4.18E-03	3.21E-02
Human toxicity, soil (HTS)	310	7.69E-02	-1.55E-02	6.14E-02
Ecotoxicity, aquatic, chronic (ETWC)	470000	2.67E-02	-2.71E-03	2.40E-02
Ecotoxicity, terrestrial, chronic (ETSC)	30000	1.04	-9.44E-02	9.48E-01
Ecotoxicity, aquatic, acute (ETWA)	48000	1.73E-02	-1.20E-03	1.61E-02
Human toxicity, air (HTA)	9.20E+09	1.28E-02	-5.26E-03	7.58E-03
Waste				
Bulk waste (non-hazardous)	1350	1.55E-01	-6.08E-02	9.42E-02
Hazardous waste	20.7	4.32E-01	-2.81E-02	4.04E-01
Slag and ashes	320	1.75E-02	-5.55E-05	1.75E-02
Nuclear waste	0.159	9.42E-02	8.18E-03	1.02E-01
Resources				
Oil	590	5.60E-02	-1.53E-02	4.07E-02
Coal	570	2.60E-01	-1.77E-02	2.42E-01
Brown coal	250	9.74E-03	-1.13E-03	8.61E-03
Natural gas	310	7.08E-02	-5.38E-03	6.54E-02
Aluminium	3.1	2.08	-3.62E-01	1.71
Lead	0.64	0	0	0
Iron	100	7.41E-01	-6.88E-01	5.27E-02
Copper	1.7	0	0	0
Manganese	1.8	9.58E-07	-6.46E-08	8.93E-07
Nickel	0.18	0	0	0
Tin	0.04	4.51	0	4.51
Zinc	1.4	0	0	0

(1) The normalisation references have the following units: characterisation equivalent/pers/year (for environmental impacts), kg/pers/year (for waste) m^3/pers/year (for wood) and kg/pers/year (for other resources).

(2) PE_{WDK90}: person equivalent based on emission levels, waste levels and resource demand in the year 1990.

4.3 Weighting

Table 4.5
Weighting results for the packaging system with 33 cl steel cans. Functional unit: packaging and distribution of 1000 litres.

Weighting: Environmental impact categories	Weighting factor	Packaging system	Effects on other life cycles	Total
Environmental impacts	[$PET_{WDK2000}$ /PE_{WDK90}] (1)	[$PET_{WDK2000}$]	[$PET_{WDK2000}$]	[$PET_{WDK2000}$]
Global warming (GWP)	1.3	1.03E-01	-3.52E-02	6.80E-02
Photochemical ozone formation (POCP)	1.2	1.50E-02	-4.74E-03	1.02E-02
Acidification (AP)	1.3	3.02E-02	-7.75E-03	2.24E-02
Nutrient enrichment (NP)	1.2	1.07E-02	-2.30E-03	8.40E-03
Human toxicity, water (HTW)	3.1	1.47E-01	-2.01E-02	1.27E-01
Human toxicity, soil (HTS)	2.3	2.04E-01	-4.18E-02	1.62E-01
Ecotoxicity, aquatic, chronic (ETWC)	2.6	8.38E-02	-9.42E-03	7.44E-02
Ecotoxicity, terrestrial, chronic (ETSC)	1.9	2.26	-1.92E-01	2.07
Ecotoxicity, aquatic, acute (ETWA)	2.6	5.59E-02	-5.01E-03	5.08E-02
Human toxicity, air (HTA)	2.8	4.15E-02	-1.67E-02	2.48E-02
Waste	[$PET_{WDK2000}$/PE_{WDK90}]	[$PET_{WDK2000}$]	[$PET_{WDK2000}$]	[$PET_{WDK2000}$]
Bulk waste (non-hazardous)	1.1	2.03E-01	-7.87E-02	1.24E-01
Hazardous waste	1.1	5.64E-01	-5.11E-02	5.13E-01
Slag and ashes	1.1	2.30E-02	8.70E-04	2.39E-02
Nuclear waste	1.1	1.14E-01	1.65E-02	1.31E-01
Resources	[PR_{W90}/PE_{WDK90}]	[PR_{W90}] (2)	[PR_{W90}]	[PR_{W90}]
Oil	2.30E-02	1.58E-03	-4.57E-04	1.12E-03
Coal	5.80E-03	1.89E-03	-1.70E-04	1.72E-03
Brown coal	2.60E-03	3.11E-05	-4.22E-06	2.69E-05
Natural gas	1.60E-02	1.32E-03	-1.34E-04	1.19E-03
Aluminium	5.10E-03	1.60E-02	-2.80E-03	1.32E-02
Lead	4.80E-02	0	0	0
Iron	8.50E-03	7.01E-03	-6.55E-03	4.62E-04
Copper	2.80E-02	0	0	0
Manganese	1.20E-02	1.44E-08	-1.29E-09	1.31E-08
Nickel	1.90E-02	0	0	0
Tin	3.70E-02	1.85E-01	0	1.85E-01
Zinc	5.00E-02	0	0	0

(1) $PET_{WDK2000}$: person equivalent based on target emissions in the year 2000.
PE_{WDK90}: person equivalent based on emission levels in the year 1990.

(2) PR_{W90}: person-reserve, *i.e.*, the fraction of known global reserves per person, in 1990.

Table 4.6

Weighting results for the packaging system with 50 cl steel cans. Functional unit: packaging and distribution of 1000 litres.

Weighting: Environmental impact categories	Weighting factor	Packaging system	Effects on other life cycles	Total
Environmental impacts	[$PET_{WDK2000}$ /PE_{WDK90}] (1)	[$PET_{WDK2000}$]	[$PET_{WDK2000}$]	[$PET_{WDK2000}$]
Global warming (GWP)	1.3	8.33E-02	-2.86E-02	5.47E-02
Photochemical ozone formation (POCP)	1.2	1.27E-02	-3.92E-03	8.79E-03
Acidification (AP)	1.3	2.38E-02	-6.16E-03	1.76E-02
Nutrient enrichment (NP)	1.2	8.65E-03	-1.84E-03	6.81E-03
Human toxicity, water (HTW)	3.1	1.12E-01	-1.29E-02	9.94E-02
Human toxicity, soil (HTS)	2.3	1.77E-01	-3.56E-02	1.41E-01
Ecotoxicity, aquatic, chronic (ETWC)	2.6	6.93E-02	-7.03E-03	6.23E-02
Ecotoxicity, terrestrial, chronic (ETSC)	1.9	1.98	-1.79E-01	1.80
Ecotoxicity, aquatic, acute (ETWA)	2.6	4.51E-02	-3.11E-03	4.20E-02
Human toxicity, air (HTA)	2.8	3.60E-02	-1.47E-02	2.12E-02
Waste	[$PET_{WDK2000}$/PE_{WDK90}]	[$PET_{WDK2000}$]	[$PET_{WDK2000}$]	[$PET_{WDK2000}$]
Bulk waste (non-hazardous)	1.1	1.71E-01	-6.69E-02	1.04E-01
Hazardous waste	1.1	4.75E-01	-3.09E-02	4.44E-01
Slag and ashes	1.1	1.93E-02	-6.10E-05	1.92E-02
Nuclear waste	1.1	1.04E-01	9.00E-03	1.13E-01
Resources	[PR_{W90}/PE_{WDK90}]	[PR_{W90}] (2)	[PR_{W90}]	[PR_{W90}]
Oil	2.30E-02	1.29E-03	-3.52E-04	9.36E-04
Coal	5.80E-03	1.51E-03	-1.02E-04	1.40E-03
Brown coal	2.60E-03	2.53E-05	-2.95E-06	2.24E-05
Natural gas	1.60E-02	1.13E-03	-8.61E-05	1.05E-03
Aluminium	5.10E-03	1.06E-02	-1.85E-03	8.74E-03
Lead	4.80E-02	0	0	0
Iron	8.50E-03	6.30E-03	-5.85E-03	4.48E-04
Copper	2.80E-02	0	0	0
Manganese	1.20E-02	1.15E-08	-7.75E-10	1.07E-08
Nickel	1.90E-02	0	0	0
Tin	3.70E-02	1.67E-01	0	1.67E-01
Zinc	5.00E-02	0	0	0

(1) $PET_{WDK2000}$: person equivalent based on target emissions in the year 2000.
PE_{WDK90}: person equivalent based on emission levels in the year 1990.

(2) PR_{W90}: person-reserve, *i.e.*, the fraction of known global reserves per person, in 1990.

5 Interpretation

5.1 Dominance Analysis

Important impacts

The normalisation and weighting results indicate that the packaging systems with steel cans contribute most to the following environmental impacts (see Tables 4.3-4.6):

- Ecotoxicity, terrestrial, chronic (ETSC)
- Human toxicity, soil (HTS)
- Human toxicity, water (HTW)

However, the uncertainties in the normalisation and weighting results for toxicity and ecotoxicity impacts are very large. There are large uncertainties and possibly important data gaps in the inventory results regarding toxic emissions (see, *e.g.*, sections 2.1 and 3.3 in Technical report 7). There are large data gaps in the characterisation of toxicity and ecotoxicity impacts (see section 5.3 below). Furthermore, there are large uncertainties in the reference flows used in the normalisation of these impacts (see section 5.4.3).

It should also be noted that the fact that an environmental impact gets a high score in the normalisation and weighting does not necessarily imply that the impact is important. The normalisation and weighting results shows how much the packaging system contributes to an environmental impact, compared to current impact levels or targets levels. But the normalisation and weighting do not take into account the fact that different target levels may not be equally important.

Waste and resources

The steel can systems contribute a relatively large share (>100 mPET) of the target levels for generation of bulk waste, hazardous waste and nuclear waste. They also contribute significantly (more than approximately 1 mPR) to the depletion of coal, natural gas, aluminium and tin resources.

Important processes

The processes contributing most to the environmental impacts of the 33 cl steel can system are identified in Table 5.1. This table also presents processes or parts of the system investigated were the packaging system results in significant environmental gains. Such gains can be caused by, *e.g.*, the use of recycled material from the packaging system.

The results of a dominance analysis of the 50 cl steel can system would be similar to the results presented in Table 5.1. The reason is that the structure of the two systems is quite similar.

Table 5.1
The processes most important for the environmental impacts of the 33 cl steel can system. The figures are given in % of the net total potential environmental impact.

	GWP	POCP	AP	NP	HTW	HTS	ETWC	ETSC	ETWA	HTA
1. Steel can production	77	60	39	39	43	26	51	13	63	73
11. Trp of iron to tinplate production			14	15		13		12		12
12. Primary aluminium production	46	27	54	39	49	21	28	17	31	23
53. Distribution of beverage		21		12		31	12	43		31
66. Avoided steel production	-37	-33	-22	-19		-21		-12		-61

Steel can production

The largest contributions to GWP, POCP, ETWC, ETWA and HTA are caused by the production of steel cans (The process *steel can production* includes aggregated data for a group of processes, of which tinplate production and can production are the most important ones). The main contributing parameters are carbon dioxide emissions (GWP), carbon monoxide emissions (POCP), emissions of strontium to water (ETWC and ETWA) and emissions of lead to air (HTA). The production of steel cans also contributes significantly to AP, NP, HTW and HTS, mainly caused by emissions of NO_x (AP and NP) and SO_2 (AP), mercury emissions to air (HTW), and emissions of benzene and NMVOC from diesel engines (HTS).

Primary aluminium production

The largest contributions to AP, NP and HTW are caused by emissions of NO_x (AP and NP), SO_2 (AP) and mercury emissions to air (HTW) from the production of primary aluminium. The production of primary aluminium also contributes significantly to GWP, POCP, HTS, ETWC, ETWA and HTA, mainly caused by carbon dioxide emissions (GWP), carbon monoxide emissions (POCP), emissions of NMVOC from diesel engines (HTS) and strontium emissions to water (ETWC and ETWA).

Distribution of beverage

The largest contributions to HTS and ETSC are caused by emissions of NMVOC from diesel engines arising from the distribution of beverage. The distribution of beverage also contributes significantly to POCP and HTA, caused by emissions of NMVOC (POCP) and NMVOC from diesel engines (POCP and HTA).

Avoided steel production

The avoided steel production mainly contributes to avoided impacts for GWP, POCP, AP, HTS and HTA. The avoided impacts are caused by avoided carbon dioxide emissions (GWP), avoided carbon monoxide emissions (POCP), avoided emissions of SO_2 and NO_x (AP), avoided emissions of benzene and NMVOC from diesel engines (HTS), and avoided emissions of lead to air (HTA).

Waste generation

The bulk waste consists mainly of industrial waste and unspecified bulk waste. The industrial waste is generated at steel can production. The unspecified bulk waste is generated at steel can production (*i.e.* at the tinplate production and/or at the can production) and at primary aluminium production. The hazardous waste consists mainly of unspecified, hazardous waste and is generated at steel can production. The nuclear waste consists mainly of highly radioactive waste and is generated at the production of oil and diesel.

Resource demand

Most of the coal is used as coke at the production of pig iron in the blast furnace. A significant amount is also used for production of the electricity that is used for primary aluminium production. The natural gas is mainly used at the production of steel cans where it serves as a fuel. The depletion of aluminium (*i.e.* the resource bauxite) arises from the production of primary aluminium. The primary aluminium is used for the lid production. The depletion of the tin arises from the extraction of tin ore. The tin is used as an alloy in the can body.

5.2 Sensitivity Analysis

5.2.1 Non-elementary inflows

Refining boundaries

Non-elementary inflows are auxiliary materials and other material flows that are not traced back all the way to the boundary between technosphere and nature. After initial calculations we performed a sensitivity analysis to estimate the environmental significance of the non-elementary inflows. As a result of this sensitivity analysis we decided to include the production of base coat and inside coatings.

Amounts

Many non-elementary inflows remain in this LCA (see Tables 3.3 and 3.6) but they are all relatively small. The total amount of non-elementary inflows to the 33 cl system is 6.5 kg per 1000 litres (the inflows to the 50 cl system are smaller). This corresponds to approx. 5% of the weight of the total packaging. The largest non-elementary inflows are:

- Bark which is used as a fuel in the production of planks, cardboard, corrugated board and kraftliner: 0.9 kg/1000 litres
- Alloys (other than tin) used at tinplate production: 0.5 kg/1000 litres
- Sulphur used at sulphuric acid (H_2SO_4) production: 0.4 kg/1000 litres.

Environmental significance

We have performed an assessment to estimate the environmental significance of the cut-offs made in this LCA. This evaluation of inflows not accounted for in the inventory is based upon expert judgement concerning the production and the toxic effects of the items listed. Most of the auxiliary chemicals do not constitute significant hazards by themselves or in their production or are only used in insignificant amounts.

Alloys

The composition of the alloys is unknown. However, the production of these alloys is not likely to have a significant effect on the LCA results, since the amount is small.

5.2.2 Non-elementary outflows

Co-products

Non-elementary outflows are waste and co-products that are not traced all the way to the boundary between technosphere and nature. The non-elementary outflows are documented in Tables 3.3 and 3.6. The effects of the co-products depend on for what purpose the co-products are used, and what, if anything, they can replace. The total amount of non-elementary co-product outflows from the 33 cl system is 23.6 kg per 1000 litres (the outflows from the 50 cl system are smaller). This corresponds to approx. 18 % of the weight of the total packaging. The major part of these co-products is slags that are used for road construction and we therefore estimate the effects of the co-products to be relatively minor.

Bulk waste

The total non-elementary waste flows from the 33 cl system amount to 170 kg. However, most of this waste (153 kg) is bulk waste (industrial waste from the production of natural gas and unspecified bulk waste from the production of coal). The energy demanded for management of bulk waste is small (Tillman *et al.* 1992). We also estimate most of this waste to cause little environmental impacts in the landfill because it is relatively inert.

Hazardous waste

The amount of hazardous waste from the 33 cl system is 9.7 kg. It mainly consists of unspecified hazardous waste from the production of natural gas and electricity. The environmental impacts of the management of this waste are unknown, *i.e.*, no information has been available within the project.

5.2.3 Excluded processes

As stated above (section 2.1), production of materials for secondary packagings (trays, boxes etc.) and pallets is included in the LCA, but the actual packaging production - conversion, nailing etc. - is not included. The retailer is not included as well.

Pallet production

Since 95% of the pallets are reused, the demand for new pallets is only 0.06 pieces (for the 33 cl system). The energy demand for pallet production has been given as 7 kWh electricity and 0.3 kg oil per 25 kg pallet (IDEMAT database 1995 referred to by RDC 1997). This means the energy demand for pallet production is well below 1% of total energy demand in the packaging system.

Pallet production also causes emissions of approximately 130 g sawdust per 1000 litres (IDEMAT 1995 via RDC 1997). This is the same order of magnitude as the emissions of particulates from the packaging system, but the sawdust is estimated to be much less environmentally hazardous.

Plastic ligature production

The amount of plastic ligature corresponds to 0.01 % of the primary packaging weight. The production of plastic ligature could therefore be considered as negligible.

Retailer

In the base case the retailer was excluded. When including these data in the base case for refillable PET-bottles the emissions of CO_2, NO_x, SO_2 and total VOC increases by about 1 % for each of these emissions. For steel cans, the retailer is of less importance than for the refillable PET-bottles since the collected steel cans are less bulky than the refillable PET bottles and therefore need less space for storing.

Consumer transports

Transports between retailer and the residence of the consumer are also excluded from the analysis. The effect of the beverage packaging on the fuel demand for this transport is estimated to be less than 1 MJ per 1000 litres (see Technical report 7). This is clearly insignificant for the total energy demand of the packaging system.

5.2.4 Other factors

Table 5.2
Results of sensitivity analyses.

Parameters	Base case [g/1000 l beverage]	Can weight (+ 20 %) [% of basics]	Distribution (light truck) [% of base case]	Allocation method: 50/50 [% of base case]	Amount of inside coating [% of base case]	El, Natural gas marginal [% of base case]	El, fragmented markets [% of base case]	El, European base-load [% of base case]
CO_2	3,36E+05	110	103	122	102	76	99	73
SO_2	7,98E+02	106	101	116	101	60	98	169
NO_x	1,25E+03	108	109	112	101	73	99	83
VOC, total	2,77E+02	109	114	110	102	89	100	115

Can weight

The can weight is 28.2 g in the base case. This could be compared to 28.4 g in the previous study. A sensitivity scenario corresponding to an increase of the can weight by 20 % (33.8 g) was performed. The results for some important inventory parameters are shown in table 5.2. The results are increased between 6 and 10%.

Distribution of beverage

The transport data used in the distribution of beverage represent a mix of different modes of conveyance. A sensitivity analysis regarding the distribution of beverage was performed using data for distribution by light trucks. The mode of conveyance appeared to be of minor importance, especially for CO_2 and SO_2 (see Table 5.2).

Allocation methods

In the base case the recycled steel are assumed to replace the same amount of virgin steel in new products. A sensitivity analysis was performed where the recycled steel are assumed to replace equal amounts of virgin steel and recycled steel from other products. The results for some inventory parameters are shown in table 5.2.

Amount of inside coatings

The amount of inside coatings differ between the cans that are used for beer and for those that are used for soft drinks (the amount is bigger in the soft drink cans). In the base case, an average between these amounts was used. A sensitivity analysis was performed where the amount of inside coatings were increased to the amount used for soft drink cans. The amount of inside coatings appeared to be of minor importance (see Table 5.2).

Electricity production

The electricity data used in the base case represent coal marginal. Three sensitivity analyses were performed for electricity production (natural gas marginal, fragmented markets and European base-load). It is clear from the results (see Table 5.2) that the assumption regarding the electricity production is important.

5.3 Assessment of data gaps

Inventory

There are no known significant data gaps in the inventory analysis of this study.

Characterisation

There are no known data gaps in the characterisation of global warming, photochemical ozone formation, acidification and nutrification. However, it should be noted that emissions measured as BOD or COD are not considered in the characterisation. These emissions have oxygen depleting impacts similar to those of nutrifying chemicals, but they do not contribute significantly to nutrification or any other environmental impact considered in this study.

There are large data gaps in the characterisation of most toxicity impacts since a large share of the hydrocarbon and NMVOC emissions have an unspecified composition. The characterisation indicates that hydrocarbons and NMVOCs are important for human toxicity in air and soil, and for chronic terrestrial and aquatic ecotoxicity. No characterisation factors were available for the unspecified emissions.

Normalisation

Reference values for the normalisation are available for all environmental impact categories covered by this LCA. Reference values are missing for the depletion of some of the resources, *e.g.*, dolomite, feldspar and uranium. We estimate the effects of these data gaps on the conclusions of the LCA to be small. The demand for uranium is small in this LCA, since the nuclear share of electricity production is small. It should really be zero. The reason why any uranium demand is reported in the LCA is that we have not used marginal data for electricity that is used in production of plastics and fuel.

Weighting

The data gaps in the weighting are similar to those in the normalisation.

5.4 Assessment of data quality

5.4.1 Overview

In order to assess the environmental consequences of choosing a packaging system with steel cans, we should ideally have used data representing the specific processes and transports actually affected by such a choice. As stated in the main report (section 2.9), the ideal data should be recent and relevant for actual or potential Danish packaging systems. They should reflect the technologies actually affected by a change in the packaging systems. For many processes, this is the long-term marginal technology.

In practice, we used specific data for the production of steel cans and for the distribution of the beverage. We explicitly used long-term marginal data for electricity production, for steel recycling and for waste management. Marginal thinking was also applied to the transports between retailer and consumer residence, and to the refrigeration of the beverage container. For most other processes and transports, marginal data were not available and average or site specific data were used instead. This reduces the quality of these data with respect to the goal of this study.

5.4.2 Specific processes

Quality aspects

The data quality of the most important processes is summarised in Table 5.3. The uncertainty, completeness and representativity of the data are considered. The data uncertainty includes uncertainties in measurements, calculations and estimations. The uncertainty is estimated to be small, medium or large compared to what is common in LCAs.

The assessment of data completeness includes considerations of how large share of the relevant industries etc. that are presented in the data. It also includes considerations of whether the data reflects yearly averages or single measurements. The completeness is estimated to be good, fair or poor compared to what is common in LCAs.

The representativity reflects an assessment of how well the data set represents the industries etc. that are really relevant for the study. The representativity assessment also includes considerations of the time-related, geographical and technological representativity of the data. The completeness is estimated to be good, fair or poor compared to what is common in LCAs.

Table 5.3
Assessment of the data quality for the most important processes.

	Uncertainty	Completeness	Representativity
1.Steel can production	Medium	Fair	Fair
11. Trp of iron to tinplate production	Medium	Good	Fair
12. Primary aluminium production	Medium	Good	Fair
53. Distribution of beverage	Medium	Good	Good
66. Avoided steel production	Medium	Fair	Fair

Steel can production

These data are aggregated data for a group of processes, of which tinplate production and can production are the most important ones. The data on tinplate production are average data and the data on the can production are plant specific data .Altogether, we estimate the representativity and completeness to be fair. For the electricity production, standardised emission factors has been used. The uncertainty for these emission factors is small for CO_2, medium for hydrocarbons, SO_2 and NO_x and large for the emissions that contributes to the toxic effects, why we estimate the total uncertainty to be medium.

Primary aluminium production

The data used are EAA data, which represent a large share of the total aluminium producers, why we estimate the completeness to be good. However, they are average data and no information about if they represent the marginal technology or not was provided, why the representativity is assessed to be fair. For the electricity production, standardised emission factors has been used, see steel can production.

Distribution of beverage

Data on distribution represent the transport activities affected by a choice of packaging system. We used data on actual transport distances and truck sizes (Jacobsen 1997). The fuel demand is based on data on the relevant vehicles from Volvo (Rydberg 1997). Most of the emissions are calculated using standardised emission factors from CORINAIR (1996). Hence, there is a significant uncertainty in the emissions. For further details, see Technical report 7.

Avoided steel production

For the steel production, APEAL data has been used. We estimate that these data covers a fair share of the steel producers. No information about if the production technology represents the marginal technology or not was provided, why the representativity is assessed to be fair. For the electricity production, standardised emission factors has been used, see steel can production.

5.5 Known errors

There are no known errors in this LCA.

6 References

Boustead, I. (1992) Eco-balance methodology for commodity thermoplastics, Association of plastics manufacturers in Europe (APME). Brussels.

Boustead, I. (1993) Eco-profiles of the European plastics industry - Report 3: Polyethylene and Polypropylene, Association of plastics manufacturers in Europe (APME). Brussels.

CORINAIR (1996) The EMEP/CORINAIR Atmospheric Emission Inventory Guidebook (CORINAIR 90). European Environment Agency. Copenhagen.

Jacobsen, J (1997) Personal communication. Logisys. Copenhagen.

RDC (1997) Eco-balances for policy-making in the domain of packaging and packaging waste. Reference no.: B4-3040/95001058/MAR/E3. Recherche Développement & Consulting. Brussels.

Rydberg T (1997) Personal communication. Volvo. Gothenburg.

Tillman A-M, Baumann H, Eriksson E, Rydberg T (1992) Packaging and the Environment. Offprint from SOU 1991:77. Chalmers Industriteknik. Gothenburg.

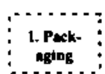
Wenzel H, Hauschild M, Alting L. (1997). Environmental assessment of products. Vol. I: Methodology, tools, and case studies in product development. Chapman & Hall. London.

Annex A:

Description of the input data in annex A and B

Detailed process trees

The detailed process trees for the two systems are presented in figure A.1 and B.1 in annex A and B.



In some cases the boxes with dotted lines represent processes for which we have no data. However, in many cases these boxes do not represent any processes. These are only modules used to facilitate the calculations.

Transports are represented by an arrow containing an oval and "Trp X".

Input data

The input data of the life cycle systems are presented in printouts from the LCA software *LCA inventory Tool (LCAiT).*

Annex A contains the input data for the 33 cl system. Annex B, which contains the input data for the 50 cl system, has been reduced to contain only data that is not identical to the 33 cl system.

The data presentation is explained in the beginning of the annex A printout.

The processes and transports have the same number in the process tree as in the data printout.

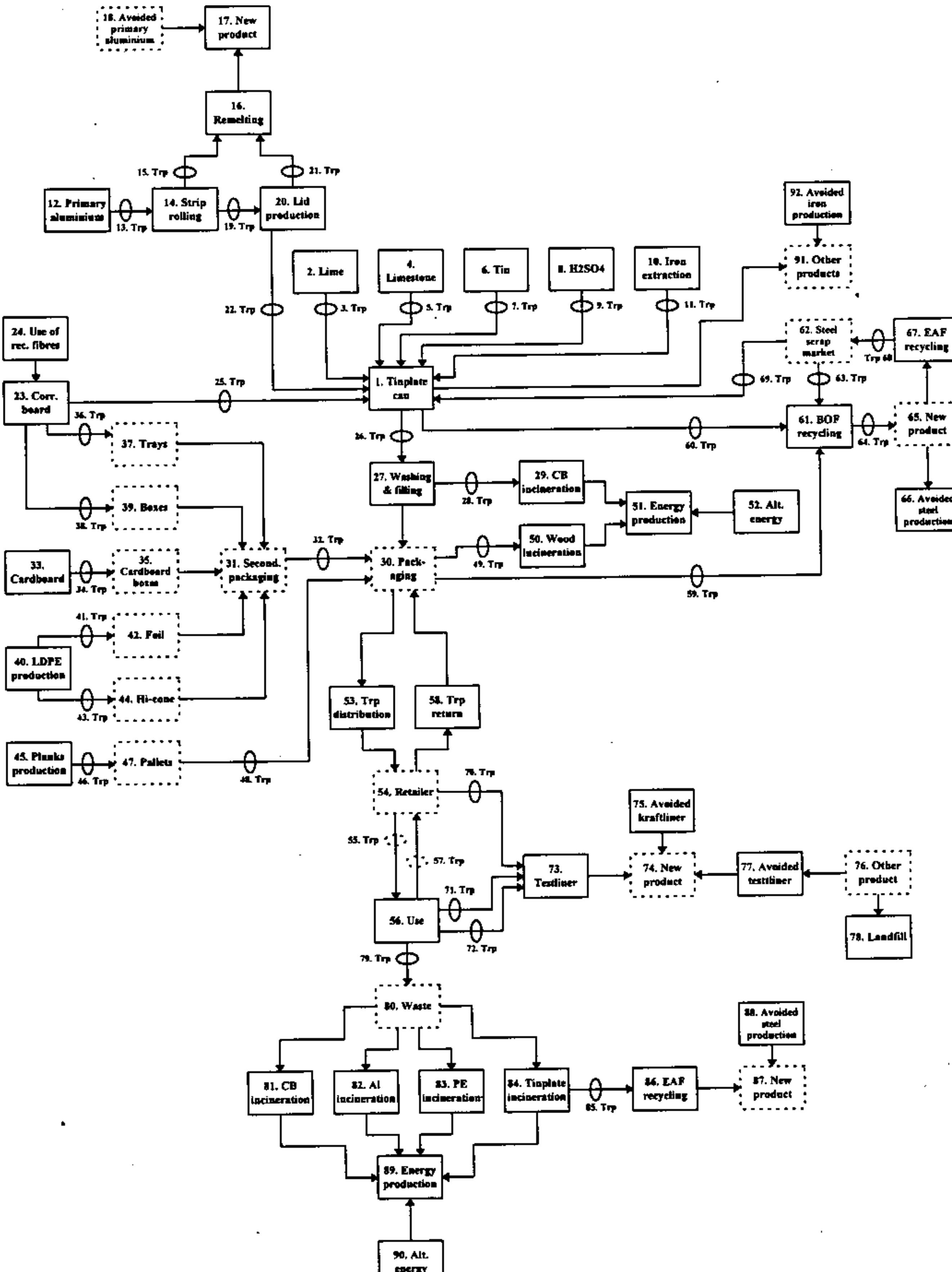


Figure A.1
Process tree for the 33 cl steel can system.

File: 33CL-SC.LCA **Printed:** Fri 98-05-29 10:38

Energy carrier:
All energy demand presented under the heading "Energy carrier" describes energy at final use in the processes and transports of the system. Most of these parameters are internal parameters, i.e. they describe flows that do not cross the boundary of the system investigated. They make it possible to calculated, e.g., how much electricity is used in the system.

Parameter names:
Some parameters appear in both of the two categories air- and water emissions. To be able to separate these parameters in the inventory profile, the emissions to water have been given the name: parameter (aq) e.g. Cu (aq). Resources have in the same way been called resource (r) e.g. crude oil (r). Non-elementary inflows and outflows have been given the name parameter (in) and (out) respectively.

Calculation procedures - process cards:
The data are entered in most process cards as g or MJ per kg total outflow from the process card. In some cases, the data are entered as g or MJ per kg of total inflow to the process card. Whether the data refer to the outflow or inflow is stated immediately below the data. The magnitude of the total outflow (or inflow) is also stated here. The magnitude of the flows have been calculated by the software when the system was solved.

In some processes, data on emissions etc. from the combustion of a fuel are missing. When the system is solved, estimates for the combustion emissions per kg outflow (inflow) from the process card are calculated through multiplying the fuel demand entered under the heading "Energy carrier" with emission factors for final use in our energy database (see Technical report 7). This calculation is reported through the use of the letters FU under the heading "E Factor". In many cases, the data entered in the process card do not include emissions etc. from the production of fuels and electricity used in the process. These emissions are calculated through multiplying the fuel and electricity demand with the corresponding emission factors for extraction etc. in the energy database (see Technical report 7). This calculation is reported through the use of the letters "Ex" under the heading "Energy carriers".

When the system is solved, the environmental inputs and outputs of the whole system are calculated. For each process, the data estimated through the use of emission factors are added to the data entered under the heading "Emissions, waste and resources". The totals are multiplied by the total outflow (or inflow, when applicable) to obtain the total resource demand, emissions etc. of the process.

Calculation procedures - transport cards:
Data on transport modes and distances are entered in the transport cards. When the system is solved, the distances are multiplied by the output flow from the transport card to obtain the transport volume measured as kg-km per functional unit. For each transport mode, this volume is multiplied by the fuel demand factors in our transport database (see Technical report 7). The emissions and resource demand are calculated through multiplying the fuel demand by the emission factors for fuel production and final use in the energy database.

Process Card: 91. Other products

Inflows	**Percent**	**Massflow [kg]**
Virgin iron	37.500 %	1.554
Mill scale (recyc.)		2.589

Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (4.143 kg) is used to calculate emissions and energies

Notes
The iron-content in the mill scale is 60% and thus, 1 kg mill scale replaces 0,6 kg virgin iron.

Process Card: 92. Avoided iron production (Database)

Outflows	**Percent**	**Massflow [kg]**
Virgin iron		1.554

Emissions, waste and resources	**[g]**	**Reference**
Water (r)	-2.24e+005	
CO2	-1.67e+003	
CO	-12.943	
NOx	-4.230	
CH4	-9.239	
Particulates	-0.706	
Benzene	-9.60e-005	
Cd	-3.81e-005	
Tl	-3.50e-005	
Ni	-4.06e-004	
Pb	-4.11e-003	
Cr	-1.82e-004	
Cu	-3.24e-004	
Mn	-1.57e-003	
V	-7.46e-004	
H2S	-9.13e-003	
HF	-4.06e-003	
HCl	-3.28e-002	
NH3	-4.61e-004	
Dioxin	-2.21e-010	
Waste, sludge	-2.62e-010	
Waste, industrial	-29.914	
BF-additives (in)	-30.600	
Benzene (out)	-3.300	
H2SO4 (out)	-1.000	

--- To be continued ---

Tar (out)	-10.000
Slag (out)	-255.000
Dust (out)	-15.000
Limestone (r)	-152.401
Waste, bulky	-339.597
Waste, oil	-7.21e-004
SO2	-3.542
Coke oven gas [MJ] (out)	-0.863
BF-gas [MJ] (out)	-0.530
Steam [MJ] (out)	-0.154
Compressed air [m3] (out)	-4.53e-002
Oxygen [m3] (out)	-1.47e-003
Iron ore, 10% Fe (r)	-8.29e+003
Waste	-834.901
CaO (in)	-6.718
Coke (in)	-6.801
Explosives (in)	-5.94e-002
VOC, natural gas combustion	-6.12e-011
VOC, coal combustion	-9.24e-004
VOC, diesel engines	-2.17e-002
NMVOC, power plants	-1.66e-002
NMVOC, diesel engines	-0.117
NMVOC, petrol engines	-5.85e-012
HC	-9.51e-002
PAH	-2.34e-007
Benzo(a)pyrene	-3.50e-008
Aromates (C9-C10)	-3.71e-004
Aldehydes	-2.31e-005
N2O	-6.86e-003
Organics	-4.61e-005
Radioactive emissions [kBq]	-8.56e+004
As	-1.26e-005
Hg	-2.50e-006
Se	-8.37e-006
Zn	-8.82e-005
Metals	-1.49e-005
COD (aq)	-1.29e-003
BOD (aq)	-7.45e-005
Dissolved organics (aq)	-4.10e-012
Dissolved solids (aq)	-0.621
Suspended solids (aq)	-1.02e-002
NO3-N (aq)	-3.84e-006
NH4-N (aq)	-4.97e-004
Nitrogen (aq)	-2.26e-004
H+ (aq)	-4.46e-004
HC (aq)	-2.99e-004
Oil (aq)	-5.18e-002
Phenol (aq)	-1.02e-013
Aromates (C9-C10) (aq)	-1.02e-004
Radioactive emissions [kBq] (aq)	-805.404
Al (aq)	-8.59e-004
Fe (aq)	-1.24e-003
Mn (aq)	-6.21e-004
Ni (aq)	-8.04e-005
Sr (aq)	-3.11e-003
Zn (aq)	-2.00e-004
Metals (aq)	-7.45e-005
F- (aq)	-2.40e-003
Cl- (aq)	-12.208
SO42- (aq)	-0.497
Salt (aq)	-6.21e-002
Waste, mineral	-3.24e-002
Waste, slags & ashes (waste incin.)	-4.86e-006
Waste, slags & ashes (energy prod.)	-1.822
Waste, rubber	-3.81e-004
Waste, chemical	-2.51e-003
Waste, hazardous	-11.181
Waste, radioactive	-2.18e-003
Crude oil, feedstock (r)	-1.06e-004
Crude oil (r)	-71.803
Natural gas (r)	-3.354
Hard coal (r)	-1.05e+003
Brown coal (r)	-10.739
Softwood (r)	-0.326

--- To be continued ---

Biomass (r)	-4.94e-002
Fuel, unspecified [MJ] (r)	-3.48e-006
Uranium (as pure U) (r)	-7.40e-004
Hydro power-water (r)	-760.214
NaCl (r)	-2.09e-003
Clay (r)	-4.46e-004
CaCO3 (r)	-2.09e-003
Al (r)	-1.19e-003
Fe (r)	-1.25e-003
Mn (r)	-7.38e-006
Ground water (r)	-2.82e-005
Surface water (r)	-5.76e-007
NMVOC, oil combustion	-0.373
Benzene	-1.34e-003
Cr3+	-2.15e-006
CN-	-1.28e-005
Tot-N (aq)	-6.46e-003
PO43- (aq)	-1.29e-004
Organics (aq)	-3.90e-002
As (aq)	-6.11e-006
Cd (aq)	-3.02e-006
Cr3+ (aq)	-3.86e-005
Pb (aq)	-2.24e-005
NMVOC	-6.02e-002
Propane	-1.36e-004
Butane	-2.77e-006
Pentane	-4.75e-006
Toluene	-2.25e-005
Formaldehyde	-1.32e-004
Acetaldehyde	-3.96e-009
VOC	-2.13e-004
Ethane	-1.88e-004
Alkanes	-2.55e-004
Ethene	-3.77e-004
Acetylene	-6.31e-005
Propene	-6.44e-005
Alkenes	-7.24e-005
Xylene	-1.24e-005
Co	-2.21e-005
Be	-8.65e-007
Mo	-1.49e-005
Sb	-5.93e-006
BOD-5 (aq)	-3.45e-005
Phosphate (aq)	-1.82e-005
H2S (aq)	-5.99e-008
Co (aq)	-4.66e-007
Cr (aq)	-5.75e-006
Cu (aq)	-1.89e-006
V (aq)	-1.53e-006
Sb (aq)	-6.55e-009
Sn (aq)	-5.13e-004
CN- (aq)	-1.83e-006
Waste, highly radioactive	-1.84e-002
Wood (r)	-7.47e-003
Ca	-2.15e-005
Fe	-4.83e-005
Na	-2.01e-004
TOC (aq)	-7.99e-006

Energy carrier	**[MJ]**	**E Factor**	**Reference**
Electricity, coal marginal	-0.355	Ex	
Natural gas (>100 kW)	-3.96e-003	None	
Hard coal	-0.124	None	
Oil, light fuel	-3.20e-002	None	
Oil, heavy fuel	-0.268	None	
Diesel, heavy & medium truck (urban)	-5.35e-002	None	
Hard coal, feedstock	-18.093	None	
Oil, heavy, feedstock	-0.492	None	
Diesel, heavy & medium truck (highway)	-0.210	None	
Fuel oil, ship (2-stroke)	-0.855	None	

The sum of output flow(s) (1.554 kg) is used to calculate emissions and energies

Notes

--- To be continued ---

The avoided production of 1 kg pig-iron caused by the outflow of recycled steel (mill-scale) from the packaging system. The data are imported from a database file (piron.lca). The file includes data on avoided extraction of limestone and burning into lime (lime calcination), avoided extraction of iron ore and avoided pig iron production. Data on iron ore extraction are adapted from reference (1). Data on iron production (blast furnace, BF) were supplied by reference (2).

The data above include emissions etc. from fuel production. These have been calculated by using emission factors from our energy database. The emission factors take into account emissions etc. for production of the electricity that is used for fuel production. However, the data above do not include emissions etc. for production of the electricity that is used at limestone extraction, lime calcination and iron ore extraction. When the total emissions profile of the packaging system is calculated, these emissions etc. are included through the use of emission factors for extraction etc. as is denoted above (E Factor: Ex).

References:

(1) SHRIFTENREIHE UMWELT NR. 250/II: Ökoinventar f•r Verpackungen, Band II, Tab. 18.6.3, Budesamt f•r Umwelt, Wald und Landscaft (BUWAL), Bern,1996.

(2) Hatscher, N (1997) personal communication, Informations-Zentrum Weissblech for APEAL.

Data were collected by Niels Frees, IPU LCC, Denmark and entered by Anna Ryberg, CIT.

Process Card: 1. Steel cans, 33 cl

Inflows	**Percent**	**Massflow [kg]**
Lime	4.175 %	7.386
Limestone	5.795 %	10.252
Tin	0.113 %	0.200
H2SO4	0.629 %	1.113
Iron ore + pellets		137.444
External scraps	6.349 %	11.232
Layer pads, CB	0.461 %	0.816
Aluminium lid	4.788 %	8.471
Outflows		
Mill scale (recyc.)	2.316 %	2.589
Scraps, can prod.	20.815 %	23.273
Can + layer pads		85.946

Emissions, waste and resources	**[g]**	**Reference**
Alloys (in)	4.256	
Water (r)	2.09e+005	
Oil (in)	1.788	
NaOH (in)	1.107	
H2 (in)	6.12e-002	
Benzene (out)	2.979	
H2SO4 (out)	0.936	
Tar (out)	9.108	
Slag (out)	303.879	
Dust (out)	51.157	
Iron oxide (out)	1.362	
Tin hydroxide sludge (out)	0.340	
Tin ash (out)	8.51e-002	
Iron(II)sulphate (out)	13.960	
Oil (out)	0.426	
CO2	1.96e+003	
CO	13.431	
NOx	2.864	
NMVOC	0.112	
CH4	8.123	
Particulates	0.567	
Benzene	8.77e-005	
Cd	3.47e-005	
Tl	3.23e-005	
Ni	3.41e-004	
Pb	3.67e-003	
Cr	1.17e-004	
Cu	2.30e-004	
Mn	1.39e-003	
V	8.47e-004	
H2S	8.27e-003	
HF	4.46e-003	
HCl	2.72e-002	
NH3	3.50e-004	
Dioxin	1.36e-010	
COD (aq)	0.449	
Cr (aq)	2.47e-004	
Sn (aq)	7.42e-003	
Fe (aq)	3.60e-002	
AOX (aq)	4.17e-004	

--- To be continued ---

TOC (aq)	1.11e-003
BOD (aq)	0.146
B (aq)	5.36e-002
NH4-N (aq)	6.95e-004
Hg (aq)	1.28e-005
Ni (aq)	3.21e-004
Cu (aq)	2.47e-004
Pb (aq)	4.52e-005
Chloride (aq)	2.043
SO2	2.337
N2O	2.54e-003
Tot-C	5.93e-002
Oil (aq)	4.43e-002
Suspended solids (aq)	1.98e-002
Waste, emulsions	2.211
Waste, solvent	1.063
Waste, ink	7.99e-002
Waste, sludge	0.346
Waste, combustible	1.756
Waste, wood	6.356
Waste	2.078
Printing ink (in)	0.940
Bottom coat (in)	0.470
Cupper-lubricant (in)	9.92e-002
Wim-lubricant (in)	0.742
Washing chemicals (in)	4.95e-002
Mobility enhance (in)	0.569
Polyester for strips (in)	0.223
BF-additives (in)	27.238
Waste, industrial	416.889
Waste, hazardous	66.725
Crude oil (r)	50.825
Natural gas (r)	163.289
Tot-P (aq)	1.28e-002
Tot-F (aq)	2.64e-002
Hydrogen	1.31e-004
HC	0.324
Metals	9.03e-005
NH4+ (aq)	4.51e-004
Cl- (aq)	10.376
Metals (aq)	9.89e-003
HC (aq)	4.42e-003
Iron ore (r)	4.04e-003
Limestone (r)	2.55e-003
Bauxite (r)	1.62e-002
NaCl (r)	0.150
Clay (r)	7.60e-004
Ferromanganese (r)	1.83e-005
Coal (r)	0.480
Crude oil, feedstock (r)	15.737
Natural gas, feedstock (r)	13.310
Coal, feedstock (r)	6.75e-003
Phenol (aq)	5.97e-006
Other organics	5.97e-006
Other nitrogen (aq)	2.48e-004
Nitrates (aq)	1.83e-005
Sulphur (aq)	2.99e-005
Waste, mineral	0.162
Waste, toxic chemicals	1.24e-005
Radioactive emissions [kBq]	79.653
As	5.50e-006
Hg	1.99e-006
CN-	8.95e-006
BOD-5 (aq)	9.56e-007
Tot-N (aq)	3.41e-003
Phosphate (aq)	5.05e-007
H2S (aq)	1.66e-009
Organics (aq)	2.34e-002
Radioactive emissions [kBq] (aq)	1.131
Al (aq)	5.55e-004
As (aq)	3.76e-006
Cd (aq)	1.82e-006
Co (aq)	1.29e-008
Sb (aq)	1.81e-010

--- To be continued ---

V (aq)	4.25e-008
Zn (aq)	1.71e-004
F- (aq)	2.01e-003
SO42- (aq)	0.423
CN- (aq)	5.07e-008
Waste, highly radioactive	7.15e-004
Hard coal (r)	926.571
Brown coal (r)	9.191
Wood (r)	2.07e-004
Uranium (as pure U) (r)	6.31e-004
Hydro power-water (r)	480.843
Se	4.04e-006
Zn	1.52e-005
NMVOC, diesel engines	3.64e-002
NMVOC, oil combustion	0.262
Benzene	1.49e-003
Cr3+	1.51e-006
PO43- (aq)	9.06e-005
Cr3+ (aq)	2.71e-005
Waste, radioactive	1.88e-003
Biomass (r)	3.47e-002
Propane	3.09e-004
Alkanes	1.94e-004
Alkenes	9.70e-006
PAH	1.52e-005
Toluene	3.09e-004
Benzo(a)pyrene	4.73e-008
Aromates (C9-C10)	3.38e-004
Formaldehyde	2.95e-004
Aldehydes	2.04e-005
Ca	2.59e-005
Co	1.07e-005
Fe	5.82e-005
Mo	5.17e-006
Na	2.42e-004
Butane	1.05e-003
Pentane	1.80e-003
Acetaldehyde	1.50e-006
VOC, natural gas combustion	5.41e-011
VOC, coal combustion	8.16e-004
VOC, diesel engines	1.91e-002
NMVOC, power plants	1.46e-002
NMVOC, petrol engines	5.16e-012
Organics	4.07e-005
Dissolved organics (aq)	3.62e-012
Dissolved solids (aq)	0.557
NO3-N (aq)	3.39e-006
Nitrogen (aq)	1.99e-004
H+ (aq)	3.94e-004
Aromates (C9-C10) (aq)	9.04e-005
Mn (aq)	5.49e-004
Sr (aq)	2.75e-003
Salt (aq)	5.49e-002
Waste, slags & ashes (waste incin.)	4.30e-006
Waste, slags & ashes (energy prod.)	1.609
Waste, bulky	297.607
Waste, rubber	3.36e-004
Waste, chemical	2.22e-003
Softwood (r)	0.288
Fuel, unspecified [MJ] (r)	3.07e-006
CaCO3 (r)	1.85e-003
Al (r)	1.05e-003
Fe (r)	1.10e-003
Mn (r)	6.52e-006
Ground water (r)	2.49e-005
Surface water (r)	5.08e-007
Acid as H+ (aq)	1.13e-003
Dissolved organics (aq)	7.31e-004
Waste, ashes	5.15e-002
Waste, non toxic chemicals	0.152

Energy carrier	**[MJ]**	**E Factor**	**Reference**
Oil, feedstock	0.610	None	
Hard coal, feedstock	16.087	None	

--- To be continued ---

Natural gas (>100 kW)	7.566	None
Electricity, coal marginal	3.586	Ex
Oil	9.77e-002	None
Natural gas	0.198	None
Coal	1.30e-002	None
Natural gas, feedstock	0.594	None
Coal, feedstock	1.83e-004	None
Electricity	1.03e-002	None
Nuclear power [MJel]	1.77e-003	None
Hydro power [MJel]	1.63e-003	None
Diesel, heavy & medium truck (highway)	8.17e-003	None
Oil, heavy, feedstock	0.810	None
Oil, heavy fuel	0.323	None

The sum of output flow(s) (111.809 kg) is used to calculate emissions and energies
Mass change factor 0.632

Notes

Production of tinplate cans.
The data are imported from a database file (Aggreg33.lca). The file includes data on tinplate production, can production and the transport of tinplate between these two production sites. It also includes data on production of base-coat and inside coating.

Material balance per can:
Inflows:
- Iron ore + pellets: 45.486 g (1).
- External scraps: 3.717 g (1).
- Aluminium lid: 2.803 g (1).
- Lime: 2.4444 g.
- Limestone: 3.39255 g (1).
- Tin: 0.06615 g (1).
- H_2SO_4: 0.36855 g (1).
- Layer pads: 0.27g (2).

Total inflows: 58.54765 g.

Outflows:
- Tinplate can + layer pads: 28.435 g.
- Scraps, can production: 7.7g (2).
- Mill scale for recycling into other products: 0.8568g (1).

Total outflows: 36.9918 g.

Mass change factor (out/in) = 0.632.

Data-gaps:
The production of chemicals, additives etc. are not included in the data from the suppliers. These materials have therefore been accounted for as non-elementary inflows to the system. The landfill disposal of waste is not included in the LCA. Hence, the waste flows are non-elementary outflows. Both at tinplate production and at can production, natural gas is used. No information about the furnace size was provided. A furnace size larger than 100 kW has been assumed.

The data above include emissions etc. from fuel production. These have been calculated by using emission factors from our energy database. The emission factors take into account emissions etc. for production of the electricity that is used for fuel production. However, the data above do not include emissions etc. for production of the electricity that is used in production of tinplate and production of tinplate cans. When the total emissions profile of the packaging system is calculated, these emissions etc. are included through the use of emission factors for extraction etc. as is denoted above (E Factor: Ex).

References and comments:
(1) Hatscher, N (1997) personal communication, Informations-Zentrum Weissblech for APEAL.
(2) Dr. Gert-Walter Minét, Schmalbach Lubeca, Ratingen, Germany.

Process Card: 2. Lime

Outflows	**Percent**	**Massflow [kg]**	
Lime		7.386	
Emissions, waste and resources	**[g]**		**Reference**
Limestone (r)	2.06e+003		Resource
CO_2	440.000		Air
Waste, bulky	140.000		Waste
Waste, oil	3.90e-002		Waste
Energy carrier	**[MJ]**	**E Factor**	**Reference**
Natural gas (>100 kW)	8.93e-002	FU/Ex	(1)
Hard coal	6.639	FU/Ex	(2)
Electricity, coal marginal	0.270	Ex	
Electricity, coal marginal	7.86e-002	Ex	(3)
Oil, light fuel	1.445	FU/Ex	(4)

The sum of output flow(s) (7.386 kg) is used to calculate emissions and energies

--- To be continued ---

Notes
Extraction of limestone and burning into lime.

- These data were supplied by Niels Frees, IPU LCC, and entered by Johan Widheden, CIT Ekologik.

References:
(1) The heat value used for natural gas is 48.5 MJ/kg.
(2) The heat value used for hard coal is 29.3 MJ/kg.
(3) The heat value used for diesel is 42.95 MJ/kg.
(4) The heat value used for light fuel oil is 42.5 MJ/kg.

Transport Card: 3. Trp

Inflows	Percent	Massflow [kg]	
Lime		7.386	
Outflows			
Lime		7.386	
Modes of conveyance	**[km]**		**Reference**
Train, el coal marginal	800.000		
Truck, heavy (highway, 70%)	300.000		

The sum of output flow(s) (7.386 kg) is used to calculate emissions and energies

Notes
Transportation of lime.

Process Card: 4. Limestone

Outflows	Percent	Massflow [kg]	
Limestone		10.252	
Emissions, waste and resources	**[g]**		**Reference**
Limestone (r)	1.00e+003		Resource
Energy carrier	**[MJ]**	**E Factor**	**Reference**
Natural gas (>100 kW)	2.24e-002	FU/Ex	(1)
Hard coal	8.18e-003	FU/Ex	(2)
Electricity, coal marginal	2.47e-002	Ex	
Oil, light fuel	3.67e-002	FU/Ex	(3)

The sum of output flow(s) (10.252 kg) is used to calculate emissions and energies

Notes
Extraction of limestone.

- These data were supplied by Niels Frees, IPU LCC, and entered by Johan Widheden, CIT Ekologik.

References:
(1) The heat value used for natural gas is 48.5 MJ/kg.
(2) The heat value used for hard coal is 29.3 MJ/kg.
(3) The heat value used for diesel is 42.95 MJ/kg.
(4) The heat value used for gasoline is 43.71 MJ/kg.

Transport Card: 5. Trp

Inflows	Percent	Massflow [kg]	
Limestone		10.252	
Outflows			
Limestone.		10.252	
Modes of conveyance	**[km]**		**Reference**
Train, el coal marginal	800.000		
Truck, heavy (highway, 70%)	300.000		

The sum of output flow(s) (10.252 kg) is used to calculate emissions and energies

Notes
Transportation of limestone.

Process Card: 6. Tin

Outflows	Percent	Massflow [kg]	
Tin		0.200	
Emissions, waste and resources	**[g]**		**Reference**
Tin (r)	1.00e+003		Resource
Energy carrier	**[MJ]**	**E Factor**	**Reference**

--- To be continued ---

Electricity, coal marginal	50.000	Ex
Oil, light fuel	100.000	FU/Ex

The sum of output flow(s) (0.200 kg) is used to calculate emissions and energies

Notes
Extraction and refining of tin ore.

The energy used to extract and refine tin is in the order of 150 MJ/kg tin, of which about 1/3 is assumed to be electrical energy from the grid.

Reference and comments:
- Wuth W. (1981). Energiverbrauch zur Herstellung von NE-Metailen (Energy Consumption for Production of Non-ferrous Metals). Erzmetall 34 (1981) no 7/8 p. 375-380.

The information was collected by Niels Frees, IPU LCC, and entered by Johan Widheden, CIT Ekologik.

Transport Card: 7. Trp

Inflows	Percent	Massflow [kg]	
Tin		0.200	
Outflows			
Tin		0.200	
Modes of conveyance	**[km]**		**Reference**
Train, el coal marginal	500.000		
Truck, heavy (highway, 70%)	1.00e+003		
Ship, bulk carrier	1.00e+004		

The sum of output flow(s) (0.200 kg) is used to calculate emissions and energies

Notes
Tranportation of tin.

Process Card: 8. H2SO4

Outflows	Percent	Massflow [kg]	
H2SO4		1.113	
Emissions, waste and resources	**[g]**		**Reference**
Sulphur (in)	330.000		(2) Non-elementary inflow
Water (r)	184.000		(3)
SO2	12.000		Air
SO3	0.600		
Steam [MJ] (out)	2.000		Non-elementary outflow
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (1.113 kg) is used to calculate emissions and energies

Notes
Production of H2SO4.

- The data was found in (1), supplied by Per Nielsen, IPU, and entered by Johan Widheden, CIT.

References:
(1) European Fertilizer Manufacturer's Association, EFMA (1995): Best available Techniques for pollution prevention and control in the European fertilizer industry. Booklet no. 3: production of sulphuric acid.
(2) Elemental sulphur is obtained from natural deposits or from the desulphurisation of natural gas or crude oil.
(3) The quantity of water is determined by stoichiometric calculations.

Transport Card: 9. Trp

Inflows	Percent	Massflow [kg]	
H2SO4		1.113	
Outflows			
H2SO4		1.113	
Modes of conveyance	**[km]**		**Reference**
Truck, heavy (highway, 70%)	300.000		Assumed distance.

The sum of output flow(s) (1.113 kg) is used to calculate emissions and energies

Notes
Transportation of sulphuric acid.

Process Card: 10. Iron ore extraction

Outflows	Percent	Massflow [kg]	
Iron ore + pellets		137.444	
Emissions, waste and resources	**[g]**		**Reference**

--- To be continued ---

Iron ore, 10% Fe (r)	6.00e+003		(1) Resource
Limestone (r)	8.190		(1)
Waste	604.000		(1) Waste
CaO (in)	4.860		(1) Non-elementary inflow
Coke (in)	4.920		(1)
Explosives (in)	4.30e-002		(1)
Energy carrier	**[MJ]**	**E Factor**	**Reference**
Electricity, coal marginal	0.120	Ex	(1).
Oil, heavy fuel	0.194	FU/Ex	(1)
Diesel, heavy & medium truck (urban)	3.87e-002	FU/Ex	(1)

The sum of output flow(s) (137.444 kg) is used to calculate emissions and energies

Notes
Iron ore extraction

Reference
(1) SHRIFTENREIHE UMWELT NR. 250/II: Ökoinventar f•r Verpackungen, Band II, Tab. 18.6.3, Budesamt f•r Umwelt, Wald und Landscaft (BUWAL), Bern,1996.

Data were entered by Anna Ryberg, CIT.

Transport Card: 11. Trp

Inflows	**Percent**	**Massflow [kg]**	
Iron ore + pellets		137.444	
Outflows			
Iron ore + pellets		137.444	
Modes of conveyance	**[km]**		**Reference**
Ship, bulk carrier	1.19e+004		
Train, el coal marginal	1.00e+003		
Truck, heavy (highway, 70%)	200.000		

The sum of output flow(s) (137.444 kg) is used to calculate emissions and energies

Notes
Transportation of iron ore and pellets.

Process Card: 12. Primary aluminium (database)

Outflows	**Percent**	**Massflow [kg]**	
Primary aluminium		10.577	
Emissions, waste and resources	**[g]**		**Reference**
SO2	45.335		
NOx	22.483		
CO	61.612		
CO2	4.87e+003		
Dust	16.328		
PAH	5.00e-002		
VOC	0.619		
PAH (aq)	2.00e-002		
Tot-F (aq)	1.00e-003		
H2SO4 (aq)	0.800		
Chloride (aq)	2.667		
Waste, refractory	11.400		
Crude oil (r)	791.968		
Natural gas (r)	164.822		
Crude oil, feedstock (r)	452.000		
Limestone (r)	169.857		
Water (r)	8.62e+003		
Carbon reused as fuel (out)	16.600		
Skimmings and dross for recycling (out)	12.000		
Steel scrap (out)	6.100		
Bauxite (r)	3.66e+003		
Salt (r)	53.954		
Coal (r)	9.694		
Fluorides	0.960		
Coal, feedstock (r)	93.400		
Waste, carbon	7.600		
Waste, inert residues	108.950		
Waste, dross fines	2.100		
Aluminium hydroxide (in)	11.700		
Calcium fluoride (in)	25.400		
Sulphuric acid (in)	29.400		
Refractory materials (in)	8.600		

--- To be continued ---

33 cl steel can

File: 33CL-SC.LCA **Printed:** Fri 98-05-29 10:38

Steel (in)	6.100
Carbon (in)	30.700
Waste, red mud	1.06e+003
Suspended solids (aq)	0.730
COD (aq)	1.98e-002
CF4	0.360
C2F6	4.00e-002
Organics (aq)	0.169
COS	4.000
NMVOC	4.11e-002
CH4	0.944
Dioxin	9.49e-010
NH3	1.38e-004
N2O	4.21e-002
HCl	3.18e-003
H2S	4.79e-005
HF	3.35e-003
Particulates	1.238
Radioactive emissions [kBq]	566.552
As	6.35e-006
Cd	1.49e-005
Cr	9.97e-006
Hg	1.42e-006
Ni	4.98e-004
Pb	4.23e-005
CN-	6.29e-005
BOD-5 (aq)	2.36e-005
Tot-N (aq)	2.48e-002
Phosphate (aq)	1.25e-005
H2S (aq)	4.09e-008
Oil (aq)	0.217
Radioactive emissions [kBq] (aq)	5.322
Al (aq)	1.63e-004
As (aq)	2.68e-005
Cd (aq)	1.30e-005
Co (aq)	3.19e-007
Cr (aq)	3.93e-006
Cu (aq)	1.29e-006
Ni (aq)	8.00e-005
Pb (aq)	9.75e-005
Sb (aq)	4.48e-009
Sn (aq)	3.51e-004
V (aq)	1.05e-006
Zn (aq)	4.42e-006
F- (aq)	2.63e-003
Cl- (aq)	6.410
SO42- (aq)	0.249
CN- (aq)	1.25e-006
Waste, industrial	24.470
Waste, hazardous	0.245
Waste, highly radioactive	1.76e-002
Hard coal (r)	5.494
Brown coal (r)	5.183
Wood (r)	5.10e-003
Uranium (as pure U) (r)	4.04e-004
Hydro power-water (r)	3.24e+009
NMVOC, diesel engines	0.482
Zn	1.96e-004
Se	1.96e-006
Cu	3.34e-004
NMVOC, oil combustion	1.838
Benzene	6.28e-003
Cr3+	1.06e-005
PO43- (aq)	6.36e-004
Cr3+ (aq)	1.90e-004
Waste, radioactive	1.11e-003
Biomass (r)	0.243

Energy carrier	[MJ]	E Factor	Reference
Electricity, coal marginal	56.649	Ex	
Diesel, heavy & medium truck (highway)	0.202	None	
Fuel oil, ship (2-stroke)	7.956	None	

The sum of output flow(s) (10.577 kg) is used to calculate emissions and energies

--- To be continued ---

Notes
Production of primary aluminium. The data are imported from a database file (prim-al.lca).

Data-gaps:
The production of chemicals, additives etc. are not included in the data from reference 1. These materials have therefore been accounted for as non-elementary inflows to the system. The landfill disposal of waste is not included in the LCA. Hence, the waste flows are non-elementary outflo\

(1) Ecological Profile Report for the European Aluminium Industry, European Aluminium Association, 1996.

Transport Card: 13. Trp

Inflows	Percent	Massflow [kg]	
Primary aluminium		10.577	
Outflows			
Primary aluminium		10.577	
Modes of conveyance	**[km]**		**Reference**
Truck, heavy (highway, 70%)	850.000		Estimated
Ship, container	75.000		Estimated

The sum of output flow(s) (10.577 kg) is used to calculate emissions and energies

Notes
Transport of aluminium rolling ingots to strip rolling.

Since EAA's data has been used for the aluminium production, there is no information about the exact location of the aluminium production. It has been assumed that the primary aluminium is produced in Switzerland (1). The strip rolling takes place at a number of different places in Europe (2). The exact location of these places is confidential information, why they are not mentioned here. The transport distances have been calculated as the average distances between Switzerland and these different strip rolling sites.
Transport modes and distances:
- Average distance, truck: 850 km.
- Average distance, ship: 75 km

References and comment:
(1) Pommer K., Wesnaes M.S. and Madsen C., Miljomässig kortlaegning af emballager til ol og laeskedrikke, Delrapport 3: Aluminiumsdåser. Arbeidsrapport fra Miljøstyrelsen., nr. 72
(2) Göte Nylin, PLM Beverage Can Division, Malmö, Sweden.

Process Card: 14. Strip rolling

Inflows	Percent	Massflow [kg]	
Primary aluminium		10.577	
Outflows			
Al. rolling ingots		10.420	
Scraps, strip roll.	0.990 %	0.104	
Emissions, waste and resources	**[g]**		**Reference**
VOC	0.380		(1) Air
COD (aq)	2.80e-002		(1) Water
Waste, non hazardous	1.430		(1) Waste
Waste, hazardous	2.670		(1)
Waste, oil	4.290		(1)
Water (r)	140.000		(1) Resource
Salt (r)	0.170		(1)
Limestone (r)	1.240		(1)
Oil (in)	5.100		(1) Non-elementary inflow
Chlorine (in)	0.210		(1)
Argon (in)	0.350		(1)
Packaging (in)	33.300		(1)
Energy carrier	**[MJ]**	**E Factor**	**Reference**
Electricity, coal marginal	3.139	Ex	(1)
Natural gas (>100 kW)	2.401	FU/Ex	(1)(2)

The sum of output flow(s) (10.524 kg) is used to calculate emissions and energies
Mass change factor 0.995

Notes
Strip rolling of aluminium ingots.

Material balance per can:
Inflow:
- Primary aluminium: 3.4997 g.

Outflows:
- Aluminium rolling ingots: 3.448 g.
- Scraps, strip rolling: 0.03448 g.

--- To be continued ---

Total outflows: 3.48248 g.

Mass change factor (out/in) = 0.995.

Energy data:
The production of natural gas and electricity is not included in the data from reference 1. Therefore the emission factors (extraction/Ex) from the database are used.

Emissions:
The emissions associated with the combustion of natural gas are not included. Therefore the emission factors (final use/FU) from the database are used.

Data-gaps:
The production of chemicals, additives etc. are not included in the data from reference 1. These materials have therefore been accounted for as inflows not traced back to the cradle (non-elementary inflows to the system). The landfill disposal of waste is not included in the LCA. Hence, the waste flows are non-elementary outflows.

References:
(1) Data were provided by Bernard de Gélas, European Aluminium Association and entered by Anna Ryberg, CIT.
(2) The size of the furnace (>100 kW) has been assumed.

Transport Card: 15. Trp

Inflows	**Percent**	**Massflow [kg]**	
Scraps, strip roll.		0.104	
Outflows			
Scraps, strip roll.		0.104	
Modes of conveyance	**[km]**		**Reference**
Truck, heavy (highway, 70%)	1.25e+003		
Ship, container	150.000		

The sum of output flow(s) (0.104 kg) is used to calculate emissions and energies

Notes
Transport of scraps from strip rolling to remelting plant. Transport distances have been estimated.

Process Card: 16. Remelting

Inflows	**Percent**	**Massflow [kg]**	
Scraps, strip roll.		0.104	
Scraps, lid prod.		1.949	
Outflows			
Remelted aluminium		1.846	
Emissions, waste and resources	**[g]**		**Reference**
Particulates	1.61e-002		(1) Air
HCl	5.01e-003		(1)
HF	4.40e-004		(1)
SO2	5.45e-003		(1)
NOx	0.191		(1)
Al (aq)	9.42e-003		(1) Water
Oil (aq)	4.19e-003		(1)
Suspended solids (aq)	8.18e-002		(1)
Waste, non hazardous	18.902		(1) Waste
Waste, ashes	111.807		(1)
CO2	42.913		(2) Air
CO	2.64e-002		(2)
NH3	6.60e-006		(2)
NMVOC, natural gas combustion	2.31e-003		(2)
CH4	9.90e-004		(2)
N2O	1.98e-003		(2)
Energy carrier	**[MJ]**	**E Factor**	**Reference**
Electricity, coal marginal	4.264	Ex	(1)
LPG, thermal	0.660	Ex	(1)

The sum of output flow(s) (1.846 kg) is used to calculate emissions and energies
Mass change factor 0.899

Notes
Remelting of aluminium process scraps from strip rolling and lid production.

Material balance per kilogram rolling ingots :

Material inputs:
- Process scraps from strip rolling: 0.0565 kg.

--- To be continued ---

- Process scraps from lid production: 1.0559 kg.
Total input: 1.1124 kg

Total output: 1 kg rolling ingots.

Mass change factor (out/in): 1/1.1124=0.899.

Energy data:
The production of liquefied petroleum gas (LPG) and electricity is not included in the data from reference 1. Therefore the emission factors (extraction/Ex) from the database are used.

Emissions:
Specific emissions for particulates, HCl, HF, SO2 and NOx have been received by reference 1.
As a complement to the air emissions in reference 1, emissions from the combustion of thermal LPG have been calculated (and inserted manually) using emission factors from the database.

Data-gaps:
The landfill disposal of waste is not included.

References:
(1) Confidential.
(2) Calculated from the emission factors for LPG, thermal (as a complement to the air emissions in reference 1.

Data were entered by Anna Ryberg, CIT.

Process Card: 17. New product

Inflows	**Percent**	**Massflow [kg]**	
Remelted aluminium		1.846	
Avoided virgin Al.	50.000 %	1.846	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (3.692 kg) is used to calculate emissions and energies

Process Card: 18. Avoided primary aluminium (Database)

Outflows	**Percent**	**Massflow [kg]**
Avoided virgin Al.		1.846

Emissions, waste and resources	**[g]**	**Reference**
SO2	-45.335	
NOx	-22.483	
CO	-61.612	
CO2	-4.87e+003	
Dust	-16.328	
PAH	-5.00e-002	
VOC	-0.619	
PAH (aq)	-2.00e-002	
Tot-F (aq)	-1.00e-003	
H2SO4 (aq)	-0.800	
Chloride (aq)	-2.667	
Waste, refractory	-11.400	
Crude oil (r)	-791.968	
Natural gas (r)	-164.822	
Crude oil, feedstock (r)	-452.000	
Limestone (r)	-169.857	
Water (r)	-8.62e+003	
Carbon reused as fuel (out)	-16.600	
Skimmings and dross for recycling (out)	-12.000	
Steel scrap (out)	-6.100	
Bauxite (r)	-3.66e+003	
Salt (r)	-53.954	
Coal (r)	-9.694	
Fluorides	-0.960	
Coal, feedstock (r)	-93.400	
Waste, carbon	-7.600	
Waste, inert residues	-108.950	
Waste, dross fines	-2.100	
Aluminium hydroxide (in)	-11.700	
Calcium fluoride (in)	-25.400	
Sulphuric acid (in)	-29.400	
Refractory materials (in)	-8.600	
Steel (in)	-6.100	
Carbon (in)	-30.700	
Waste, red mud	-1.06e+003	
Suspended solids (aq)	-0.730	

--- To be continued ---

COD (aq)	-1.98e-002
CF4	-0.360
C2F6	-4.00e-002
Organics (aq)	-0.169
COS	-4.000
NMVOC	-4.11e-002
CH4	-0.944
Dioxin	-9.49e-010
NH3	-1.38e-004
N2O	-4.21e-002
HCl	-3.18e-003
H2S	-4.79e-005
HF	-3.35e-003
Particulates	-1.238
Radioactive emissions [kBq]	-566.552
As	-6.35e-006
Cd	-1.49e-005
Cr	-9.97e-006
Hg	-1.42e-006
Ni	-4.98e-004
Pb	-4.23e-005
CN-	-6.29e-005
BOD-5 (aq)	-2.36e-005
Tot-N (aq)	-2.48e-002
Phosphate (aq)	-1.25e-005
H2S (aq)	-4.09e-008
Oil (aq)	-0.217
Radioactive emissions [kBq] (aq)	-5.322
Al (aq)	-1.63e-004
As (aq)	-2.68e-005
Cd (aq)	-1.30e-005
Co (aq)	-3.19e-007
Cr (aq)	-3.93e-006
Cu (aq)	-1.29e-006
Ni (aq)	-8.00e-005
Pb (aq)	-9.75e-005
Sb (aq)	-4.48e-009
Sn (aq)	-3.51e-004
V (aq)	-1.05e-006
Zn (aq)	-4.42e-006
F- (aq)	-2.63e-003
Cl- (aq)	-6.410
SO42- (aq)	-0.249
CN- (aq)	-1.25e-006
Waste, industrial	-24.470
Waste, hazardous	-0.245
Waste, highly radioactive	-1.76e-002
Hard coal (r)	-5.494
Brown coal (r)	-5.183
Wood (r)	-5.10e-003
Uranium (as pure U) (r)	-4.04e-004
Hydro power-water (r)	-3.24e+009
NMVOC, diesel engines	-0.482
Zn	-1.96e-004
Se	-1.96e-006
Cu	-3.34e-004
NMVOC, oil combustion	-1.838
Benzene	-6.28e-003
Cr3+	-1.06e-005
PO43- (aq)	-6.36e-004
Cr3+ (aq)	-1.90e-004
Waste, radioactive	-1.11e-003
Biomass (r)	-0.243

Energy carrier	**[MJ]**	**E Factor**	**Reference**
Electricity, coal marginal	-56.649	Ex	
Diesel, heavy & medium truck (highway)	-0.202	None	
Fuel oil, ship (2-stroke)	-7.956	None	

The sum of output flow(s) (1.846 kg) is used to calculate emissions and energies

Notes

Avoided production of primary aluminium. The data are imported from a database file (Av-al.lca).

--- To be continued ---

Data-gaps:
The production of chemicals, additives etc. are not included in the data from reference 1. These materials have therefore been accounted for as non-elementary inflows to the system. The landfill disposal of waste is not included in the LCA. Hence, the waste flows are non-elementary outflov

(1) Ecological Profile Report for the European Aluminium Industry, European Aluminium Association, 1996.

Transport Card: 19. Trp

Inflows	**Percent**	**Massflow [kg]**	
Al. rolling ingots		10.420	
Outflows			
Al. rolling ingots		10.420	
Modes of conveyance	**[km]**		**Reference**
Truck, heavy (highway, 70%)	1.20e+003		Estimated
Ship, container	550.000		Estimated

The sum of output flow(s) (10.420 kg) is used to calculate emissions and energies

Notes
Transport of rolled aluminium sheets to can production at PLM, Malmö.

Transport modes and distances:
- Average distance, lid, truck: 1200 km.
- Average distance, lid, ship: 550 km.

Process Card: 20. Lid production

Inflows	**Percent**	**Massflow [kg]**	
Al. rolling ingots		10.420	
Outflows			
Aluminium lid		8.471	
Scraps, lid prod.	18.706 %	1.949	
Emissions, waste and resources	**[g]**		**Reference**
Rubber for tightening (in)	21.049		(1) Non-elementary inflow
Oil (in)	6.065		(1)
Wood for pallets and frames (in)	14.627		(1)
Paper (in)	18.908		(1)
Energy carrier	**[MJ]**	**E Factor**	**Reference**
Electricity, coal marginal	5.625	Ex	

The sum of output flow(s) (10.420 kg) is used to calculate emissions and energies

Notes
Production of aluminium lids.

Reference:
(1) Göte Nylin, PLM Beverage Can Division, Malmö, Sweden.

Transport Card: 21. Trp

Inflows	**Percent**	**Massflow [kg]**	
Scraps, lid prod.		1.949	
Outflows			
Scraps, lid prod.		1.949	
Modes of conveyance	**[km]**		**Reference**
Truck, heavy (highway, 70%)	500.000		

The sum of output flow(s) (1.949 kg) is used to calculate emissions and energies

Notes
Transport of scraps from lid production, PLM Malmö, to remelting plant. The transport distance has been estimated.

Transport Card: 22. Trp

Inflows	**Percent**	**Massflow [kg]**	
Aluminium lid		8.471	
Outflows			
Aluminium lid		8.471	
Modes of conveyance	**[km]**		**Reference**
Truck, heavy (highway, 70%)	800.000		Estimated
Ship, coaster	50.000		

The sum of output flow(s) (8.471 kg) is used to calculate emissions and energies

Notes

--- To be continued ---

Transport of aluminium lids from PLM, Malmö, Sweden, to Schmalbach Lubeca, Ratingen, Germany.

Process Card: 23. Corrugated board (Database)

Inflows	**Percent**	**Massflow [kg]**
Recycled fibres		9.642
Outflows		
Corrugated board		0.816
Corrugated board		4.281
Corrugated board		7.554

Emissions, waste and resources	**[g]**	**Reference**
Land use [m2*years] (r)	5.608	
Particulates	0.655	
CO2 (bio)	384.953	
CO2	650.227	
CO	0.337	
NOx	2.176	
SO2	1.527	
H2S	3.36e-002	
COD (aq)	6.911	
BOD-5 (aq)	2.146	
AOX (aq)	2.61e-004	
Suspended solids (aq)	0.827	
Tot-N (aq)	3.17e-002	
NH3 (aq)	2.58e-003	
NO3- (aq)	1.23e-002	
Phosphate (aq)	2.50e-003	
Cu (aq)	5.61e-005	
Zn (aq)	2.01e-004	
Cl- (aq)	2.564	
SO42- (aq)	0.491	
Waste, ashes	3.531	
Waste, inorganic sludges	4.504	
Waste, paper related	6.150	
Waste, other rejects	22.632	
Waste, organic sludges	2.133	
Rejects incinerated + energy (out)	0.413	
Recycled lubricants (out)	3.75e-002	
Reused lubricants (out)	7.50e-002	
NaOH (in)	2.959	
HCl (in)	0.141	
Colorants (in)	0.521	
Starch (in)	22.516	
Sizing agents (in)	2.702	
Retention agents (in)	0.779	
Defoamer (in)	0.410	
Biocides (in)	1.52e-002	
Lubricants (in)	0.234	
Urea (in)	4.50e-002	
Phosphoric acid (in)	5.25e-002	
Na2CO3 (in)	0.748	
CaCO3 (in)	0.769	
CaO (in)	2.061	
Na2SO4 (in)	1.216	
H2SO4 (in)	3.293	
Sulphur (in)	1.110	
Alum (in)	0.918	
MgO (in)	9.97e-002	
NH3 (in)	1.106	
SO2 (in)	0.109	
Other additives (in)	0.140	
Auxiliary materials (in)	2.72e-002	
NMVOC	0.232	
CH4	0.402	
Dioxin	3.11e-010	
NH3	1.24e-004	
N2O	5.78e-003	
HCl	2.93e-003	
HF	9.91e-004	
Radioactive emissions [kBq]	6.40e+005	
As	1.91e-005	
Cd	4.77e-005	
Cr	2.31e-005	

--- To be continued ---

Hg	6.88e-007
Ni	1.02e-003
Pb	8.89e-005
CN-	1.45e-005
H2S (aq)	2.22e-007
Oil (aq)	7.51e-002
Organics (aq)	5.94e-002
Radioactive emissions [kBq] (aq)	6.02e+003
Al (aq)	8.84e-004
As (aq)	8.93e-006
Cd (aq)	4.54e-006
Co (aq)	6.00e-004
Cr (aq)	2.13e-005
Ni (aq)	2.71e-005
Pb (aq)	3.32e-005
Sb (aq)	2.42e-008
Sn (aq)	1.90e-003
V (aq)	5.67e-006
F- (aq)	6.51e-004
CN- (aq)	6.76e-006
Waste, industrial	326.006
Waste, hazardous	44.090
Waste, highly radioactive	1.51e-002
Crude oil (r)	82.242
Natural gas (r)	124.373
Hard coal (r)	8.567
Brown coal (r)	1.690
Wood (r)	2.76e-002
Uranium (as pure U) (r)	1.29e-004
Hydro power-water (r)	1.06e+003
NMVOC, oil combustion	0.425
Benzene	1.63e-003
Cr3+	2.44e-006
PO43- (aq)	1.47e-004
Cr3+ (aq)	4.39e-005
Waste, radioactive	2.70e-004
Biomass (r)	5.63e-002
NMVOC, diesel engines	8.22e-002
Zn	7.18e-005
Se	1.60e-005
Cu	9.77e-005
Peat (in)	21.144
Bark (in)	16.225
VOC, natural gas combustion	3.95e-013
VOC, coal combustion	5.97e-006
VOC, diesel engines	1.40e-004
NMVOC, power plants	1.07e-004
NMVOC, petrol engines	3.78e-014
HC	6.15e-004
PAH	5.17e-006
Benzo(a)pyrene	4.43e-008
Aromates (C9-C10)	2.02e-004
Aldehydes	1.50e-007
Organics	2.98e-007
V	3.43e-003
Metals	9.64e-008
BOD (aq)	4.82e-007
Dissolved organics (aq)	2.65e-014
Dissolved solids (aq)	4.02e-003
NO3-N (aq)	2.49e-008
NH4-N (aq)	3.22e-006
Nitrogen (aq)	1.46e-006
H+ (aq)	2.89e-006
HC (aq)	1.93e-006
Phenol (aq)	6.62e-016
Aromates (C9-C10) (aq)	6.62e-007
Fe (aq)	8.04e-006
Mn (aq)	4.02e-006
Sr (aq)	2.01e-005
Metals (aq)	4.82e-007
Salt (aq)	4.02e-004
Waste, mineral	2.10e-004
Waste, slags & ashes (waste incin.)	3.15e-008
Waste, slags & ashes (energy prod.)	1.18e-002

--- To be continued ---

Waste, bulky	2.180
Waste, sludge	1.69e-012
Waste, rubber	2.46e-006
Waste, chemical	1.62e-005
Crude oil, feedstock (r)	6.84e-007
Softwood (r)	2.11e-003
Fuel, unspecified [MJ] (r)	2.25e-008
NaCl (r)	1.35e-005
Clay (r)	2.89e-006
CaCO3 (r)	1.35e-005
Al (r)	7.71e-006
Fe (r)	8.08e-006
Mn (r)	4.77e-008
Water (r)	1.45e+003
Ground water (r)	1.82e-007
Surface water (r)	3.72e-009
Ethane	1.60e-006
Propane	1.32e-004
Alkanes	8.12e-004
Ethene	4.00e-006
Acetylene	8.00e-007
Propene	1.60e-006
Alkenes	4.12e-005
Toluene	1.30e-004
Formaldehyde	6.39e-004
Ca	1.06e-004
Co	4.36e-005
Fe	2.38e-004
Mo	2.11e-005
Na	9.90e-004
TOC (aq)	5.00e-006
Butane	3.15e-004
Pentane	5.40e-004
Acetaldehyde	4.50e-007

Energy carrier	[MJ]	E Factor	Reference
Electricity, coal marginal	1.495	Ex	
Oil, heavy fuel	1.826	None	
Oil, light fuel	0.240	None	
Natural gas (>100 kW)	5.842	None	
LPG, forklift	1.22e-002	None	
Diesel, heavy & medium truck (urban)	0.299	None	
Hard coal	0.118	None	
Peat	0.444	None	
Bark	0.276	None	
Heat	-0.121	None	
Diesel, heavy & medium truck (highway)	0.172	None	
Diesel, ship (4-stroke)	0.379	None	

The sum of output flow(s) (12.651 kg) is used to calculate emissions and energies
Mass change factor 1.312

Notes

Production of 1 kg of corrugated board. The data are imported from a database file (corr-brd.lca). The file includes data on wood harvesting, production of kraftliner, testliner, wellenstoff, semi-chemical fluting and corrugated board, and associated transports. The effects on other systems of the use of recycled fibres in the packaging system are documented in a separate file (corr-b-r.lca; see the process "Use of recycled fibres").

Data for most transports and for production of kraftliner, testliner, wellenstoff, semi-chemical fluting and corrugated board are adapted from FEFCO (1). Data for wood harvesting are adapted from reference 2.

The data above include emissions etc. from fuel production. These have been calculated by using emission factors from our energy database. The emission factors take into account emissions etc. for production of the electricity that is used for fuel production. However, the data above do not include emissions etc. for production of the electricity that is used in production of kraftliner, testliner, fluting, wellenstoff and corrugated board. When the total emissions profile of the packaging system is calculated, these emissions etc. are included through the use of emission factors for extraction etc. as is denoted above (E Factor: Ex).

Material balance:
- There is 0.762 kg of recovered paper per kg of corrugated board.
- Mass change factor (out/in) = 1/0.762 = 1.3112.

References:
(1) European Database for Corrugated Board Life Cycle Studies, FEFCO, Groupement Ondulé, KRAFT Institute, 1996/1.
(2) Örjan Hedenberg, Birgit Backlund Jacobson, Tiina Pajula, Lisa Person, Helena Wessman; Use of agro fibre for paper production from an environmental point of view, NordPap DP2/54, Scan Forskrapport 682, Nordic Industrial Fund, Oslo, 1997.
(3) Sundqvist J-O et al, Life Cycle Assessment and Solid Waste, AFR, Stockholm, 1994, page 78.

--- To be continued ---

The data were entered by Lisa Person, CIT. The notes were revised by Tomas Ekvall, CIT, 98-01-06.

Process Card: 24. Use of recycled fibres (Database)

Outflows	Percent	Massflow [kg]	
Recycled fibres		9.642	
Emissions, waste and resources	**[g]**		**Reference**
Crude oil (r)	98.305		
Natural gas (r)	-101.857		
Hard coal (r)	2.075		
Brown coal (r)	1.841		
Uranium (as pure U) (r)	1.39e-004		
Hydro power-water (r)	1.21e+003		
Wood (r)	5.50e-002		
Biomass (r)	4.51e-002		
Land use [m2*years] (r)	13.255		
Particulates	1.487		
CO2 (bio)	882.018		
CO2	6.222		
CO	0.562		
NOx	2.633		
SO2	0.825		
CH4	-16.214		
H2S	8.07e-002		
Cl-	-0.349		
NMVOC	0.435		
NMVOC, diesel engines	0.190		
NMVOC, oil combustion	0.341		
Dioxin	3.63e-010		
NH3	2.02e-004		
N2O	8.52e-003		
HCl	1.12e-003		
HF	6.77e-004		
Radioactive emissions [kBq]	2.41e+004		
Benzene	1.16e-003		
As	2.16e-006		
Cd	4.83e-006		
Cu	8.63e-005		
Cr	4.52e-006		
Cr3+	1.96e-006		
Hg	4.99e-007		
Se	4.96e-007		
Ni	1.83e-004		
Pb	1.57e-005		
Zn	4.96e-005		
CN-	1.17e-005		
COD (aq)	11.834		
BOD-5 (aq)	4.299		
Tot-N (aq)	-5.32e-003		
NO3- (aq)	-1.34e-002		
Phosphate (aq)	-2.14e-003		
H2S (aq)	4.41e-007		
Oil (aq)	9.11e-002		
Organics (aq)	7.35e-002		
Suspended solids (aq)	1.511		
Radioactive emissions [kBq] (aq)	226.094		
Al (aq)	1.75e-003		
Cu (aq)	-3.74e-005		
As (aq)	1.06e-005		
Cd (aq)	5.53e-006		
Co (aq)	2.13e-003		
Cr (aq)	4.24e-005		
Zn (aq)	-1.36e-004		
Ni (aq)	3.17e-005		
Pb (aq)	3.98e-005		
Sb (aq)	4.82e-008		
Sn (aq)	3.78e-003		
V (aq)	1.13e-005		
F- (aq)	5.50e-004		
SO42- (aq)	-0.377		
Cl- (aq)	2.676		
CN- (aq)	1.35e-005		
PO43- (aq)	1.18e-004		

--- To be continued ---

Cr3+ (aq)	3.52e-005
Waste, ashes	4.255
Waste, inorganic sludges	11.518
Waste, paper related	-7.043
Waste, other rejects	-13.131
Waste, organic sludges	1.834
Rejects incinerated + energy (out)	-0.807
Recycled lubricants (out)	-7.34e-002
Reused lubricants (out)	-0.147
Waste, industrial	-267.120
Waste, hazardous	-38.396
Waste, highly radioactive	2.37e-002
Waste, radioactive	2.06e-004
Elementary waste, corrugated board	-89.400
NaOH (in)	5.355
HCl (in)	-0.103
Colorants (in)	-1.020
Sizing agents (in)	1.907
Starch (in)	-18.120
Retention agents (in)	1.247
Defoamer (in)	0.807
Lubricants (in)	6.60e-002
Biocides (in)	7.34e-003
Phosphoric acid (in)	-0.103
Na2CO3 (in)	1.247
CaCO3 (in)	2.274
Na2SO4 (in)	3.595
Urea (in)	-8.80e-002
Sulphur (in)	0.147
CaO (in)	6.016
H2SO4 (in)	9.684
Other additives (in)	0.220
Alum (in)	2.714
Peat (in)	3.841
Bark (in)	35.371
Biogas (out)	-8.400

Energy carrier	[MJ]	E Factor	Reference
Electricity, coal marginal	1.801	Ex	
Oil, heavy fuel	1.497	None	
Oil, light fuel	6.90e-003	None	
Diesel, heavy & medium truck (highway)	0.269	None	
Diesel, heavy & medium truck (rural)	-6.36e-003	None	
Diesel, heavy & medium truck (urban)	0.553	None	
Diesel, ship (4-stroke)	1.350	None	
Natural gas (>100 kW)	-5.121	None	
LPG, forklift	-2.20e-002	None	
Peat	8.07e-002	None	
Bark	0.602	None	
Heat	-0.249	None	

The sum of output flow(s) (9.642 kg) is used to calculate emissions and energies

Notes

Effects on other life cycles of the use of 1 kg of recovered paper in production of corrugated board for the packaging system. The data are imported from a database file (corr-b-r.lca). Data for the actual production of liner, fluting and corrugated board are documented in another file (corr-brd.lca; see the process "Corrugated board").

The use of 1 kg of recovered paper in the packaging system is assumed to result in a reduction in landfilling by 0.2 kg and a reduction in the use of recovered paper in production of testliner for other systems by 0.8 kg. The latter is assumed to result in an increase in the use of kraftliner in other systems by nearly 0.8 kg. See Main report for a discussion on these assumptions.

The file corr-b-r.lca contains data on the reduction in landfilling and testliner production for other systems. It also includes data on the extra production of kraftliner for other systems. Data for most transports and for production of kraftliner and testliner are adapted from FEFCO (1). Data for wood harvesting are adapted from reference 2. Data for avoided landfilling are adapted from reference 3.

The data above include emissions etc. from fuel production. These have been calculated by using emission factors from our energy database. The emission factors take into account emissions etc. for production of the electricity that is used for fuel production. However, the data above do not include emissions etc. for production of the electricity that is used in kraftliner production, testliner production, and landfilling. When the total emissions profile of the packaging system is calculated, these emissions etc. are included through the use of emission factors for extraction etc. as is denoted above (E Factor: Ex).

References:

(1) European Database for Corrugated Board Life Cycle Studies, FEFCO, Groupement Ondulé, KRAFT Institute, 1996/1.
(2) Örjan Hedenberg, Birgit Backlund Jacobson, Tiina Pajula, Lisa Person, Helena Wessman; Use of agro fibre for paper production from an

--- To be continued ---

environmental point of view, NordPap DP2/54, Scan Forskrapport 682, Nordic Industrial Fund, Oslo, 1997.
(3) Sundqvist J-O et al, Life Cycle Assessment and Solid Waste, AFR, Stockholm, 1994, page 78.

The data were entered by Lisa Person, CIT. The notes were revised by Tomas Ekvall, CIT, 98-01-06.

Transport Card: 25. Trp

Inflows	Percent	Massflow [kg]	
Corrugated board		0.816	
Outflows			
Corrugated board		0.816	
Modes of conveyance	**[km]**		**Reference**
Truck, heavy (highway, 70%)	300.000		See notes

The sum of output flow(s) (0.816 kg) is used to calculate emissions and energies

Notes
Transport of corrugated board.

The board is produced in Germany according to reference (1). The distance has been estimated.

Reference:
(1) Dr. Gert-Walter Minét, Scmalbach Lubeca, Ratingen, Germany.

Transport Card: 26. Trp

Inflows	Percent	Massflow [kg]	
Can + layer pads		85.946	
Outflows			
Can + layer pads		85.946	
Modes of conveyance	**[km]**		**Reference**
Truck, heavy (highway, 70%)	750.000		Estimated
Ship, coaster	25.000		Estimated

The sum of output flow(s) (85.946 kg) is used to calculate emissions and energies

Notes
Transport of 33 cl steel cans from Scmalbach Lubeca, Ratingen, Germany, to brewery, Denmark. The distances are estimated.

Process Card: 27. Washing & filling

Inflows	Percent	Massflow [kg]	
Can + layer pads		85.946	
Outflows			
80% of layer pads	6.00e-002 %	0.650	
Can + beverage		1.08e+003	
Emissions, waste and resources	**[g]**		**Reference**
Water (r)	41.344		(1) Resource
Corrugated board (from layer pads) (out)	0.151		(2) Non-elementary outflow
Energy carrier	**[MJ]**	**E Factor**	**Reference**
Electricity, coal marginal	7.00e-003	Ex	(1)
Natural gas (>100 kW)	4.88e-002	FU/Ex	(1)

The sum of output flow(s) (1.08e+003 kg) is used to calculate emissions and energies
Mass change factor 12.604

Notes
Washing and filling of 33 cl tinplate cans for beer and soft drinks in the brewery (1).

20% of the corrugated board layer pads is assumed to be recycled into other materials (5). We do not expand system boundaries to deal with this recycling, since the outflow is less than 1% of the primary packaging. Instead, the outflow of corrugated board to recycling is a non-elementary outflow from the system. This has little effect on the total LCA results. The system has other, larger outflows of board to recycling, and there the system is expanded.

The amount of heat (provided by the data supplier) has been recalculated into primary fuel assuming an efficiency of 80 % (2). The fuel used is natural gas according to the supplier, but no information about the furnace size was provided. A furnace size larger than 100 kW has been assume

Material balance per can:
Inflows:
- Tinplate can + layer pads: 28.435 g (3).

Outflows:
- Tinplate can + beverage: 358.165 g (4).
- 80% of the layer pads (to waste incineration): 0.216 g. (5)
Total outflows: 358.381 g.

--- To be continued ---

Mass change factor (out/in) = 12.604.

Data gaps:
Pasteurisation of beer and soft drink is associated with the beverage. Thus energy use associated with the pasteurisation procedure is not included. Cleaning agents are used in quite small amounts and have not been accounted for. Aquatic emissions of e.g. COD, BOD, N and P are subject to efficient cleaning procedures in municipal waste water treatment plants and emissions to the environment are assumed to be negligible. Energy use at the waste water treatment plant is estimated to be only a few percent of the total energy use for tapping. The fate of organic cleaning agents in municipal waste water treatment plants as well as their eventual impact in the environment have not been quantified due to lack of data, and potential environmental impacts are unknown.

References and comments:
(1) The brewery (confidential).
(2) O'Callaghan, P. (1993): Energy management. A comprehensive guide to reducing costs by efficient energy use. McGraw-Hill Book Company, London, United Kingdom.
(3) Dr. Gert-Walter Minét, Schmalbach Lubeca, Ratingen, Germany.
(4) The amount of beverage is 33 cl, which corresponds to 330 g.
(5) Bryggeriforeningen via Jan Jacobsen, Logisys, 1997.

Transport Card: 28. Trp

Inflows	**Percent**	**Massflow [kg]**
80% of layer pads		0.650
Outflows		
80% of layer pads		0.650

Modes of conveyance	**[km]**	**Reference**
Truck, medium (rural, 40%)	20.000	(1)

The sum of output flow(s) (0.650 kg) is used to calculate emissions and energies

Notes
Transport of 80% of used layer pads (corrugated board) to incineration plant.

Reference:
(1) Bryggeriforeningen via Jan Jacobsen, Logisys, 1997.

Process Card: 29. Corrugated board incineration

Inflows	**Percent**	**Massflow [kg]**
80% of layer pads		0.650
Outflows		
Energy [MJ]		7.715

Emissions, waste and resources	**[g]**	**Reference**
Ca(OH)2 (in)	17.600	(1)(2) Non-elementary inflow
Water (r)	243.000	(1)(2)
CO2 (bio)	1.59e+003	(1) Air
CO	5.000	(1)
NOx	1.200	(1)
Dioxin	1.00e-008	(1)
H2O	544.000	(1)
Water to WWTP	243.000	(1) Water
Waste, slags & ashes	20.000	(1) Waste

Energy carrier	**[MJ]**	**E Factor**	**Reference**
Electricity, coal marginal	0.180	Ex	(1)

The sum of input flow(s) (0.650 kg) is used to calculate emissions and energies
Mass change factor 11.870

Notes
Incineration of corrugated board (CB) used in layer pads.
Data used for cardboard and corrugated board were found in the EDIP unit process database (1), and calculated as cellulose, except data for the amount of heat and electricity produced in the process. These were calculated based on energy production in Danish waste incineration plants in 1992 (3). The incineration plants' own energy consumption was subtracted from the production, to yield the energy exported from the plant. The (lower) heat value used for cardboard and corrugated board was 15 MJ/kg (3). For further details, see Technical report 7.

Energy production:
The heat produced in waste incineration is 11.3 MJ/kg waste and the electricity produced is 0.57 MJ/kg waste (3).

The outflow of energy from this process is not a mass flow, despite what is indicated above. Instead it is an energy flow, measured in MJ.

"Mass change factor":
The mass change factor in the LCAiT software is generally defined as the total outflow [kg]/total inflow [kg]. Since the outflow from this process is energy, the "mass change factor" is in this case the energy outflow[MJ]/the waste inflow [kg] = 11.87 MJ produced energy/kg waste.

References and comments:

--- To be continued ---

(1) Frees N and Pedersen M A (1996): EDIP unit database.
(2) Used for flue gas cleaning.
(3) SK energi (1994): Opgørelse af affaldsressourcer i Danmark. Elsam/Elkraft. Styregruppe 4 for biomasse.

Process Card: 30. Packaging

Inflows	Percent	Massflow [kg]	
Can + beverage		1.08e+003	
Return		104.604	
5% of pallet	0.116 %	1.401	
Secondary packaging	1.605 %	19.389	
Outflows			
90% of can (recyc.)	6.342 %	76.612	
5% of pallet	0.116 %	1.401	
Beverage distrib.		1.13e+003	
Emissions, waste and resources	**[g]**		**Reference**
Plastic ligature (in)	1.58e-002		Non-elementary inflow
Glue (in)	5.20e-002		
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (1.21e+003 kg) is used to calculate emissions and energies

Notes
Packaging of the beverage cans in the brewery. The environmental impact of the actual packaging process is not included in the LCA. It is likely to be negligible.

Material balance per can:
Inflows:
- Tinplate can + beverage: 358.165 g.
- Secondary packaging: 6.4164 g.
- 5% of pallet (The pallet is reused in 95% of the cases, why it only needs to be replaced in 5% of the cases. Each life cycle should therefore hold 5% of the environmental loadings caused by the pallet): 0.4630 g.
- Return: 90% of the (used) cans for recycling, pallet (distribution flow): 34.6078 g.

Total inflows: 399.6522 g

Outflows:
- Beverage distribution: Can + beverage, secondary packaging, pallet (distribution flow), plastic ligature and glue: 373.8678 g.
- 5% of the pallet to waste incineration: 0.4630 g.
- 90 of the can for recycling: 25.3485 g.

Total outflows: 399.6793 g.

Mass change factor (out/in):= 1.000.

When packing the corrugated board boxes on the pallet, LDPE ligature or glue is used for holding the boxes together. On 75% of the pallets, 20 g of ligature is used (1). This means the amount of ligature is: 20/2376*0.75=0.0063 g/can or 0.0158 g/kg outflow.

Glue is used on 25% of the pallets. Our data indicate that the amount of glue is 2 g (1), but we assume that this amount is used for each box. This means the amount of glue is 0.25*2/24=0.0208 g/can or 0,0520 g/ kg outflow.

The glue and ligature are non-elementary inflows, i.e. they are not followed from the cradle.

Reference: Bryggeriforeningen via Jan Jacobsen, Logisys, 1997.

Process Card: 31. Secondary packaging

Inflows	Percent	Massflow [kg]	
Tray, CB		7.554	
CB box (24 cans)	22.079 %	4.281	
Foil, LDPE	4.286 %	0.831	
Hi-cone, LDPE	2.208 %	0.428	
CB box (6 cans)	32.464 %	6.294	
Outflows			
Secondary packaging		19.389	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (19.389 kg) is used to calculate emissions and energies

Notes
Secondary packaging:
- Tray, corrugated board (24 cans): 120/24*0.5 = 2.5 g/can.
- Cardboard box (6 cans): 50/6*0.25 = 2.083 g/can.
- Foil for cardboard, LDPE (24 cans): 20/24*0.33 = 0.275 g/can.
- Corrugated board box (24 cans): 200/24*0.17 = 200/24*0.17 = 1.4167 g/can.
- Hi-cone, LDPE (6 cans): 3.4/6*0.25 = 0.1417 g/can.

--- To be continued ---

Total, secondary packaging: 6.4164 g/can.

Reference: Bryggeriforeningen via Jan Jacobsen, Logisys, 1997.

Transport Card: 32. Trp

Inflows	Percent	Massflow [kg]	
Secondary packaging		19.389	
Outflows			
Secondary packaging		19.389	
Modes of conveyance	**[km]**		**Reference**
Truck, medium (rural, 40%)	100.000		Estimated

The sum of output flow(s) (19.389 kg) is used to calculate emissions and energies

Process Card: 33. Cardboard (Database)

Outflows	Percent	Massflow [kg]	
Cardboard		6.294	
Emissions, waste and resources	**[g]**		**Reference**
Land use [m2*years] (r)	18.069		
Particulates	1.959		
CO2 (bio)	1.33e+003		
CO2	456.176		
NOx	3.782		
SO2	1.194		
H2S	0.110		
COD (aq)	16.710		
BOD-5 (aq)	5.900		
Suspended solids (aq)	2.100		
Waste, ashes	5.800		
Waste, inorganic sludges	15.700		
Waste, other rejects	10.800		
Waste, organic sludges	2.600		
NaOH (in)	7.800		
HCl (in)	6.00e-002		
Starch (in)	1.600		
Sizing agents (in)	5.900		
Retention agents (in)	2.000		
Defoamer (in)	1.200		
Biocides (in)	2.00e-002		
Lubricants (in)	0.260		
Na2CO3 (in)	1.700		
CaCO3 (in)	3.100		
CaO (in)	8.200		
Na2SO4 (in)	4.900		
H2SO4 (in)	13.200		
Sulphur (in)	0.200		
Alum (in)	3.700		
Other additives (in)	0.300		
CO	0.722		
NMVOC	0.510		
CH4	0.499		
Dioxin	4.58e-010		
NH3	2.65e-004		
N2O	9.65e-003		
HCl	1.42e-003		
HF	9.23e-004		
Radioactive emissions [kBq]	3.32e+004		
As	2.75e-006		
Cd	6.10e-006		
Cr	5.16e-006		
Hg	6.34e-007		
Ni	2.31e-004		
Pb	1.99e-005		
CN-	1.61e-005		
Tot-N (aq)	2.01e-002		
Phosphate (aq)	1.54e-004		
H2S (aq)	5.07e-007		
Oil (aq)	0.114		
Organics (aq)	9.15e-002		
Radioactive emissions [kBq] (aq)	311.600		
Al (aq)	2.01e-003		
As (aq)	1.33e-005		

--- To be continued ---

Cd (aq)	6.91e-006		
Co (aq)	2.18e-003		
Cr (aq)	4.87e-005		
Cu (aq)	1.60e-005		
Ni (aq)	3.98e-005		
Pb (aq)	4.99e-005		
Sb (aq)	5.54e-008		
Sn (aq)	4.34e-003		
V (aq)	1.30e-005		
Zn (aq)	5.47e-005		
F- (aq)	7.47e-004		
Cl- (aq)	3.347		
SO42- (aq)	0.131		
CN- (aq)	1.55e-005		
Waste, industrial	51.055		
Waste, hazardous	5.326		
Waste, highly radioactive	2.86e-002		
Crude oil (r)	123.652		
Natural gas (r)	19.466		
Hard coal (r)	2.619		
Brown coal (r)	2.336		
Wood (r)	6.31e-002		
Uranium (as pure U) (r)	1.77e-004		
Hydro power-water (r)	8.34e+008		
NMVOC, diesel engines	0.232		
Zn	5.65e-005		
Se	5.65e-007		
Cu	9.82e-005		
NMVOC, oil combustion	0.471		
Benzene	1.61e-003		
Cr3+	2.71e-006		
PO43- (aq)	1.63e-004		
Cr3+ (aq)	4.88e-005		
Waste, radioactive	2.86e-004		
Biomass (r)	6.24e-002		
Peat (in)	5.236		
Bark (in)	48.216		
Energy carrier	**[MJ]**	**E Factor**	**Reference**
Oil, heavy fuel	2.040	None	
Oil, light fuel	1.00e-002	None	
Natural gas (>100 kW)	0.690	None	
Diesel, heavy & medium truck (urban)	0.784	None	
Peat	0.110	None	
Bark	0.820	None	
Heat	-0.340	None	
Electricity, coal marginal	2.600	Ex	
Diesel, heavy & medium truck (highway)	0.325	None	
Diesel, ship (4-stroke)	1.377	None	

The sum of output flow(s) (6.294 kg) is used to calculate emissions and energies

Notes
Production of 1 kg of cardboard (1). The data are imported from a database file (card-b.lca).

Production of cardboard has been approximated with data for production of kraftliner. This approximation has been validated through a comparison with confidential actual cardboard data.

The file includes data on wood harvesting, wood transport and production of kraftliner. Data on wood transport and on kraftliner production are adapted from FEFCO (1). Data on wood harvesting are adapted from reference 2.

The data above include emissions etc. from fuel production. These have been calculated by using emission factors from our energy database. The emission factors take into account emissions etc. for production of the electricity that is used for fuel production. However, the data above do not include emissions etc. for production of the electricity that is used in production of kraftliner. When the total emissions profile of the packaging system is calculated, these emissions etc. are included through the use of emission factors for extraction etc. as is denoted above (E Factor: Ex).

References:
(1) European Database for Corrugated Board Life Cycle Studies, FEFCO, Groupement Ondulé, KRAFT Institute, 1996/1;
(2) Örjan Hedenberg, Birgit Backlund Jacobson, Tiina Pajula, Lisa Person, Helena Wessman; Use of agro fibre for paper production from an environmental point of view, NordPap DP2/54, Scan Forskrapport 682, Nordic Industrial Fund, Oslo, 1997.

Transport Card: 34. Trp

Inflows	**Percent**	**Massflow [kg]**
Cardboard		6.294

Outflows

--- To be continued ---

Cardboard 6.294

Modes of conveyance	[km]	Reference
Truck, heavy (highway, 70%)	300.000	Estimated

The sum of output flow(s) (6.294 kg) is used to calculate emissions and energies

Notes

Process Card: 35. Cardboard box (6 cans)

Inflows	Percent	Massflow [kg]
Cardboard		6.294
Outflows		
CB box (6 cans)		6.294

Energy carrier	[MJ]	E Factor	Reference

The sum of output flow(s) (6.294 kg) is used to calculate emissions and energies

Notes
Datagap: No data for box production have been available. The effect of this data gap on total LCA results is likely to be negligible.

Transport Card: 36. Trp

Inflows	Percent	Massflow [kg]
Corrugated board		7.554
Outflows		
Corrugated board		7.554

Modes of conveyance	[km]	Reference
Truck, heavy (highway, 70%)	300.000	Estimated

The sum of output flow(s) (7.554 kg) is used to calculate emissions and energies

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Process Card: 37. Tray

Inflows	Percent	Massflow [kg]
Corrugated board		7.554
Outflows		
Tray, CB		7.554

Energy carrier	[MJ]	E Factor	Reference

The sum of output flow(s) (7.554 kg) is used to calculate emissions and energies

Notes
Datagap: No data for tray production have been available. The effect of this data gap on total LCA results is likely to be negligible.

Transport Card: 38. Trp

Inflows	Percent	Massflow [kg]
Corrugated board		4.281
Outflows		
Corrugated board		4.281

Modes of conveyance	[km]	Reference
Truck, heavy (highway, 70%)	300.000	Estimated

The sum of output flow(s) (4.281 kg) is used to calculate emissions and energies

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Process Card: 39. Corrugated board box (24 cans)

Inflows	Percent	Massflow [kg]
Corrugated board		4.281
Outflows		
CB box (24 cans)		4.281

Energy carrier	[MJ]	E Factor	Reference

The sum of output flow(s) (4.281 kg) is used to calculate emissions and energies

Notes
Datagap: No data for box production have been available. The effect of this data gap on total LCA results is likely to be negligible.

Process Card: 40. LDPE

Outflows	Percent	Massflow [kg]
LDPE		0.428
LDPE		0.831

Emissions, waste and resources	[g]	Reference
Particulates	3.000	Air

--- To be continued ---

CO_2	1.25e+003		
CO	0.900		
SO_2	9.000		
NOx	12.000		
HCl	7.00e-002		
HF	5.00e-003		
HC	21.000		
Metals	5.00e-003		
COD (aq)	1.500		Water
BOD (aq)	0.200		
Acid as H+ (aq)	6.00e-002		
Nitrates (aq)	5.00e-003		
Metals (aq)	0.250		
NH4+ (aq)	5.00e-003		
Cl- (aq)	0.130		
Dissolved organics (aq)	2.00e-002		
Suspended solids (aq)	0.500		
Oil (aq)	0.200		
HC (aq)	0.100		
Dissolved solids (aq)	0.300		
Phosphate (aq)	5.00e-003		
Other nitrogen (aq)	1.00e-002		
Waste, industrial	3.500		Waste
Waste, mineral	26.000		
Waste, ashes	9.000		
Waste, toxic chemicals	0.100		
Waste, non toxic chemicals	0.800		
Iron ore (r)	0.200		Resource
Limestone (r)	0.150		
Water (r)	2.40e+004		
Bauxite (r)	0.300		
NaCl (r)	8.000		
Clay (r)	2.00e-002		
Ferromanganese (r)	1.00e-003		
Crude oil (r)	88.760		(1) Fuel resource
Natural gas (r)	228.800		(1) Fuel resource
Coal (r)	117.100		(1) Fuel resource
Crude oil, feedstock (r)	793.200		(1) Feedstock resource
Natural gas, feedstock (r)	610.400		(1) Feedstock resource
Coal, feedstock (r)	0.357		(1) Feedstock resource
Hydropower [MJel] (r)	0.540		(2) Electricity resource
Uranium (as pure U) (r)	1.27e-002		(3) Electricity resource
Waste, highly radioactive	3.50e-002		(4) Waste
Energy carrier	**[MJ]**	**E Factor**	**Reference**
Oil	3.790	None	(5) Fuel
Natural gas	12.380	None	(5) Fuel
Coal	3.280	None	(5) Fuel
Oil, feedstock	33.870	None	(5) Feedstock
Natural gas, feedstock	33.020	None	(5) Feedstock
Coal, feedstock	1.00e-002	None	(5) Feedstock
Electricity	3.140	None	(6)
Nuclear power [MJel]	1.670	None	(8)
Hydro power [MJel]	0.540	None	(7)

The sum of output flow(s) (1.259 kg) is used to calculate emissions and energies

Notes

Production of 1 kg of low density polyethylene (LDPE) from virgin feedstock (ethylene). The data includes all process steps from extraction of feedstock resources (crude oil and natural gas) to polymerisation.

General comments concerning the APME Eco-profile report series:
- In the APME-reports, the results for the cradle to gate life cycle are aggregated. This means that emissions from combustion of fuels and from the production of electricity are already included in the process emissions and that resources from the production of electricity are included in the energy demand (fuels). The fuel "other" (in the APME-report) mainly consists of oil and gas and has therefore been added to the value for oil.

Main reference: Boustead, Ian, Eco-profiles of the European plastics industry, Report 3: Polyethylene and Polypropylene, A report for The European Centre for Plastics in the Environment (PWMI/APME), Brussels, May 1993, table 17, page 11.

Other references and comments:
(1) The fuels and feedstocks in the Eco-profile report correspond to primary resources (MJ). The MJ-figure has been converted to g by using the higher heat value (9).
(2) Hydro power has been accounted for as a resource in MJ electricity. Since LCAiT does not handle other units than g, the MJel is put in the na
(3) The consumption of uranium has been calculated based on the original figure for nuclear power given as MJ electricity. 1 MJ of electricity from nuclear power corresponds to 0.00758 g of uranium (as pure U) (10).

--- To be continued ---

(4) The generation of radioactive waste has been calculated based on the original figure for nuclear power given as MJ electricity. 1 MJ of electricity from nuclear power corresponds to 0.021 g of highly radioactive waste (10).
(5) The original figure is an internal parameter because the environmental load associated with the production and combustion is included in the emissions and resource consumption above. Therefore it would not be correct to use the emission factors from the database.
(6) The original figure is an internal parameter because the environmental load associated with the production is included in the emissions and resource consumption above. Therefore it would not be correct to use any emission factors for electricity production from the database.
(7) The original figure corresponds to MJ consumed electricity from hydro power. This parameter is internal because the environmental load associated with the production is included in the emissions and resource consumption above.
(8) The original figure corresponds to MJ consumed electricity from nuclear power. This parameter is internal because the environmental load associated with the production is included in the emissions and resource consumption above.
(9) The Eco-profile reports from APME have been carried out by Boustead Consulting (Ian Boustead). The heat values used in these studies were provided by William Dove, Boustead Consulting, UK.
- Oil: 42.7 MJ/kg.
- Natural gas: 54.1 MJ/kg.
- Coal: 28 MJ/kg.
(10) Livscykelanalys av Vattenfalls Elproduktion, Sammanfattande rapport, Stockholm, Sweden, 1996, page 70-71.

Transport Card: 41. Trp

Inflows	Percent	Massflow [kg]
LDPE		0.831
Outflows		
LDPE		0.831

Modes of conveyance	[km]	Reference
Truck, heavy (highway, 70%)	300.000	Estimated

The sum of output flow(s) (0.831 kg) is used to calculate emissions and energies

Notes

Process Card: 42. Foil

Inflows	Percent	Massflow [kg]
LDPE		0.831
Outflows		
Foil, LDPE		0.831

Energy carrier	[MJ]	E Factor	Reference

The sum of output flow(s) (0.831 kg) is used to calculate emissions and energies

Notes
Datagap: No data for foil production have been available. The effect of this data gap on total LCA results is likely to be negligible.

Transport Card: 43. Trp

Inflows	Percent	Massflow [kg]
LDPE		0.428
Outflows		
LDPE		0.428

Modes of conveyance	[km]	Reference
Truck, heavy (highway, 70%)	300.000	Estimated

The sum of output flow(s) (0.428 kg) is used to calculate emissions and energies

Process Card: 44. Hi-cone

Inflows	Percent	Massflow [kg]
LDPE		0.428
Outflows		
Hi-cone, LDPE		0.428

Energy carrier	[MJ]	E Factor	Reference

The sum of output flow(s) (0.428 kg) is used to calculate emissions and energies

Notes
Datagap. No data for production of Hi-cone have been available. The effect of this data gap on total LCA results is likely to be negligible.

Process Card: 45. Planks for pallets (Database)

Outflows	Percent	Massflow [kg]
Planks		1.401

Emissions, waste and resources	[g]	Reference
Land use {m2*years} (r)	18.770	
HC	0.571	
CO2	103.001	
CO	1.324	

--- To be continued ---

NOx	1.050
SO2	0.140
NMVOC	0.250
CH4	0.131
Dioxin	1.08e-010
NH3	1.88e-004
N2O	2.28e-003
HCl	3.03e-004
H2S	5.98e-006
HF	3.33e-005
Particulates	0.273
Radioactive emissions [kBq]	7.04e+005
As	5.62e-007
Cd	1.32e-006
Cr	2.24e-006
Hg	2.67e-007
Ni	5.33e-005
Pb	4.51e-006
CN-	8.70e-009
COD (aq)	4.72e-003
BOD-5 (aq)	1.43e-004
Tot-N (aq)	6.90e-003
Phosphate (aq)	7.58e-005
H2S (aq)	2.49e-007
Oil (aq)	2.92e-002
Organics (aq)	2.44e-002
Radioactive emissions [kBq] (aq)	6.61e+003
Al (aq)	9.89e-004
As (aq)	3.22e-006
Cd (aq)	1.79e-006
Co (aq)	9.57e-005
Cr (aq)	2.39e-005
Cu (aq)	7.85e-006
Ni (aq)	9.68e-006
Pb (aq)	1.25e-005
Sb (aq)	2.72e-008
Sn (aq)	2.13e-003
V (aq)	6.37e-006
Zn (aq)	2.69e-005
F- (aq)	3.60e-005
Cl- (aq)	0.854
SO42- (aq)	3.37e-002
CN- (aq)	7.59e-006
Waste, industrial	3.666
Waste, hazardous	3.74e-002
Waste, highly radioactive	1.04e-002
Crude oil (r)	31.529
Natural gas (r)	1.306
Hard coal (r)	0.606
Brown coal (r)	0.505
Wood (r)	3.10e-002
Uranium (as pure U) (r)	3.67e-005
Hydro power-water (r)	7.42e+007
NMVOC, diesel engines	0.146
Zn	2.22e-005
Se	2.21e-007
Cu	3.85e-005
Ethane	2.11e-005
Propane	3.17e-005
Alkanes	2.64e-004
Ethene	5.28e-005
Acetylene	1.06e-005
Propene	2.11e-005
Alkenes	2.11e-005
PAH	1.21e-007
Benzene	2.11e-005
Toluene	1.06e-005
Aromates (C9-C10)	2.11e-005
Formaldehyde	6.34e-006
TOC (aq)	6.60e-005
Bark (in)	94.080
Waste, slags & ashes	5.760

Energy carrier	[MJ]	E Factor	Reference

--- To be continued ---

Electricity, coal marginal	0.525	Ex
Oil, light fuel	0.264	None
Diesel, heavy & medium truck (urban)	0.783	None
Bark	1.600	None
Diesel, heavy & medium truck (highway)	0.118	None
Diesel, ship (4-stroke)	5.94e-002	None

The sum of output flow(s) (1.401 kg) is used to calculate emissions and energies

Notes

Production of 1 kg of planks. The data are imported from a database file (planks.lca).

The file includes data on production (planting, forestry and harvesting) of pine pulpwood (softwood) in Sweden, using mechanised and manual wood harvesting (1). The softwood is both naturally rejuvenated and planted. The sawmill includes barking, sawing and drying of wood (2). The transport between harvesting and saw mill is included as well (3).

The data above include emissions etc. from fuel production and combustion. These have been calculated by using emission factors from our energy database. The emission factors take into account emissions etc. for production of the electricity that is used for fuel production. However, the data above do not include emissions etc. for production of the electricity that is used in the saw mill. When the total emissions profile of the packaging system is calculated, these emissions etc. are included through the use of emission factors for extraction etc. as is denoted above (E Factor: Ex).

References:

(1) Örjan Hedenberg, Birgit Backlund Jacobson, Tiina Pajula, Lisa Person, Helena Wessman; Use of agro fibre for paper production from an environmental point of view, NordPap DP2/54, Scan Forskrapport 682, Nordic Industrial Fund, Oslo, 1997.
(2) Tillman et al., Packaging and the Environment, Chalmers Industriteknik, Gothenburg, Sweden, 1992.
(3) Data from the STFI database (The Swedish Pulp and Paper Institute).

Transport Card: 46. Trp

Inflows	**Percent**	**Massflow [kg]**	
Planks		1.401	
Outflows			
Planks		1.401	
Modes of conveyance	**[km]**		**Reference**
Truck, heavy (highway, 70%)	100.000		Estimated

The sum of output flow(s) (1.401 kg) is used to calculate emissions and energies

Process Card: 47. Pallet

Inflows	**Percent**	**Massflow [kg]**	
Planks		1.401	
Outflows			
5% of pallet		1.401	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (1.401 kg) is used to calculate emissions and energies

Notes

Datagap: No data for the production of pallets have been available. The effect of this data gap on total LCA results is likely to be negligible.

The pallets are reused in 95% of the cases (1), why they only needs to be replaced in 5% of the cases. Each life cycle should therefore hold 5% of the environmental loadings caused by the production of the pallets.

Reference:

(1): Bryggeriforeningen via Jan Jacobsen, Logisys, 1997.

Transport Card: 48. Trp

Inflows	**Percent**	**Massflow [kg]**	
5% of pallet		1.401	
Outflows			
5% of pallet		1.401	
Modes of conveyance	**[km]**		**Reference**
Truck, medium (rural, 40%)	100.000		Estimated

The sum of output flow(s) (1.401 kg) is used to calculate emissions and energies

Transport Card: 49. Trp

Inflows	**Percent**	**Massflow [kg]**	
5% of pallet		1.401	
Outflows			
5% of pallet		1.401	
Modes of conveyance	**[km]**		**Reference**
Truck, medium (rural, 40%)	20.000		(1)

--- To be continued ---

The sum of output flow(s) (1.401 kg) is used to calculate emissions and energies

Notes
Transport of wood to inceneration plant.

Reference:
(1) Bryggeriforeningen via Jan Jacobsen, Logisys, 1997.

Process Card: 50. Wood incineration

Inflows	**Percent**	**Massflow [kg]**	
5% of pallet		1.401	
Outflows			
Energy, wood		20.137	
Emissions, waste and resources	**[g]**		**Reference**
Ca(OH)2 (in)	17.600		(1)(2) Non-elementary inflow
Water (r)	243.000		(1)(2)
CO2 (bio)	1.78e+003		(1)(4) Air
CO	6.000		(1)(4)
NOx	1.200		(1)(4)
Dioxin	1.00e-008		(1)(4)
H2O	522.000		(1)(4)
Water to WWTP	243.000		(1) Water
Waste, slags & ashes	30.000		(1) Waste
Energy carrier	**[MJ]**	**E Factor**	**Reference**
Electricity, coal marginal	0.180	Ex	(1)

The sum of input flow(s) (1.401 kg) is used to calculate emissions and energies
Mass change factor 14.370

Notes
Incineration of wood used in pallets.
Data used for wood were found in the EDIP unit process database (1), except data for the amount of heat and electricity produced in the process. These were calculated based on energy production in Danish waste incineration plants in 1992 (3). The incineration plants' own energy consumption was subtracted from the production, to yield the energy exported from the plant. The (lower) heat value used for wood was 18.3 MJ/kg (5). For further details, see Technical report 7.

Energy production:
The heat produced in waste incineration is 13.8 MJ/kg waste and the electricity produced is 0.57 MJ/kg waste (3).

The outflow of energy from this process is not a mass flow, despite what is indicated above. Instead it is an energy flow, measured in MJ.

"Mass change factor":
The mass change factor in the LCAiT software is generally defined as the total outflow [kg]/total inflow [kg]. Since the outflow from this process is energy, the "mass change factor" is in this case the energy outflow[MJ]/the waste inflow [kg] = 14.37 MJ produced energy/kg waste.

References and comments:
(1) Frees N and Pedersen M A (1996): EDIP unit database.
(2) Used for flue gas cleaning.
(3) SK energi (1994): Opgørelse af affaldsressourcer i Danmark. Elsam/Elkraft. Styregruppe 4 for biomasse.
(4) The air emissions are calculated based on an assumption that during incineration, 1 % of the wood becomes ashes, and also that the ashes consist of 50 wt% C, 44 wt% O and 6 wt% H (6).
(5) Arbeidsrapport nr. 29 (1995): Miljøøkonomi for papir- og papkredsløb. Delrapport 2: Bølgepap. Miljø- og Energiministeriet Miljøstyrelsen.

Process Card: 51. Energy use

Inflows	**Percent**	**Massflow [kg]**	
Alternative energy	50.000 %	27.852	
Energy, wood		20.137	
Energy, CB		7.715	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (55.703 kg) is used to calculate emissions and energies

Notes
Heat and electricity produced in waste incineration is assumed to replace the same amount of heat and electricity from alternative energy production. The outflows/inflows of energy to/from this process are not mass flows, despite what is indicated above. Instead they are energy flows, measured in MJ (see remarks in the incineration processes).

Process Card: 52. Alt. energy production

Outflows	**Percent**	**Massflow [kg]**	
Alternative energy		27.852	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

--- To be continued ---

Natural gas (>100 kW)	-0.447	FU/Ex	(1) (2)
Oil, light fuel	-0.671	FU/Ex	(1) (2)
Electricity, coal marginal	-5.00e-002	Ex	(1)

The sum of output flow(s) (27.852 kg) is used to calculate emissions and energies

Notes
Alternative production of heat and electricity per MJ total energy produced:

- Heat: 0.95 MJ (2). The efficiency for production of heat from oil and natural gas is assumed to be 85 %. The total amount of primary fuels = 0.95/0.85 = 1.118 MJ/MJ of total energy produced. The heat produced in waste incineration is assumed to replace district heat produced from other fuels, which (as an average for Denmark) is a mix of 60 % light fuel oil and 40 % natural gas (1). This corresponds to 0.671 MJ of light fuel oil and 0.447 MJ of natural gas.

- Electricity: 0.05 MJ (2). The electricity produced in waste incineration is assumed to replace electricity from the grid.

The outflow of energy from this process is not a mass flow, despite what is indicated above. Instead it is an energy flow, measured in MJ (see remarks in the incineration processes).

References:
(1) Eurostat. (1997a). Energy Balance Sheets 1994-1995. Luxembourg: Statistical Office of the European Communities.
(2) Frees N and Pedersen M A (1996): EDIP unit database.

Transport Card: 53. Distribution

Inflows	**Percent**	**Massflow [kg]**	
Beverage distrib.		1.13e+003	
Outflows			
Beverage distrib.		1.13e+003	
Modes of conveyance	**[km]**		**Reference**
Distr, heavy (highway, 50%)(Scan)	56.700		(1)
Distr, heavy (rural, 50%)(Scan)	45.360		(1)
Distr, heavy (urban, 50%)(Scan)	11.340		(1)
Distr, medium (highway, 50%)	14.400		(1)
Distr, medium (rural, 50%)	14.400		(1)
Distr, medium (urban, 50%)	19.200		(1)
Distr, medium (highway, 50%)	0.792		(1)
Distr, medium (rural, 50%)	2.376		(1)
Distr, medium (urban, 50%)	4.752		(1)

Calculated for a reference flow of 1.13e+003 [kg] which corresponds to distr. of 1000 l
The sum of output flow(s) (1.13e+003 kg) is used to calculate emissions and energies

Notes
Reference:
(1) Bryggeriforeningen via Jan Jacobsen, Logisys, 1997.

Process Card: 54. Retailer

Inflows	**Percent**	**Massflow [kg]**	
Beverage distrib.		1.13e+003	
90% of can (recyc.)		76.645	
Outflows			
Return	8.669 %	104.604	
CB recycling (tray)	0.125 %	1.508	
Bever. to consumer		1.10e+003	
Emissions, waste and resources	**[g]**		**Reference**
Plastic ligature (out)	1.10e-002		(1)
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (1.21e+003 kg) is used to calculate emissions and energies

Notes
The choice of packaging is assumed to have negligible effect on the environmental impacts of the retailer.

70% of the plastic ligature (0.0044 g/can) is assumed to be recycled to be used in other products (1). We do not expand system boundaries to deal with this recycling, since the outflow is less than 1% of the primary packaging. Instead, the outflow of plastic ligature to recycling is a non-elementary outflow from the system

Material balance per can:
Inflows:
- Beverage distribution: Can + beverage, secondary packaging, pallet (distribution flow), plastic ligature and glue: 373.8678 g.
- 90% of the can for recycling: 25.3485 g.
Total inflows: 399.2163 g.

--- To be continued ---

Outflows:
- To consumer: Can + beverage, cardboard box, foil for cardboard, corrugated board box, hi-cone, 80% of tray to waste incineration, 30% of plastic ligature to waste incineration and glue: 364.1041 g.
- Return: 90% of the can for recycling, pallet (distribution flow): 34. 6078 g.
- CB recycling: 20% of tray for recycling: 0.5 g.
Total outflows: 399.2119 g.

Mass change factor = 1.0.

Reference:
(1) Bryggeriforeningen via Jan Jacobsen, Logisys, 1997.

Transport Card: 55. Trp

Inflows	**Percent**	**Massflow [kg]**	
Bever. to consumer		1.10e+003	
Outflows			
Bever. to consumer		1.10e+003	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (1.10e+003 kg) is used to calculate emissions and energies

Notes
Transport of filled tinplate cans from retailer to consumer. The choice of beverage packaging is assumed not to affect the transport mode, the transport distance or the number of transports from retailer to home. Under this assumption, preliminary calculations show that the choice of packaging has negligible effect on the environmental impact of this transport.

Process Card: 56. Use (refrigeration)

Inflows	**Percent**	**Massflow [kg]**	
Bever. to consumer		1.10e+003	
Outflows			
90% of can (recyc.)		76.645	
CB recyc. (box 24)	0.831 %	0.857	
CB recyc. (box 6)	1.222 %	1.260	
Waste	23.621 %	24.358	
Energy carrier	**[MJ]**	**E Factor**	**Reference**
Electricity, coal marginal	1.77e-002	Ex	See notes

The sum of output flow(s) (103.120 kg) is used to calculate emissions and energies
Mass change factor 9.37e-002

Notes
Use (refrigeration)

The can is cooled from 20 to 5 degrees Celsius. The heat capacitivity of steel is 0.00046 MJ/(kg*°) (1), and the heat capacitivity of aluminium is 0.0009 MJ/(kg*°) (1). This means, that the heat capacitivity for the can (which contains of 23.8 g steel and 2.803 g aluminium) becomes 0.0005 MJ/(kg*°), which gives an energy demand of 0.0005*15=0.0075 MJ/kg steel & aluminium. An efficiency of 33% for the refrigerator has been used (2), which gives a total energy demand of 0.0227 MJ/kg steel & aluminium. The amount of steel and aluminium in the outflow is 26.603 g/can (23.8+2.803). The total outflow is (see below) 34.1041 g/can, which gives 26.603/34.1041 = 0.7801 kg steel and aluminium / kg outflow. This means that the energy demand becomes 0.8901*0.0227 = 0.0177 MJ/kg outflow.

Material balance per can:

Inflows:
- To consumer: Can + beverage, cardboard box, foil for cardboard, corrugated board box, hi-cone, 80% of tray to waste incineration, 30% of plastic ligature for waste incineration, glue: 364.1041 g/can.

Outflows:
- Waste: 10% of can to waste incineration, 80% of cardboard box to waste incineration, foil for cardboard (to waste incineration), 80% of corrugated board box to waste incineration, 80% of tray to waste incineration, 30% of plastic ligature to waste incineration, hi-cone (to waste incineration) and glue (to waste incineration): 8.0557 g.
- 90% of can for recycling: 25.3485 g.
- CB recycling: 20% of corrugated board box for recycling: 0.2833 g.
- Cardboard recycling: 20% of cardboard box for recycling, 0.4166 g.
Total outflows: 34.1041 g.

Mass change factor (out/in) = 0.0937.

References:
(1) Nordling Carl, Österman Jonny, Physics handbook.
(2) Pommer K., Wesnaes M.S., Madsen C., Miljomaessig kortlaegning af emballager til ol og laeskedrikke. Delrapport 6: Engangsflasker af PET, Arbefjdsrapport fra Miljostyrelsen Nr. 75 1995.

Transport Card: 57. Trp

--- To be continued ---

Inflows	Percent	Massflow [kg]	
90% of can (recyc.)		76.645	
Outflows			
90% of can (recyc.)		76.645	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (76.645 kg) is used to calculate emissions and energies

Notes

Transport of used tinsteel cans from customer back to retailer. In accordance with the terms of this project, the recycling rate is assumed to be 90%.

The choice of beverage packaging is assumed not to affect the transport mode, the transport distance or the number of transports from home to retailer. Under this assumption, preliminary calculations show that the choice of packaging has negligible effect on the environmental impact of this transport.

Transport Card: 58. Trp

Inflows	Percent	Massflow [kg]	
Return		104.604	
Outflows			
Return		104.604	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (104.604 kg) is used to calculate emissions and energies

Notes

This transport is included in the distribution.

Transport Card: 59. Trp

Inflows	Percent	Massflow [kg]	
90% of can (recyc.)		76.612	
Outflows			
90% of can (recyc.)		76.612	
Modes of conveyance	**[km]**		**Reference**
Truck, heavy (highway, 70%)	300.000		Estimated

The sum of output flow(s) (76.612 kg) is used to calculate emissions and energies

Transport Card: 60. Trp

Inflows	Percent	Massflow [kg]	
Scraps, can prod.		23.273	
Outflows			
Scraps, can prod.		23.273	
Modes of conveyance	**[km]**		**Reference**
Truck, heavy (highway, 70%)	300.000		Estimated

The sum of output flow(s) (23.273 kg) is used to calculate emissions and energies

Process Card: 61. BOF recycling

Inflows	Percent	Massflow [kg]	
Additional scraps	12.650 %	14.465	
90% of can (recyc.)		76.612	
Scraps, can prod.		23.273	
Outflows			
Recycled steel, BOF		98.913	
Emissions, waste and resources	**[g]**		**Reference**
Water (r)	37.639		(1) Resource
Particulates	1.25e-002		(1) Air
Alloys (in)	4.122		(1) Non-elementary inflow
Slag (out)	73.486		(1) Non-elementary outflow
Dust (out)	41.224		(1)
Mill scale (out)	9.410		(1)
Waste, slags	12.546		(1) Waste
Waste, sludge	16.131		(1)
Energy carrier	**[MJ]**	**E Factor**	**Reference**
Electricity, coal marginal	0.234	Ex	(6)
Natural gas (<100 kW)	0.156	FU/Ex	(5)(6)
Electricity, coal marginal	2.67e-002	Ex	(7)

The sum of input flow(s) (114.351 kg) is used to calculate emissions and energies
Mass change factor 0.865

--- To be continued ---

Notes

Steel can recycling over BOF.

Steel cans are likely to be recycled in a basic oxygen furnace (BOF) because the tin content of the cans can be dealt with easier in an BOF than in an electric arc furnace (EAF). Data for steel production in a BF+BOF steel plant were delivered by reference (1). The disaggregation of BF and BOF is based on a number of assumptions based on information from reference (1), (2), (3) and some anonymous references.

Material balance per can:
Inflows:
- Steel scraps from can production: 7.7 g.
- 90% of the can (recycling flow):25.3485 g (out of which 2.5227 g is aluminium and 1.4058 g is printing ink and coatings).
- Additional steel scrap (see material flows below): 4.7860 g.

Total inflows: 37.8345 g.

Outflows:
- Recycled steel: 32.71929 g.

Total outflows: 32.7193 g.

Mass change factor (out/in) = 32.7193/37.8345 = 0.865.

Material flows:
The aluminium lid of the can oxidizes to Al2O3, thereby releasing 27 MJ energy per kg Al, which is the enthalpy at BOF temperature 1700 degrees centigrade and which can be used to melt steel scrap. For cooling the 27 MJ released energy 14 kg steel scrap is added (4) meaning that approximately 2.0 MJ of energy is cooled per kg scrap. Since the energy for heating and melting the steel scrap is approximately 1.5 MJ/kg (8) the "efficiency" to melt the steel is 2/1.5 = 0.75 which seems likely. The remaining energy is cooled by temperature loss through convection and outflow of gases and particles. The aluminium content in one can is 2.803 g and the tin-steel content is 23.8 g. The steel scrap from can production is 7.7 g per can produced (see process 1. Tinplate cans, 33 cl.). The recycling rate is 90%. This means that for each can that is produced and used, the energy from the aluminium lid makes it possible to melt 0.9*2.8*27/2 = 33.9 g of steel scrap. This means the steel in the recycled can share, the scrap from tinplate production and 4.8 g more can be melted in the BOF when the energy in the aluminium from one can is utilized. The additional 4.8 g/can is assumed to be bought on the steel scrap market.

Energy data:
The energy released by oxidation of aluminium lids replace the energy from carbon in the pig iron and therefore the energy available for internal energy production (6). The data from reference (1) included a heat consumption, which has been recalculated to the amount of natural gas needed to produce this amount of heat. An efficiency of 80% for the heat production has been assumed. For this heat production, a furnace size <100 kW has been assumed. The production of natural gas (for heat production) and electricity is not included in the data from reference 1. Therefore the emission factors (extraction/Ex) from the database are used. The emissions associated with the combustion of natural gas are not included in the data from reference (1). Therefore the emission factors (final use/FU) from the database are used.

References and comments:
(1) Hatscher, N (1997) personal communication, Informations-Zentrum Weissblech for APEAL.
(2) Habersatter, K et al. (1996) Ökoinventeare für Verpackungen. Schriftenreihe Umwelt nr. 250, BUWAL, Bern.
(3) Neuhaus, H (1980) Vom Erz zum Klöckner Stahl. Klöckner Werke AG, Duisburg.
(4) Täffner K (1997), Personal communication, Rasselstein Hoesch and APEAL.
(5) A furnace size larger than 100 kW has been assumed.
(6) Material flows:
Each can contains 2.803 g aluminium. The energy from the aluminium is 27 MJ/kg. For cooling the 27 MJ released energy 14 kg steel scrap is added (4) meaning that approximately 2.0 MJ of energy is cooled per kg scrap. Thus, the energy in the aluminium is sufficient to melt 2.8*27/2 = 37.8 g steel scrap per collected can.
Energy demand:
The increased scrap input is assumed to replace pig iron on a one to one basis. The amount of carbon available in the BOF is proportional to the pig iron input: the carbon content is 4.3% in the pig iron (eutectically determined) and 0.2% in the steel. This means the aluminium input reduces the amount of available carbon by approximately 37.8*(0.043-0.002) = 1.55 g/collected can. In the BOF, the available carbon is oxidized to CO with an energy content of 23.64 kJ/gC. The CO gas is used in an internal power plant which delivers 0.268 MJ of electricity and 0.143 MJ of heat per MJ of CO. This means the aluminium input reduces the internal energy production by 1.55*23.64*0.268 = 9.81 kJ of electricity (or 26.755 MJ/1000 litres) and 1.55*23.64*0.143 = 5.24 kJ of heat per collected can. The reduction in internal energy production is assumed to be replaced by external electricity and by heat produced from natural gas with an efficiency of 80%. The amount of natural gas thus becomes 5.24/0.8 =6.55 kJ per collected can or 17.864 MJ/1000 litres.
(7) The aluminium input also affects the electricity demand for oxygen production. The oxygen demand for oxidation is 0.89 g O2 per g Al (to Al2O3) and 1.33 g O2 per g C (to CO). This means the aluminium input increases the oxygen demand by 2.80*0.89-1.55*1.33 = 0.43 g per can. The electricity demand is 2.62 kJ per g O2. This means the electricity demand is increased by 2.62*0.43 = 1.12 kJ/can or 3.055 MJ / 1000 litres.
(8) Calculated from values of thermodynamic properties of iron provided by CRC, Handbook of Chemistry and Physics, 55ed.

Process Card: 62. Steel scrap market

Inflows	**Percent**	**Massflow [kg]**	
Scraps from market		25.698	
Outflows			
External scraps		11.232	
Additional scraps		14.465	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (25.698 kg) is used to calculate emissions and energies

Notes

--- To be continued ---

Steel scrap market.
This is a homogenous market which is affected by the steel can system. Steel scrap is used for production of tinplate. In addition, the scrap demand of the BOF where the steel can is recycled increases due to utilization of the energy in the aluminium lids. We assume that there is a scrap shortage, i.e. that all available steel scrap will be used. The demand for scrap in tinplate production and BOF recycling means that the marginal steel recycling will be reduced by a corresponding amount. The marginal steel recycling can be assumed to be EAF recycling (see also main text).

Transport Card: 63. Trp

Inflows	**Percent**	**Massflow [kg]**	
Additional scraps		14.465	
Outflows			
Additional scraps		14.465	
Modes of conveyance	**[km]**		**Reference**
Truck, heavy (highway, 70%)	300.000		Estimated

The sum of output flow(s) (14.465 kg) is used to calculate emissions and energies

Transport Card: 64. Trp

Inflows	**Percent**	**Massflow [kg]**	
Recycled steel, BOF		98.913	
Outflows			
Recycled steel, BOF		98.913	
Modes of conveyance	**[km]**		**Reference**
Truck, heavy (highway, 70%)	300.000		Estimated

The sum of output flow(s) (98.913 kg) is used to calculate emissions and energies

Process Card: 65. New product

Inflows	**Percent**	**Massflow [kg]**	
Recycled steel, BOF		98.913	
Outflows			
Recycled steel, EAF		24.474	
Virgin steel		74.439	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (98.913 kg) is used to calculate emissions and energies

Notes
New product.

The effect of the 33 cl steel can system is that BOF recycling is increased and EAF recycling is reduced. The net effect is an increase of recycled steel. This recycled steel is assumed to replace the same amount of virgin steel in new products.

Process Card: 66. Avoided steel production (Database)

Inflows	**Percent**	**Massflow [kg]**	
Virgin steel		74.439	
Emissions, waste and resources	**[g]**		**Reference**
Water (r)	-7.05e+003		
CO2	-2.09e+003		
CO	-17.299		
NOx	-3.711		
CH4	-0.555		
Particulates	-0.680		
Benzene	-1.11e-004		
Cd	-5.16e-005		
Tl	-4.02e-005		
Ni	-6.88e-004		
Pb	-4.85e-003		
Cr	-3.88e-004		
Cu	-5.18e-004		
Mn	-1.96e-003		
V	-1.00e-003		
H2S	-1.06e-002		
HF	-5.45e-003		
HCl	-5.29e-002		
NH3	-4.54e-004		
Dioxin	-2.76e-010		
Waste, slags & ashes	-14.000		
Waste, sludge	-18.000		
Waste, industrial	-32.048		
BF-additives (in)	-35.356		

--- To be continued ---

Alloys (in)	-4.600
Benzene (out)	-3.901
H2SO4 (out)	-1.219
Tar (out)	-12.192
Slag (out)	-323.000
Dust (out)	-54.500
Mill scale (out)	-10.500
Limestone (r)	-308.266
Waste, bulky	-22.523
Waste, oil	-3.34e-003
SO2	-3.459
Coke oven gas [MJ] (out)	-0.996
BF-gas [MJ] (out)	-0.610
Steam [MJ] (out)	-0.207
Compressed air [m3] (out)	-6.30e-002
Oxygen [m3] (out)	-2.04e-003
Iron ore, 10% Fe (r)	-9.56e+003
Waste	-962.848
CaO (in)	-7.747
Coke (in)	-7.843
Explosives (in)	-6.85e-002
Waste, hazardous	-0.495
Crude oil (r)	-67.059
Natural gas (r)	-3.064
N2O	-7.28e-003
NMVOC	-9.22e-002
Propane	-5.97e-004
Butane	-7.22e-006
Pentane	-1.24e-005
PAH	-3.21e-007
Benzene	-1.79e-003
Toluene	-7.37e-005
Benzo(a)pyrene	-1.59e-008
Formaldehyde	-1.89e-004
Acetaldehyde	-1.03e-008
Hg	-1.69e-006
Aldehydes	-7.23e-007
Aromates (C9-C10)	-6.74e-005
HC	-2.97e-003
NMVOC, petrol engines	-1.83e-013
NMVOC, diesel engines	-9.01e-002
NMVOC, power plants	-5.17e-004
VOC, diesel engines	-6.78e-004
VOC, coal combustion	-2.88e-005
VOC, natural gas combustion	-1.91e-012
Organics	-1.44e-006
Radioactive emissions [kBq]	-3.59e+005
As	-3.93e-005
Se	-2.57e-005
Zn	-2.67e-004
Metals	-4.66e-007
COD (aq)	-1.74e-003
BOD (aq)	-2.33e-006
Dissolved organics (aq)	-1.28e-013
Dissolved solids (aq)	-1.94e-002
Suspended solids (aq)	-3.19e-004
NO3-N (aq)	-1.20e-007
NH4-N (aq)	-1.55e-005
Nitrogen (aq)	-7.07e-006
H+ (aq)	-1.40e-005
HC (aq)	-9.32e-006
Oil (aq)	-6.12e-002
Phenol (aq)	-3.20e-015
Aromates (C9-C10) (aq)	-3.20e-006
Radioactive emissions [kBq] (aq)	-3.37e+003
Al (aq)	-3.84e-004
Fe (aq)	-3.89e-005
Mn (aq)	-1.94e-005
Ni (aq)	-2.41e-005
Sr (aq)	-9.72e-005
Zn (aq)	-1.59e-005
Metals (aq)	-2.33e-006
F- (aq)	-6.94e-004
Cl- (aq)	-2.137

--- To be continued ---

SO42- (aq)	-8.39e-002		
Salt (aq)	-1.94e-003		
Waste, mineral	-1.01e-003		
Waste, slags & ashes (waste incin.)	-1.52e-007		
Waste, slags & ashes (energy prod.)	-5.69e-002		
Waste, rubber	-1.19e-005		
Waste, chemical	-7.84e-005		
Waste, radioactive	-3.25e-004		
Crude oil, feedstock (r)	-3.30e-006		
Hard coal (r)	-34.275		
Brown coal (r)	-1.695		
Softwood (r)	-1.02e-002		
Biomass (r)	-5.77e-002		
Fuel, unspecified [MJ] (r)	-1.09e-007		
Uranium (as pure U) (r)	-1.28e-004		
Hydro power-water (r)	-896.693		
NaCl (r)	-6.52e-005		
Clay (r)	-1.40e-005		
CaCO3 (r)	-6.53e-005		
Al (r)	-3.73e-005		
Fe (r)	-3.91e-005		
Mn (r)	-2.30e-007		
Ground water (r)	-8.81e-007		
Surface water (r)	-1.80e-008		
VOC	-9.79e-004		
Ethane	-8.65e-004		
Alkanes	-6.05e-004		
Ethene	-1.74e-003		
Acetylene	-2.90e-004		
Propene	-2.96e-004		
Alkenes	-3.05e-004		
Xylene	-5.69e-005		
Co	-7.11e-005		
Be	-3.99e-006		
Mo	-5.39e-005		
Sb	-2.73e-005		
CN-	-1.49e-005		
BOD-5 (aq)	-5.28e-005		
Tot-N (aq)	-8.15e-003		
Phosphate (aq)	-2.79e-005		
H2S (aq)	-9.17e-008		
Organics (aq)	-4.77e-002		
As (aq)	-7.41e-006		
Cd (aq)	-3.68e-006		
Co (aq)	-7.14e-007		
Cr (aq)	-8.80e-006		
Cu (aq)	-2.89e-006		
Pb (aq)	-2.72e-005		
V (aq)	-2.35e-006		
Sb (aq)	-1.00e-008		
Sn (aq)	-7.85e-004		
CN- (aq)	-2.80e-006		
Waste, highly radioactive	-2.23e-002		
Wood (r)	-1.14e-002		
Ca	-2.47e-005		
Fe	-5.57e-005		
Na	-2.32e-004		
TOC (aq)	-3.37e-005		
NMVOC, oil combustion	-0.436		
Cr3+	-2.51e-006		
PO43- (aq)	-1.51e-004		
Cr3+ (aq)	-4.51e-005		
Energy carrier	**[MJ]**	**E Factor**	**Reference**
Coal, feedstock	-20.876	None	
Electricity, coal marginal	-0.381	Ex	
Natural gas (>100 kW)	-1.03e-002	None	
Hard coal	-0.569	None	
Oil, light fuel	-0.135	None	
Oil, heavy fuel	-0.309	None	
Diesel, heavy & medium truck (urban)	-6.17e-002	None	
Diesel, heavy & medium truck (highway)	-0.255	None	
Fuel oil, ship (2-stroke)	-0.986	None	
Oil, heavy, feedstock	-0.591	None	

--- To be continued ---

The sum of input flow(s) (74.439 kg) is used to calculate emissions and energies

Notes
The avoided production of 1 kg virgin steel caused by the outflow of recycled steel from the packaging system. The data are imported from a database file (Vsteel.lca). The file includes data on avoided extraction of limestone and burning into lime (lime calcination), avoided extraction of iron ore and avoided steel production. Data on iron ore extraction are adapted from reference (1). Data on limestone extraction and lime calcination were supplied by reference (2). Data on steel production were supplide by reference (3).

The data above include emissions etc. from fuel production. These have been calculated by using emission factors from our energy database. The emission factors take into account emissions etc. for production of the electricity that is used for fuel production. However, the data above do not include emissions etc. for production of the electricity that is used at limestone mining, lime calcination and iron ore extraction. When the total emissions profile of the packaging system is calculated, these emissions etc. are included through the use of emission factors for extraction etc. as is denoted above (E Factor: Ex).

References:
(1) SHRIFTENREIHE UMWELT NR. 250/II: Ökoinventar f•r Verpackungen, Band II, Tab. 18.6.3, Budesamt f•r Umwelt, Wald und Landscaft (BUWAL), Bern,1996.
(2) Niels Frees, IPU LCC, Denmark.
(3) Hatscher, N (1997) personal communication, Informations-Zentrum Weissblech for APEAL.

Data were entered by Anna Ryberg, CIT.

Process Card: 67. Avoided EAF recycling

Inflows	**Percent**	**Massflow [kg]**	
Recycled steel, EAF		24.474	
Outflows			
Scraps from market		25.698	
Emissions, waste and resources	**[g]**		**Reference**
CO2	-50.900		(1) Air
CO	-0.620		(1)
NOx	-8.40e-002		(1)
Particulates	-1.34e-002		(1)
Waste, slags & ashes	-1.800		(1)
Alloys (in)	-4.400		(1) Non-elementary inflow
Oxygen [m3] (in)	-15.000		(1)
Slag (out)	-38.000		(1) Non-elementary outflow
Dust (out)	-14.500		(1)
Refractories (out)	-22.500		(1)
SO2	-0.182		(2) Air
VOC, coal combustion	-6.24e-004		(2)
CH4	-4.19e-003		(2)
NMVOC	-7.80e-003		(2)
N2O	-3.91e-004		(2)
Energy carrier	**[MJ]**	**E Factor**	**Reference**
Electricity, coal marginal	-1.126	Ex	(1)(4)
Natural gas (>100 kW)	-0.281	Ex	(1)(3)
Hard coal	-0.363	Ex	(1)

The sum of output flow(s) (25.698 kg) is used to calculate emissions and energies
Mass change factor 1.050

Notes
EAF recycling avoided through BOF recycling of cans.

The reason for the negative figures is that they refer to a reduction in the production. Recycling in electric arc furnaces (EAF) is reduced throug the use of steel scrap in tinplate production and through the recycling of 33 cl steel cans in basic oxygen furnaces (BOF). The reason is that the aluminium lid on the 33 cl can makes it possible to melt all steel scrap from the packaging system in the BOF plus some additional scrap from other sources. This means less steel scrap is available for EAF recycling.

Energy data:
The production of natural gas, hard coal and electricity is not included in the data from reference 1. Therefore the emission factors (extraction/Ex) from the database are used. The electricity demand is multiplied by a factor 0.91/0.97 to account for the fact that the grid loss is less than 9%. The average grid loss is estimated to be 3%.

Emissions.
The emissions of CO2, CO and NOx arise from the combustion of natural gas and hard coal.
As a complement to the air emissions in reference 1, emissions from the combustion of natural gas and hard coal have been calculated using emission factors from the database and inserted manually in the process card (2).

Data-gaps:
The production of alloys are not included in the data from reference 1. The alloys have therefore been accounted for as non-elementary inflows
The landfill disposal of waste from the process is not included in the LCA.

--- To be continued ---

References and comments
(1) Hatscher, N., Informations-Zentrum Weissblech for APEAL, Personal communication, 1997.
(2) Calculated from the emission factors (final use) for natural gas and hard coal (as a complement to the air emissions from reference 1).
(3) For the use of natural gas no information about the furnace size was provided. A furnace size larger than 100 kW has been assumed.
(4) The electricity demand is multiplied by a factor 0.91/0.97 to account for the fact that the grid loss is less than 9%. The average grid loss is estimated to be 3%.

Data were collected by Niels Frees, IPU LCC, Denmark and entered by Anna Ryberg, CIT Ekologik, Sweden.

Transport Card: 68. Trp

Inflows	**Percent**	**Massflow [kg]**	
Scraps from market		25.698	
Outflows			
Scraps from market		25.698	
Modes of conveyance	**[km]**		**Reference**
Truck, heavy (highway, 70%)	300.000		Estimated

The sum of output flow(s) (25.698 kg) is used to calculate emissions and energies

Transport Card: 69. Trp

Inflows	**Percent**	**Massflow [kg]**	
External scraps		11.232	
Outflows			
External scraps		11.232	
Modes of conveyance	**[km]**		**Reference**
Truck, heavy (highway, 70%)	300.000		Estimated

The sum of output flow(s) (11.232 kg) is used to calculate emissions and energies

Transport Card: 70. Trp

Inflows	**Percent**	**Massflow [kg]**	
CB recycling (tray)		1.508	
Outflows			
CB recycling (tray)		1.508	
Modes of conveyance	**[km]**		**Reference**
Truck, heavy (highway, 70%)	130.000		(1)

The sum of output flow(s) (1.508 kg) is used to calculate emissions and energies

Notes
Transport of 20% of the used corrugated trays to recycling.

Reference:
(1) Bryggeriforeningen via Jan Jacobsen, Logisys, 1997.

Transport Card: 71. Trp

Inflows	**Percent**	**Massflow [kg]**	
CB recyc. (box 24)		0.857	
Outflows			
CB recyc. (box 24)		0.857	
Modes of conveyance	**[km]**		**Reference**
Truck, heavy (highway, 70%)	130.000		(1)

The sum of output flow(s) (0.857 kg) is used to calculate emissions and energies

Notes
Transport of 20 % of the used corrugated board boxes to recycling.

Reference:
(1) Bryggeriforeningen via Jan Jacobsen, Logisys, 1997.

Transport Card: 72. Trp

Inflows	**Percent**	**Massflow [kg]**	
CB recyc. (box 6)		1.260	
Outflows			
CB recyc. (box 6)		1.260	
Modes of conveyance	**[km]**		**Reference**
Truck, heavy (highway, 70%)	130.000		(1)

The sum of output flow(s) (1.260 kg) is used to calculate emissions and energies

Notes

--- To be continued ---

Transport of 20% of the cardboard boxes to recycling.

Reference:
(1) Bryggeriforeningen via Jan Jacobsen, Logisys, 1997.

Process Card: 73. Testliner

Inflows	**Percent**	**Massflow [kg]**
CB recyc. (box 6)		1.260
CB recyc. (box 24)		0.857
CB recycling (tray)		1.508
Outflows		
Testliner		3.324

Emissions, waste and resources	**[g]**	**Reference**
CO2 (bio)	11.000	Air
CO2	464.000	
CO	4.00e-002	Not representative
SO2	0.120	
NOx	0.740	As NO2
COD (aq)	0.580	Water
BOD-5 (aq)	4.00e-002	
Suspended solids (aq)	4.00e-002	
Tot-N (aq)	2.99e-002	Not representative
NH3 (aq)	0.0	Not available
NO3- (aq)	1.82e-002	Not representative
AOX (aq)	0.0	Not available
Phosphate (aq)	3.10e-003	Not available
Cl- (aq)	0.476	Not representative
SO42- (aq)	0.657	Not representative
Cu (aq)	7.00e-005	Not representative
Zn (aq)	2.50e-004	Not representative
Waste, paper related	9.600	Waste
Waste, other rejects	28.700	
Waste, organic sludges	0.100	
Rejects incinerated + energy (out)	1.100	Non-elementary outflow
Recycled lubricants (out)	0.100	
Reused lubricants (out)	0.200	
NaOH (in)	0.500	Non-elementary inflow
HCl (in)	0.200	
Colorants (in)	1.390	(wet weight)
Starch (in)	26.300	
Sizing agents (in)	3.300	(wet weight)
Retention agents (in)	0.300	
Defoamer (in)	0.100	
Biocides (in)	1.00e-002	
Lubricants (in)	0.170	
Urea (in)	0.120	
Phosphoric acid (in)	0.140	

Energy carrier	**[MJ]**	**E Factor**	**Reference**
Electricity, coal marginal	0.210	Ex	
Oil, light fuel	6.00e-004	Ex	
Natural gas (>100 kW)	7.670	Ex	
Diesel, heavy & medium truck (urban)	2.00e-002	Ex	
LPG, forklift	3.00e-002	Ex	

The sum of output flow(s) (3.324 kg) is used to calculate emissions and energies
Mass change factor 0.917

Notes
Production of testliner (1) based on recycled fibres from the packaging system.

Material balance per kg testliner (2):
- Input: 1.09 kg of recovered paper (as wet weight).
- Output: 1 kg of testliner.
- Mass change factor (out/in) = ... = 0.9174.

Reference:
(1) European Database for Corrugated Board Life Cycle Studies, FEFCO, Groupement Ondulé, KRAFT Institute, 1996/1.
(2) Reference 1, page 14.

Process Card: 74. New product

Inflows	**Percent**	**Massflow [kg]**
Avoided kraftliner	40.000 %	2.660
Avoided testliner	10.000 %	0.665

--- To be continued ---

Testliner		3.324	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (6.649 kg) is used to calculate emissions and energies

Notes

The testliner produced from recycled fibres from the packaging system is assumed to replace in part (80%) kraftliner and in part (20%) testliner based on recycled fibres from other systems in Europe.

Process Card: 75. Avoided kraftliner (Database)

Outflows	**Percent**	**Massflow [kg]**
Avoided kraftliner		2.660

Emissions, waste and resources	**[g]**	**Reference**
Land use [m2*years] (r)	18.069	
Particulates	-1.846	
CO2 (bio)	-1.33e+003	
CO2	-329.751	
NOx	-2.579	
SO2	-1.053	
H2S	-0.110	
COD (aq)	-16.704	
BOD-5 (aq)	-5.900	
Suspended solids (aq)	-2.100	
Waste, ashes	-5.800	
Waste, inorganic sludges	-15.700	
Waste, other rejects	-10.800	
Waste, organic sludges	-2.600	
NaOH (in)	-7.800	
HCl (in)	-6.00e-002	
Starch (in)	-1.600	
Sizing agents (in)	-5.900	
Retention agents (in)	-2.000	
Defoamer (in)	-1.200	
Biocides (in)	-2.00e-002	
Lubricants (in)	-0.260	
Na2CO3 (in)	-1.700	
CaCO3 (in)	-3.100	
CaO (in)	-8.200	
Na2SO4 (in)	-4.900	
H2SO4 (in)	-13.200	
Sulphur (in)	-0.200	
Alum (in)	-3.700	
Other additives (in)	-0.300	
CO	2.71e-002	
NMVOC	-0.203	
CH4	-0.335	
Dioxin	-3.25e-010	
NH3	3.43e-005	
N2O	-6.51e-003	
HCl	-1.05e-003	
HF	-8.83e-004	
Radioactive emissions [kBq]	-2.92e+004	
As	-2.06e-006	
Cd	-4.39e-006	
Cr	-2.01e-006	
Hg	-4.68e-007	
Ni	-1.65e-004	
Pb	-1.43e-005	
CN-	-1.61e-005	
Tot-N (aq)	-1.16e-002	
Phosphate (aq)	-6.11e-005	
H2S (aq)	-2.01e-007	
Oil (aq)	-7.80e-002	
Organics (aq)	-6.15e-002	
Radioactive emissions [kBq] (aq)	-274.056	
Al (aq)	-7.98e-004	
As (aq)	-9.33e-006	
Cd (aq)	-4.70e-006	
Co (aq)	-2.17e-003	
Cr (aq)	-1.93e-005	
Cu (aq)	-6.34e-006	
Ni (aq)	-2.79e-005	

--- To be continued ---

Pb (aq)	-3.46e-005
Sb (aq)	-2.19e-008
Sn (aq)	-1.72e-003
V (aq)	-5.14e-006
Zn (aq)	-2.16e-005
F- (aq)	-7.02e-004
Cl- (aq)	-2.297
SO42- (aq)	-8.96e-002
CN- (aq)	-6.13e-006
Waste, industrial	-46.544
Waste, hazardous	-5.280
Waste, highly radioactive	-2.85e-002
Crude oil (r)	-84.859
Natural gas (r)	-17.863
Hard coal (r)	-1.872
Brown coal (r)	-1.714
Wood (r)	-2.50e-002
Uranium (as pure U) (r)	-1.32e-004
Hydro power-water (r)	-8.33e+008
NMVOC, diesel engines	2.47e-002
Zn	-2.18e-005
Se	-2.18e-007
Cu	-3.79e-005
NMVOC, oil combustion	-0.471
Benzene	-1.61e-003
Cr3+	-2.71e-006
PO43- (aq)	-1.63e-004
Cr3+ (aq)	-4.88e-005
Waste, radioactive	-2.86e-004
Biomass (r)	-6.24e-002
Peat (in)	-5.236
Bark (in)	-48.216

Energy carrier	[MJ]	E Factor	Reference
Electricity, coal marginal	-2.600	Ex	
Oil, heavy fuel	-2.040	None	
Oil, light fuel	-1.00e-002	None	
Natural gas (>100 kW)	-0.690	None	
Diesel, heavy & medium truck (urban)	0.724	None	
Peat	-0.110	None	
Bark	-0.820	None	
Heat	0.340	None	
Diesel, heavy & medium truck (highway)	-0.325	None	
Diesel, ship (4-stroke)	-1.377	None	

The sum of output flow(s) (2.660 kg) is used to calculate emissions and energies
Mass change factor 1.312

Notes

The avoided production of 1 kg of kraftliner caused by the outflow of recycled fibres from the packaging system. The data are imported from a database file (kraftlin.lca). The file includes data on avoided wood harvesting, wood transport and production of kraftliner. Data on wood transport and on kraftliner production are adapted from FEFCO (1). Data on wood harvesting are adapted from reference 2.

The data above include emissions etc. from fuel production. These have been calculated by using emission factors from our energy database. The emission factors take into account emissions etc. for production of the electricity that is used for fuel production. However, the data above do not include emissions etc. for production of the electricity that is used in production of kraftliner. When the total emissions profile of the packaging system is calculated, these emissions etc. are included through the use of emission factors for extraction etc. as is denoted above (E Factor: Ex).

References:

(1) European Database for Corrugated Board Life Cycle Studies, FEFCO, Groupement Ondulé, KRAFT Institute, 1996/1.
(2) Örjan Hedenberg, Birgit Backlund Jacobson, Tiina Pajula, Lisa Person, Helena Wessman; Use of agro fibre for paper production from an environmental point of view, NordPap DP2/54, Scan Forskrapport 682, Nordic Industrial Fund, Oslo, 1997.

The data were entered by Lisa Person, CIT. The notes were revised by Tomas Ekvall, CIT, 98-01-06.

Process Card: 76. Other products

Outflows	Percent	Massflow [kg]
Fibres to landfill	50.000 %	0.725
Fibres to recycling		0.725

Energy carrier	[MJ]	E Factor	Reference

The sum of output flow(s) (1.450 kg) is used to calculate emissions and energies

Notes

--- To be continued ---

When production of testliner based on recycled fibres from other systems (in Europe) is reduced, these fibres end up at waste management. The marginal waste management is assumed to be landfilling (see Main report).

Process Card: 77. Avoided testliner

Inflows	**Percent**	**Massflow [kg]**	
Fibres to recycling		0.725	
Outflows			
Avoided testliner		0.665	

Emissions, waste and resources	**[g]**	**Reference**
CO2 (bio)	-11.000	Air
CO2	-464.000	
CO	-4.00e-002	Not representative
SO2	-0.120	
NOx	-0.740	As NO2
COD (aq)	-0.580	Water
BOD-5 (aq)	-4.00e-002	
Suspended solids (aq)	-4.00e-002	
Tot-N (aq)	-2.99e-002	Not representative
NH3 (aq)	0.0	Not available
NO3- (aq)	-1.82e-002	Not representative
AOX (aq)	0.0	Not available
Phosphate (aq)	-3.10e-003	Not available
Cl-	-0.476	Not representative
SO42- (aq)	-0.657	Not representative
Cu (aq)	-7.00e-005	Not representative
Zn (aq)	-2.50e-004	Not representative
Waste, paper related	-9.600	Waste
Waste, other rejects	-28.700	
Waste, organic sludges	-0.100	
Rejects incinerated + energy (out)	-1.100	Non-elementary outflow
Recycled lubricants (out)	-0.100	
Reused lubricants (out)	-0.200	
NaOH (in)	-0.500	Non-elementary inflow
HCl (in)	-0.200	
Colorants (in)	-1.390	(wet weight)
Starch (in)	-26.300	
Sizing agents (in)	-3.300	(wet weight)
Retention agents (in)	-0.300	
Defoamer (in)	-0.100	
Biocides (in)	-1.00e-002	
Lubricants (in)	-0.170	
Urea (in)	-0.120	
Phosphoric acid (in)	-0.140	

Energy carrier	**[MJ]**	**E Factor**	**Reference**
Electricity, coal marginal	-0.210	Ex	
Oil, light fuel	-6.00e-004	Ex	
Natural gas (>100 kW)	-7.670	Ex	
Diesel, heavy & medium truck (urban)	-2.00e-002	Ex	
LPG, forklift	-3.00e-002	Ex	

The sum of output flow(s) (0.665 kg) is used to calculate emissions and energies
Mass change factor 0.917

Notes

This is the production of testliner (1) for other systems which is reduced through the use of recycled fibres in the packaging system. The reason for the negative figures is that they refer to a reduction in the production.

Material balance per kg testliner (2):
- Input: 1.09 kg of recovered paper (as wet weight).
- Output: 1 kg of testliner.
- Mass change factor (out/in) = ... = 0.9174.

Reference:
(1) European Database for Corrugated Board Life Cycle Studies, FEFCO, Groupement Ondulé, KRAFT Institute, 1996/1.
(2) Reference 1, page 14.

Process Card: 78. Landfill-corrugated board

Inflows	**Percent**	**Massflow [kg]**
Fibres to landfill		0.725

Emissions, waste and resources	**[g]**	**Reference**
CH4	83.000	Air, See notes
CO2 (bio)	428.000	Air, See notes

--- To be continued ---

Elementary waste, corrugated board	447.000		Waste. See notes
Biogas (out)	42.000		Co-product, See notes

Energy carrier	**[MJ]**	**E Factor**	**Reference**
Electricity, coal marginal	7.00e-004	Ex	(3)
Diesel, heavy & medium truck (urban)	3.50e-002	FU/Ex	(3)

The sum of input flow(s) (0.725 kg) is used to calculate emissions and energies

Notes
Landfilling of corrugated board.

Emissions:
According to reference 1 the methane produced from degradation paper is dependent of the composition of the paper according to (unit; g/kg paper): CH4 = 186 x Xc, Xc; the cellulose (and hemicellulose) content.
If the cellulose content is unkown Xc can be calculated from: Xc = 1 - (Xl + Xa + Xm)
- Xl; the lignin content
- Xa; the content of ashes
- Xm: the moisture (water content)
The carbondioxide produced is:
CO2 = 514 x Xc

The methane produced is not equal to the methane emitted since 15 % of the methane is oxidized into carbondioxide. The correct formulas will therefore be:
CH4 = (1-0.15) x 186 x Xc = 158 x Xc
CO2 = (514 x Xc) + (0.15 x 186 x Xc) = 542 x Xc

Calculation of emissions:
According to reference 2 the corrugated board content is:
Xl = 12 % (10-15 %)
Xa = 2 % (1.5-2 %)
Xm = 7 % (6-8 %)
According to the formula above Xc = ...= 79 %
CH4 = 158 x 0.79 = 125 g/kg corrugated board.
CO2 = 542 x 0.79 = 428 g/kg corrugated board.

Part of the methane (we assume 1/3) is collected as biogas and used for energy production, which means that the emissions of methane is 83 g/kg corrugated board. The biogas is a non-elementary outflow from the system, i.e. it is not followed to the grave. This has little effect on the total LCA results since the amount of biogas is small.

Remaining waste:
The remaining waste is calculated from 1000 - CH4 - CO2 = ... = 447 g/kg corrugated board.

References:
(1) Sundqvist J-O et al, Life Cycle Assessment and Solid Waste, AFR, Stockholm, 1994, page 78.
(2) ASSI Kraftliner, Research Corp., Christer Söremark, personal communication.
(3) Tillman et al., Packaging and the Environment, Chalmers Industriteknik, Gothenburg, Sweden, 1992.

Transport Card: 79. Trp

Inflows	**Percent**	**Massflow [kg]**	
Waste		24.358	
Outflows			
Waste		24.358	
Modes of conveyance	**[km]**		**Reference**
Truck, medium (rural, 40%)	20.000		(1)

The sum of output flow(s) (24.358 kg) is used to calculate emissions and energies

Notes
Transport to waste management.

Reference:
(1) Bryggeriforeningen via Jan Jacobsen, Logisys, 1997.

Process Card: 80. Waste management

Inflows	**Percent**	**Massflow [kg]**	
Waste		24.358	
Outflows			
Tinplate waste	31.565 %	7.666	
PE-waste	5.210 %	1.265	
Aluminium waste	3.489 %	0.847	
CB waste		14.507	
Emissions, waste and resources	**[g]**		**Reference**
Glue (out)	2.589		See notes
Energy carrier	**[MJ]**	**E Factor**	**Reference**

--- To be continued ---

The sum of output flow(s) (24.285 kg) is used to calculate emissions and energies
Mass change factor 0.997

Notes
Waste management.

This process is only used in order to distribute the different waste flows.

The marginal waste management in Denmark is assumed to be waste incineration with energy recovery (see Main report).

The waste flow of glue has not been followed to the grave. Instead, this flow has been accounted for as a non-elementary outflow from the system. The amount of glue is 0.0208 g/can or 2.5887 g/kg outflow.

Material balance per can:

Inflow:
- 10% of can to waste incineration, 80% of cardboard box to waste incineration, foil for cardboard (to waste incineration), 80% of corrugated board box to waste incineration, 80% of tray to waste incineration, 30% of plastic ligature to waste incineration, hi-cone (to waste incineration) and glue (to waste incineration): 8.0557 g.

Outflows:
- 80% of cardboard box, 80% of tray, 80% of corrugated board box: 4.7998 g.
- 10% of the aluminium lid: 0.2803 g.
- 10% of the rest of the can: 2.5362 g.
- 30% of plastic ligature, foil for cardboard, hi-cone: 0.4186 g.
Total outflows: 8.0349 g.

Mass change factor (out/in) = 0.997.

Process Card: 81. Cardboard/corrugated board inciner.

Inflows	**Percent**	**Massflow [kg]**	
CB waste		14.507	
Outflows			
Energy (CB)		172.196	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of input flow(s) (14.507 kg) is used to calculate emissions and energies
Mass change factor 11.870

Notes
Incineration of cardboard and corrugated board (CB) used in secondary packaging.

For further details, se process 29.

Process Card: 82. Aluminium incineration

Inflows	**Percent**	**Massflow [kg]**	
Aluminium waste		0.847	
Outflows			
Energy (Aluminium)		21.098	
Emissions, waste and resources	**[g]**		**Reference**
Ca(OH)2 (in)	17.600		(1)(2) Non-elementary inflow
Water (r)	243.000		(1)(2)
NOx	1.200		(1)
Dioxin	1.00e-008		(1)
Water to WWTP	243.000		(1) Water
Waste, slags & ashes	1.89e+003		(1) Waste
Al2O3	0.200		
Energy carrier	**[MJ]**	**E Factor**	**Reference**
Electricity, coal marginal	0.180	Ex	(1)

The sum of input flow(s) (0.847 kg) is used to calculate emissions and energies
Mass change factor 24.900

Notes
Incineration of aluminium used in lids.
Data used for aluminium were found in the EDIP unit process database (1), except data for the amount of heat and electricity produced in the process. These were calculated based on energy production in Danish waste incineration plants in 1992 (3). The incineration plants' own energy consumption was subtracted from the production, to yield the energy exported from the plant. The (lower) heat value of aluminium was 30.9 MJ/kg, calculated from the heat produced in the formation of Al2O3. (During incineration of aluminium, the aluminium oxidises to Al2O3, hereby releasing energy (4)). For further details, see Technical report 7.

Energy production:

--- To be continued ---

The heat produced in waste incineration is 23.7 MJ/kg waste and the electricity produced is 1.20 MJ/kg waste (3).

The outflow energy from this process is not a mass-flow, despite what is indicated above. Instead it is an energy flow, measured in MJ.

"Mass change factor":
The mass change factor in the LCAiT software is generally defined as the total outflow [kg]/total inflow [kg]. Since the outflow from this process is energy, the "mass change factor" is in this case the energy outflow[MJ]/the waste inflow [kg] = 24.9 MJ produced energy/kg waste.

References and comments:
(1) Frees N and Pedersen M A (1996): EDIP unit database.
(2) Used for fluegas cleaning.
(3) SK energi (1994): Opgørelse af affaldsressourcer i Danmark. Elsam/Elkraft. Styregruppe 4 for biomasse.
(4) Tillman A-M, Bauman H, Eriksson E, Rydberg T (1991: Packaging and the Environment. Life-cycle analyses of selected packaging materials. Quantification of environmental loadings. Chalmers Industriteknik (CIT). Göteborg, Sweden.

Process Card: 83. PE incineration

Inflows	**Percent**	**Massflow [kg]**	
PE-waste		1.265	
Outflows			
Energy (PE)		43.335	
Emissions, waste and resources	**[g]**		**Reference**
Ca(OH)2 (in)	17.600		(1)(2) Non-elementary inflow
Water (r)	243.000		(1)(2)
CO2	3.07e+003		(1) Air
CO	10.000		(1)
NOx	1.200		(1)
Dioxin	1.00e-008		(1)
H2O	1.26e+003		(1)
Water to WWTP	243.000		(1) Water
Waste, slags & ashes	20.000		(1) Waste
Energy carrier	**[MJ]**	**E Factor**	**Reference**
Electricity, coal marginal	0.180	Ex	(1)

The sum of input flow(s) (1.265 kg) is used to calculate emissions and energies
Mass change factor 34.250

Notes
Incineration of PE used in ligature, foil and hi-cones.
PE includes both HDPE and LDPE since the processes for these plastics during incineration are the same. Data used for PE were found in the EDIP unit process database (1), except data for the amount of heat and electricity produced in the process. These were calculated based on energy production in Danish waste incineration plants in 1992 (3). The incineration plants' own energy consumption was subtracted from the production, to yield the energy exported from the plant. The (lower) heat value used for PE was 43.3 MJ/kg (3). For further details, see Technica report 7.

Energy production:
The heat produced in waste incineration is 32.6 MJ/kg waste and the electricity produced is 1.65 MJ/kg waste (3).

The outflow of energy from this process is not a mass flow, despite what is indicated above. Instead it is an energy flow, measured in MJ.

"Mass change factor":
The mass change factor in the LCAiT software is generally defined as the total outflow [kg]/total inflow [kg]. Since the outflow from this process is energy, the "mass change factor" is in this case the energy outflow[MJ]/the waste inflow [kg] = 34.25 MJ produced energy/kg waste.

References and comments:
(1) Frees N and Pedersen M A (1996): EDIP unit database.
(2) Used for flue gas cleaning.
(3) SK energi (1994): Opgørelse af affaldsressourcer i Danmark. Elsam/Elkraft. Styregruppe 4 for biomasse.

Process Card: 84. Tinplate incineration

Inflows	**Percent**	**Massflow [kg]**	
Waste (tinplate)		7.666	
Outflows			
Remaining scraps	39.826 %	4.781	
Energy (tinplate)		7.223	
Emissions, waste and resources	**[g]**		**Reference**
Ca(OH)2 (in)	17.600		(1)(2) Non-elementary inflow
Water (r)	243.000		(1)(2)
NOx	1.200		(1)
Dioxin	1.00e-008		(1)
Water to WWTP	243.000		(1) Water
Fe	0.100		(1)
Tin	1.050		(3)

--- To be continued ---

Tin, recycling (out)	1.050		(3) Non-elementary outflow
Waste, ashes (Fe3O4)	276.371		(3)(7) Waste
Waste, slags	160.000		(3)

Energy carrier	**[MJ]**	**E Factor**	**Reference**
Electricity, coal marginal	0.180	Ex	(1)

The sum of input flow(s) (7.666 kg) is used to calculate emissions and energies
Mass change factor 1.566

Notes
Incineration of tinplate used in cans.
Tin from the thin layer tinplate diffuses into the steel during the incineration process (3). Tin therefore follows the steel fraction in the incineration plant and ends up in the slag as FeSn2 and FeSn (4).

Data used for steel were found in the EDIP unit process database (1), except data for the amount of heat and electricity produced in the process. These were calculated based on energy production in Danish waste incineration plants in 1992 (5). The incineration plants' own energy consumption was subtracted from the production, to yield the energy exported from the plant. The (lower) heat value used for iron was 6.6 MJ/kg, calculated from the heat produced by formation of Fe3O4. (During incineration of tin-plate cans, 20 % of the iron oxidises, hereby releasing energy (6)). For further details, see Technical report 7.

Energy production:
The heat produced in waste incineration is 0.88 MJ/kg waste and the electricity produced is 0.046 MJ/kg waste (3).

The outflow energy from this process is not a mass-flow, despite what is indicated above. Instead it is an energy flow, measured in MJ.

"Mass change factor":
The mass change factor in the LCAiT software is generally defined as the total outflow [kg]/total inflow [kg]. In this process, the inflow and one of the two outflows are in [kg] and the other outflow is in [MJ]. Out of 1 kg tin-steel waste, 0.926 MJ energy is formed (see above) and 0.64 kg (3) remaining tin-steel waste is collected and recycled. Thus, the "mass change factor" for this process is (0.64 + 0.926)/1 = 1.566.

References and comments:
(1) Frees N and Pedersen M A (1996): EDIP unit database.
(2) Used for flue-gas cleaning.
(3) Frees N (1997): Personal communication
(4) Ravnborg E and Johansen A (1989): Diffusionsglødning af stålbaserade sliddetaljer. Del 1: Metallurgisk del. Idustriell Metallurgi. Teknologisk Institut.
(5) SK energi (1994): Opgørelse af affaldsressourcer i Danmark. Elsam/Elkraft. Styregruppe 4 for biomasse.
(6) Apeal (1997): personal communication between Marianne Suhr Wesnaes, IPU and Apeal.
(7) Calculated as the amount of Fe3O4 formed at the incineration (20% of the iron oxidises to Fe3O4).

Transport Card: 85. Trp

Inflows	**Percent**	**Massflow [kg]**
Remaining scraps		4.781
Outflows		
Remaining scraps		4.781

Modes of conveyance	**[km]**	**Reference**
Truck, heavy (highway, 70%)	300.000	Assumed

The sum of output flow(s) (4.781 kg) is used to calculate emissions and energies

---

Process Card: 86. EAF recycling

Inflows	**Percent**	**Massflow [kg]**
Remaining scraps		4.781
Outflows		
Recycled steel slab		4.781

Emissions, waste and resources	**[g]**	**Reference**
CO2	50.900	(1) Air
CO	0.620	(1)
NOx	8.40e-002	(1)
Particulates	1.34e-002	(1)
Waste, slags & ashes	1.800	(1)
Alloys (in)	4.400	(1) Non-elementary inflow
Oxygen [m3] (in)	15.000	(1)
Slag (out)	38.000	(1) Non-elementary outflow
Dust (out)	14.500	(1)
Refractories (out)	22.500	(1)
SO2	0.182	(2) Air
VOC, coal combustion	6.24e-004	(2)
CH4	4.19e-003	(2)
NMVOC	7.80e-003	(2)
N2O	3.91e-004	(2)

Energy carrier	**[MJ]**	**E Factor**	**Reference**
Electricity, coal marginal	1.200	Ex	(1)

--- To be continued ---

Natural gas (>100 kW)	0.281	Ex	(1)(3)
Hard coal	0.363	Ex	(1)

The sum of output flow(s) (4.781 kg) is used to calculate emissions and energies

Notes
Steel recycling over EAF (Electric Arc Furnace).

Energy data:
The production of natural gas, hard coal and electricity is not included in the data from reference 1. Therefore the emission factors (extraction/Ex) from the database are used.

Emissions.
The emissions of CO2, CO and NOx arise from the combustion of natural gas and hard coal.
As a complement to the air emissions in reference 1, emissions from the combustion of natural gas and hard coal have been calculated using emission factors from the database and inserted manually in the process card (2).

Data-gaps:
The production of alloys are not included in the data from reference 1. The alloys have therefore been accounted for as non-elementary inflows.
The landfill disposal of waste from the process is not included in the LCA.

References and comments
(1) Hatscher, N., Informations-Zentrum Weissblech for APEAL, Personal communication, 1997.
(2) Calculated from the emission factors (final use) for natural gas and hard coal (as a complement to the air emissions from reference 1).
(3) For the use of natural gas no information about the furnace size was provided. A furnace size larger than 100 kW has been assumed.

Data were collected by Niels Frees, IPU LCC, Denmark and entered by Anna Ryberg, CIT Ekologik, Sweden.

Process Card: 87. New product

Inflows	**Percent**	**Massflow [kg]**	
Avoided virgin stee	50.000 %	4.781	
Recycled steel slab		4.781	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (9.562 kg) is used to calculate emissions and energies

---

Process Card: 88. Avoided steel production (Database)

Outflows	**Percent**	**Massflow [kg]**	
Avoided virgin stee		4.781	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (4.781 kg) is used to calculate emissions and energies

Notes
Identical to process 66.

Process Card: 89. Energy use

Inflows	**Percent**	**Massflow [kg]**	
Energy (CB)		172.196	
Energy (Aluminium)		21.098	
Energy (PE)		43.335	
Energy (tinplate)		7.223	
Alternative energy	50.000 %	243.852	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (487.703 kg) is used to calculate emissions and energies

Notes
Identical to process 51.

Process Card: 90. Alt. energy production

Outflows	**Percent**	**Massflow [kg]**	
Alternative energy		243.852	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (243.852 kg) is used to calculate emissions and energies

Notes
Identical to process 52.

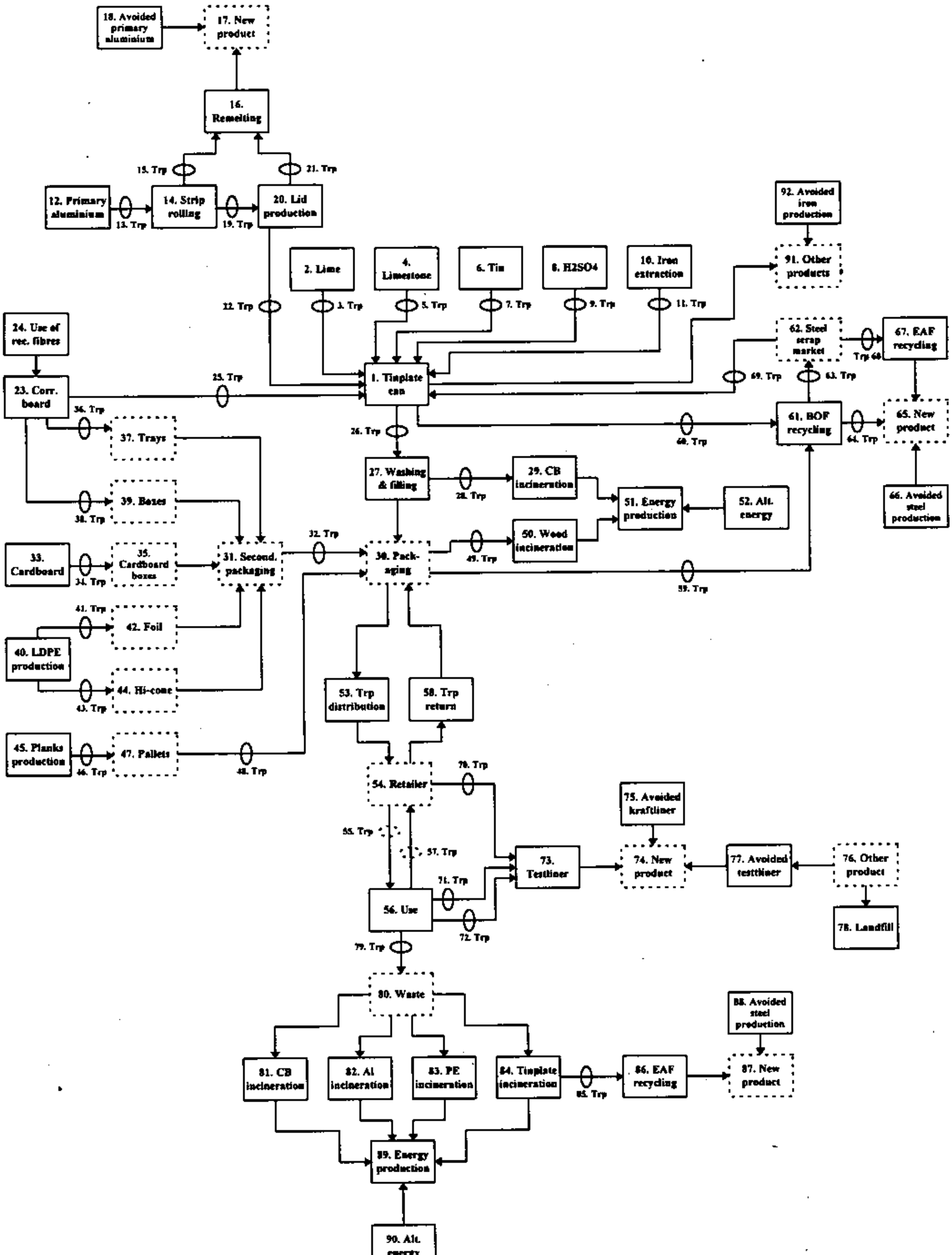

Figure B.1
Process tree for the 50 cl steel can system.

50 cl steel can

File: 50CL-SC.LCA **Printed:** Fri 98-05-29 09:18
For general comments, see Annex A.

Process Card: 91. Other products

Inflows	**Percent**	**Massflow [kg]**
Virgin iron	37.500 %	1.397
Mill scale (recyc.)		2.329

Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (3.726 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 92. Avoided iron production (Database)

Outflows	**Percent**	**Massflow [kg]**
Virgin iron		1.397

Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (1.397 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 1. Steel cans, 50cl

Inflows	**Percent**	**Massflow [kg]**
Lime	4.233 %	6.638
Limestone	5.876 %	9.214
Tin	0.115 %	0.180
H2SO4	0.638 %	1.000
Iron ore + pellets		123.536
External scraps	6.438 %	10.096
Layer pads, CB	0.345 %	0.541
Aluminium lid	3.577 %	5.609

Outflows	**Percent**	**Massflow [kg]**
Mill scale (recyc.)	2.357 %	2.329
Scraps, can prod.	15.608 %	15.420
Can + layer pads		81.045

Emissions, waste and resources	**[g]**	**Reference**
Alloys (in)	4.330	
Water (r)	2.13e+005	
Oil (in)	1.819	
NaOH (in)	1.126	
H2 (in)	6.23e-002	
Benzene (out)	3.031	
H2SO4 (out)	0.953	
Tar (out)	9.267	
Slag (out)	309.192	
Dust (out)	52.052	
Iron oxide (out)	1.386	
Tin hydroxide sludge (out)	0.346	
Tin ash (out)	8.66e-002	
Iron(II)sulphate (out)	14.204	
Oil (out)	0.433	
CO2	1.99e+003	
CO	13.642	
NOx	2.928	
NMVOC	0.113	
CH4	8.274	
Particulates	0.586	
Benzene	8.92e-005	
Cd	3.65e-005	
Tl	3.29e-005	
Ni	3.72e-004	
Pb	3.73e-003	
Cr	1.19e-004	
Cu	2.36e-004	
Mn	1.41e-003	
V	9.44e-004	
H2S	8.43e-003	
HF	4.58e-003	
HCl	2.78e-002	

--- To be continued ---

50 cl steel can

File: 50CL-SC.LCA Printed: Fri 98-05-29 09:18

NH3	3.57e-004
Dioxin	1.48e-010
COD (aq)	0.459
Cr (aq)	2.51e-004
Sn (aq)	7.55e-003
Fe (aq)	3.66e-002
AOX (aq)	4.24e-004
TOC (aq)	1.13e-003
BOD (aq)	0.148
B (aq)	5.46e-002
NH4-N (aq)	7.07e-004
Hg (aq)	1.30e-005
Ni (aq)	3.28e-004
Cu (aq)	2.51e-004
Pb (aq)	4.70e-005
Chloride (aq)	2.079
SO2	2.443
N2O	2.62e-003
Tot-C	4.55e-002
Oil (aq)	4.75e-002
Suspended solids (aq)	2.09e-002
Waste, emulsions	1.697
Waste, solvent	0.816
Waste, ink	6.13e-002
Waste, sludge	0.266
Waste, combustible	1.347
Waste, wood	4.877
Waste	1.594
Printing ink (in)	0.968
Bottom coat (in)	0.360
Cupper-lubricant (in)	9.51e-002
Wim-lubricant (in)	0.607
Washing chemicals (in)	3.79e-002
Mobility enhance (in)	0.437
Polyester for strips (in)	0.171
BF-additives (in)	27.715
Waste, industrial	411.256
Waste, hazardous	66.068
Crude oil (r)	54.415
Natural gas (r)	161.878
Tot-P (aq)	1.30e-002
Tot-F (aq)	2.68e-002
Hydrogen	1.52e-004
HC	0.365
Metals	1.03e-004
NH4+ (aq)	5.26e-004
Cl- (aq)	10.624
Metals (aq)	1.15e-002
HC (aq)	5.11e-003
Iron ore (r)	4.70e-003
Limestone (r)	2.97e-003
Bauxite (r)	1.88e-002
NaCl (r)	0.174
Clay (r)	8.28e-004
Ferromanganese (r)	2.13e-005
Coal (r)	0.559
Crude oil, feedstock (r)	18.335
Natural gas, feedstock (r)	15.508
Coal, feedstock (r)	7.87e-003
Phenol (aq)	6.95e-006
Other organics	6.95e-006
Other nitrogen (aq)	2.90e-004
Nitrates (aq)	2.13e-005
Sulphur (aq)	3.49e-005
Waste, mineral	0.185
Waste, toxic chemicals	1.44e-005
Radioactive emissions [kBq]	83.935
As	6.08e-006
Hg	2.05e-006
CN-	9.77e-006
BOD-5 (aq)	1.09e-006
Tot-N (aq)	3.73e-003
Phosphate (aq)	5.74e-007
H2S (aq)	1.88e-009

--- To be continued ---

Organics (aq)	2.55e-002
Radioactive emissions [kBq] (aq)	1.178
Al (aq)	5.66e-004
As (aq)	4.11e-006
Cd (aq)	1.99e-006
Co (aq)	1.47e-008
Sb (aq)	2.06e-010
V (aq)	4.83e-008
Zn (aq)	1.74e-004
F- (aq)	2.08e-003
SO42- (aq)	0.433
CN- (aq)	5.75e-008
Waste, highly radioactive	8.12e-004
Hard coal (r)	942.828
Brown coal (r)	9.406
Wood (r)	2.35e-004
Uranium (as pure U) (r)	6.46e-004
Hydro power-water (r)	523.837
Se	4.49e-006
Zn	1.67e-005
NMVOC, diesel engines	3.71e-002
NMVOC, oil combustion	0.286
Benzene	1.64e-003
Cr3+	1.65e-006
PO43- (aq)	9.90e-005
Cr3+ (aq)	2.96e-005
Waste, radioactive	1.92e-003
Biomass (r)	3.78e-002
Propane	3.45e-004
Alkanes	2.16e-004
Alkenes	1.08e-005
PAH	1.69e-005
Toluene	3.45e-004
Benzo(a)pyrene	5.06e-008
Aromates (C9-C10)	3.49e-004
Formaldehyde	3.29e-004
Aldehydes	2.08e-005
Ca	2.88e-005
Co	1.19e-005
Fe	6.49e-005
Mo	5.77e-006
Na	2.70e-004
Butane	1.17e-003
Pentane	2.00e-003
Acetaldehyde	1.67e-006
VOC, natural gas combustion	5.50e-011
VOC, coal combustion	8.30e-004
VOC, diesel engines	1.95e-002
NMVOC, power plants	1.49e-002
NMVOC, petrol engines	5.25e-012
Organics	4.14e-005
Dissolved organics (aq)	3.68e-012
Dissolved solids (aq)	0.568
NO3-N (aq)	3.45e-006
Nitrogen (aq)	2.03e-004
H+ (aq)	4.01e-004
Aromates (C9-C10) (aq)	9.20e-005
Mn (aq)	5.58e-004
Sr (aq)	2.80e-003
Salt (aq)	5.58e-002
Waste, slags & ashes (waste incin.)	4.37e-006
Waste, slags & ashes (energy prod.)	1.637
Waste, bulky	302.810
Waste, rubber	3.42e-004
Waste, chemical	2.26e-003
Softwood (r)	0.293
Fuel, unspecified [MJ] (r)	3.13e-006
CaCO3 (r)	1.88e-003
Al (r)	1.07e-003
Fe (r)	1.12e-003
Mn (r)	6.63e-006
Ground water (r)	2.54e-005
Surface water (r)	5.17e-007
Acid as H+ (aq)	1.31e-003

--- To be continued ---

Dissolved organics (aq)	8.51e-004		
Waste, ashes	6.00e-002		
Waste, non toxic chemicals	0.178		

Energy carrier	**[MJ]**	**E Factor**	**Reference**
Oil, feedstock	0.711	None	
Hard coal, feedstock	16.368	None	
Natural gas (>100 kW)	7.455	None	
Electricity, coal marginal	3.471	Ex	
Oil	0.114	None	
Natural gas	0.230	None	
Coal	1.52e-002	None	
Natural gas, feedstock	0.692	None	
Coal, feedstock	2.13e-004	None	
Electricity	1.20e-002	None	
Nuclear power [MJel]	2.06e-003	None	
Hydro power [MJel]	1.90e-003	None	
Diesel, heavy & medium truck (highway)	9.28e-003	None	
Oil, heavy, feedstock	0.876	None	
Oil, heavy fuel	0.360	None	

The sum of output flow(s) (98.794 kg) is used to calculate emissions and energies
Mass change factor 0.630

Notes
Production of tinplate cans.
The data are imported from a database file (Aggreg50.lca). The file includes data on tinplate production, can production and the transport of tinplate between these two production sites. It also includes data on production of base coat and inside coating.

Material balance per can:
Inflows:
- Iron ore + pellets: 61.731 g (1).
- External scraps: 5.0445 g (1).
- Aluminium lid: 2.803 g (1).
- Lime: 3.3174 g.
- Limestone: 4.604175 g (1).
- Tin: 0.089775 g (1).
- H2SO4: 0.500175 g (1).
- Layer pads: 0.27g (2).

Total inflows: 78.360025 g.

Outflows:
- Tinplate can + layer pads: 40.2015 g.
- Scraps, can production: 7.7g (2).
- Mill scale for recycling into other products: 1.1628 g (1).

Total outflows: 49.3343 g.

Mass change factor (out/in) = 0.630.

Data-gaps:
The production of chemicals, additives etc. are not included in the data from the suppliers. These materials have therefore been accounted for as non-elementary inflows to the system. The landfill disposal of waste is not included in the LCA. Hence, the waste flows are non-elementary outflows. Both at tinplate production and at can production, natural gas is used. No information about the furnace size was provided. A furnace size larger than 100 kW has been assumed.

The data above include emissions etc. from fuel production. These have been calculated by using emission factors from our energy database. Th emission factors take into account emissions etc. for production of the electricity that is used for fuel production. However, the data above do no include emissions etc. for production of the electricity that is used in production of tinplate and production of tinplate cans. When the total emissions profile of the packaging system is calculated, these emissions etc. are included through the use of emission factors for extraction etc. as is denoted above (E Factor: Ex).

References and comments:
(1) Hatscher, N (1997) personal communication, Informations-Zentrum Weissblech for APEAL.
(2) Dr. Gert-Walter Minét, Schmalbach Lubeca, Ratingen, Germany.

Process Card: 2. Lime

Outflows	**Percent**	**Massflow [kg]**	
Lime		6.638	

Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (6.638 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

--- To be continued ---

Transport Card: 3. Trp

Inflows	Percent	Massflow [kg]	
Lime		6.638	
Outflows			
Lime		6.638	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (6.638 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 4. Limestone

Outflows	Percent	Massflow [kg]	
Limestone		9.214	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (9.214 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Transport Card: 5. Trp

Inflows	Percent	Massflow [kg]	
Limestone		9.214	
Outflows			
Limestone		9.214	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (9.214 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 6. Tin

Outflows	Percent	Massflow [kg]	
Tin		0.180	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (0.180 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Transport Card: 7. Trp

Inflows	Percent	Massflow [kg]	
Tin		0.180	
Outflows			
Tin		0.180	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (0.180 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 8. H2SO4

Outflows	Percent	Massflow [kg]	
H2SO4		1.000	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (1.000 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Transport Card: 9. Trp

Inflows	Percent	Massflow [kg]
H2SO4		1.000

Outflows

--- To be continued ---

H2SO4		1.000	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (1.000 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 10. Iron ore extraction

Outflows	**Percent**	**Massflow [kg]**	
Iron ore + pellets		123.536	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (123.536 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Transport Card: 11. Trp

Inflows	**Percent**	**Massflow [kg]**	
Iron ore + pellets		123.536	
Outflows			
Iron ore + pellets		123.536	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (123.536 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 12. Primary aluminium (database)

Outflows	**Percent**	**Massflow [kg]**	
Primary aluminium		6.969	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (6.969 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Transport Card: 13. Trp

Inflows	**Percent**	**Massflow [kg]**	
Primary aluminium		6.969	
Outflows			
Primary aluminium		6.969	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (6.969 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 14. Strip rolling

Inflows	**Percent**	**Massflow [kg]**	
Primary aluminium		6.969	
Outflows			
Al. rolling ingots		6.900	
Scraps, strip roll.	0.990 %	6.90e-002	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (6.969 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Transport Card: 15. Trp

Inflows	**Percent**	**Massflow [kg]**	
Scraps, strip roll.		6.90e-002	
Outflows			
Scraps, strip roll.		6.90e-002	
Modes of conveyance	**[km]**		**Reference**

--- To be continued ---

The sum of output flow(s) (6.90e-002 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 16. Remelting

Inflows	Percent	Massflow [kg]	
Scraps, strip roll.		6.90e-002	
Scraps, lid prod.		1.291	
Outflows			
Remelted aluminium		1.360	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (1.360 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 17. New product

Inflows	Percent	Massflow [kg]	
Remelted aluminium		1.360	
Avoided virgin Al.	50.000 %	1.360	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (2.719 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 18. Avoided primary aluminium (database)

Outflows	Percent	Massflow [kg]	
Avoided virgin Al.		1.360	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (1.360 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Transport Card: 19. Trp

Inflows	Percent	Massflow [kg]	
Al. rolling ingots		6.900	
Outflows			
Al. rolling ingots		6.900	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (6.900 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 20. Lid production

Inflows	Percent	Massflow [kg]	
Al. rolling ingots		6.900	
Outflows			
Aluminium lid		5.609	
Scraps, lid prod.	18.706 %	1.291	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (6.900 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Transport Card: 21. Trp

Inflows	Percent	Massflow [kg]	
Scraps, lid prod.		1.291	
Outflows			
Scraps, lid prod.		1.291	
Modes of conveyance	**[km]**		**Reference**

--- To be continued ---

The sum of output flow(s) (1.291 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Transport Card: 22. Trp

Inflows	Percent	Massflow [kg]
Aluminium lid		5.609

Outflows		
Aluminium lid		5.609

Modes of conveyance	[km]	Reference

The sum of output flow(s) (5.609 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 23. Corrugated board (Database)

Inflows	Percent	Massflow [kg]
Recycled fibres		9.095

Outflows		
Corrugated board		0.541
Corrugated board		3.547
Corrugated board		5.007

Energy carrier	[MJ]	E Factor	Reference

The sum of output flow(s) (9.095 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 24. Use of recycled fibres (Database)

Outflows	Percent	Massflow [kg]
Recycled fibres		9.095

Energy carrier	[MJ]	E Factor	Reference

The sum of output flow(s) (9.095 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Transport Card: 25. Trp

Inflows	Percent	Massflow [kg]
Corrugated board		0.541

Outflows		
Corrugated board		0.541

Modes of conveyance	[km]	Reference

The sum of output flow(s) (0.541 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Transport Card: 26. Trp

Inflows	Percent	Massflow [kg]
Can + layer pads		81.045

Outflows		
Can + layer pads		81.045

Modes of conveyance	[km]	Reference

The sum of output flow(s) (81.045 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 27. Washing & filling

Inflows	Percent	Massflow [kg]
Can + layer pads		81.045

Outflows		
80% of layer pads	4.00e-002 %	0.433

--- To be continued ---

Can + beverage		1.08e+003	
Emissions, waste and resources	**[g]**		**Reference**
Water (r)	41.542		(1) Resource
Corrugated board (from layer pads) (out)	9.99e-002		(2) Non-elementary outflow
Energy carrier	**[MJ]**	**E Factor**	**Reference**
Electricity, coal marginal	7.03e-003	Ex	(1)
Natural gas (>100 kW)	4.90e-002	FU/Ex	(1)

The sum of output flow(s) (1.08e+003 kg) is used to calculate emissions and energies
Mass change factor 13.353

Notes

Washing and filling of 50 cl tinplate cans for beer and soft drinks in the brewery (1).

20% of the corrugated board layer pads is assumed to be recycled into other materials (5). We do not expand system boundaries to deal with this recycling, since the outflow is less than 1% of the primary packaging. Instead, the outflow of corrugated board to recycling is a non-elementary outflow from the system. This has little effect on the total LCA results. The system has other, larger outflows of board to recycling, and there the system is expanded.

The amount of heat (provided by the data supplier) has been recalculated into primary fuel assuming an efficiency of 80 % (2). The fuel used is natural gas according to the supplier, but no information about the furnace size was provided. A furnace size larger than 100 kW has been assumed.

Material balance per can:
Inflows:
- Tinplate can + layer pads: 40.4715 g (3).

Outflows:
- Tinplate can + beverage: 540.2015 g (4).
- 80% of the layer pads (to waste incineration): 0.216 g. (5)

Total outflows: 540.4175 g.

Mass change factor (out/in) = 13.353.

Data gaps:
Pasteurisation of beer and soft drink is associated with the beverage. Thus energy use associated with the pasteurisation procedure is not included. Cleaning agents are used in quite small amounts and have not been accounted for. Aquatic emissions of e.g. COD, BOD, N and P are subject to efficient cleaning procedures in municipal waste water treatment plants and emissions to the environment are assumed to be negligible. Energy use at the waste water treatment plant is estimated to be only a few percent of the total energy use for tapping. The fate of organic cleaning agents in municipal waste water treatment plants as well as their eventual impact in the environment have not been quantified due to lack of data, and potential environmental impacts are unknown.

References and comments:
(1) The brewery (confidential).
(2) O'Callaghan, P. (1993): Energy management. A comprehensive guide to reducing costs by efficient energy use. McGraw-Hill Book Company. London. United Kingdom.
(3) Dr. Gert-Walter Minét, Schmalbach Lubeca, Ratingen, Germany.
(4) The amount of beverage is 50 cl, which corresponds to 500 g.
(5) Bryggeriforeningen via Jan Jacobsen, Logisys, 1997.

Transport Card:	28. Trp		
Inflows	**Percent**	**Massflow [kg]**	
80% of layer pads		0.433	
Outflows			
80% of layer pads		0.433	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (0.433 kg) is used to calculate emissions and energies

Notes

Identical to the 33 cl steel can system, see Annex A.

Process Card:	29. Corrugated board incineration		
Inflows	**Percent**	**Massflow [kg]**	
80% of layer pads		0.433	
Outflows			
Energy [MJ]		0.433	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (0.433 kg) is used to calculate emissions and energies

Notes

Identical to the 33 cl steel can system, see Annex A.

--- To be continued ---

Process Card: 30. Packaging

Inflows	Percent	Massflow [kg]	
Can + beverage		1.08e+003	
Return		96.292	
5% of pallet	0.100 %	1.194	
Secondary packaging	1.206 %	14.395	
Outflows			
90% of can (recyc.)	6.070 %	72.454	
5% of pallet	0.100 %	1.194	
Beverage distrib.		1.12e+003	
Emissions, waste and resources	**[g]**		**Reference**
Plastic ligature (in)	1.36e-002		Non-elementary inflow
Glue (in)	3.49e-002		
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (1.19e+003 kg) is used to calculate emissions and energies

Notes

Packaging of the beverage cans in the brewery.

The environmental impact of the actual packaging process is not included in the LCA. It is likely to be negligible.

Material balance per can:
Inflows:
- Tinplate can + beverage: 540.2015 g.
- Secondary packaging: 7.1875 g.
- 5% of pallet (The pallet is reused in 95% of the cases, why it only needs to be replaced in 5% of the cases. Each life cycle should therefore hold 5% of the environmental loadings caused by the pallet): 0.5952 g.
- Return: 90% of the (used) cans for recycling, pallet (distribution flow): 48.08615 g.

Total inflows: 596.07035 g

Outflows:
- Beverage distribution: Can + beverage, secondary packaging, pallet (distribution flow), plastic ligature and glue: 559.3227 g.
- 5% of the pallet to waste incineration: 0.5952 g.
- 90 of the can for recycling: 36.18135 g.

Total outflows: 596.09925 g.

Mass change factor (out/in):= 1.000.

When packing the corrugated board boxes on the pallet, LDPE ligature or glue is used for holding the boxes together. On 75% of the pallets, 20 g of ligature is used (1). This means the amount of ligature is: 20/1848*0.75=0.0081 g/can or 0.01359 g/kg outflow.

Glue is used on 25% of the pallets. Our data indicate that the amount of glue is 2 g (1), but we assume that this amount is used for each box. This means the amount of glue is 0.25*2/24=0.0208 g/can or 0,03489 g/ kg outflow.

The glue and ligature are non-elementary inflows, i.e. they are not followed from the cradle.

Reference: Bryggeriforeningen via Jan Jacobsen, Logisys, 1997.

Process Card: 31. Secondary packaging

Inflows	Percent	Massflow [kg]	
Tray, CB		5.007	
CB box (24 cans)	24.637 %	3.547	
Foil, LDPE	3.826 %	0.551	
Hi-cone, LDPE	1.971 %	0.284	
CB box (6 cans)	34.783 %	5.007	
Outflows			
Secondary packaging		14.395	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (14.395 kg) is used to calculate emissions and energies

Notes

Secondary packaging:
- Tray, corrugated board (24 cans): 120/24*0.5 = 2.5 g/can.
- Cardboard box (6 cans): 60/6*0.25 = 2.5 g/can.
- Foil for cardboard, LDPE (24 cans): 20/24*0.33 = 0.275 g/can.
- Corrugated board box (24 cans): 250/24*0.17 = 1.7708 g/can.
- Hi-cone, LDPE (6 cans): 3.4/6*0.25 = 0.1417 g/can.

Total, secondary packaging: 7.1875 g/can.

--- To be continued ---

Reference: Bryggeriforeningen via Jan Jacobsen, Logisys, 1997.

Transport Card: 32. Trp

Inflows	**Percent**	**Massflow [kg]**	
Secondary packaging		14.395	
Outflows			
Secondary packaging		14.395	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (14.395 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 33. Cardboard (Database)

Outflows	**Percent**	**Massflow [kg]**	
Cardboard		5.007	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (5.007 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Transport Card: 34. Trp

Inflows	**Percent**	**Massflow [kg]**	
Cardboard		5.007	
Outflows			
Cardboard		5.007	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (5.007 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 35. Cardboard box (6 cans)

Inflows	**Percent**	**Massflow [kg]**	
Cardboard		5.007	
Outflows			
CB box (6 cans)		5.007	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (5.007 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Transport Card: 36. Trp

Inflows	**Percent**	**Massflow [kg]**	
Corrugated board		5.007	
Outflows			
Corrugated board		5.007	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (5.007 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 37. Tray

Inflows	**Percent**	**Massflow [kg]**	
Corrugated board		5.007	
Outflows			
Tray, CB		5.007	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (5.007 kg) is used to calculate emissions and energies

Notes

--- To be continued ---

50 cl steel can

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Identical to the 33 cl steel can system, see Annex A.

Transport Card: 38. Trp

Inflows	Percent	Massflow [kg]	
Corrugated board		3.547	
Outflows			
Corrugated board		3.547	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (3.547 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 39. Corrugated board box (24 cans)

Inflows	Percent	Massflow [kg]	
Corrugated board		3.547	
Outflows			
CB box (24 cans)		3.547	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (3.547 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 40. LDPE

Outflows	Percent	Massflow [kg]	
LDPE		0.284	
LDPE		0.551	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (0.835 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Transport Card: 41. Trp

Inflows	Percent	Massflow [kg]	
LDPE		0.551	
Outflows			
LDPE		0.551	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (0.551 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 42. Foil

Inflows	Percent	Massflow [kg]	
LDPE		0.551	
Outflows			
Foil, LDPE		0.551	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (0.551 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Transport Card: 43. Trp

Inflows	Percent	Massflow [kg]	
LDPE		0.284	
Outflows			
LDPE		0.284	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (0.284 kg) is used to calculate emissions and energies

Notes

--- To be continued ---

Identical to the 33 cl steel can system, see Annex A.

Process Card: 44. Hi-cone

Inflows	Percent	Massflow [kg]	
LDPE		0.284	
Outflows			
Hi-cone, LDPE		0.284	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (0.284 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 45. Planks for pallets (Database)

Outflows	Percent	Massflow [kg]	
Planks		1.194	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (1.194 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Transport Card: 46. Trp

Inflows	Percent	Massflow [kg]	
Planks		1.194	
Outflows			
Planks		1.194	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (1.194 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 47. Pallet

Inflows	Percent	Massflow [kg]	
Planks		1.194	
Outflows			
5% of pallet		1.194	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (1.194 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Transport Card: 48. Trp

Inflows	Percent	Massflow [kg]	
5% of pallet		1.194	
Outflows			
5% of pallet		1.194	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (1.194 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Transport Card: 49. Trp

Inflows	Percent	Massflow [kg]	
5% of pallet		1.194	
Outflows			
5% of pallet		1.194	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (1.194 kg) is used to calculate emissions and energies

Notes

--- To be continued ---

Identical to the 33 cl steel can system, see Annex A.

Process Card: 50. Wood incineration

Inflows	Percent	Massflow [kg]	
5% of pallet		1.194	
Outflows			
Energy, wood		1.194	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (1.194 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 51. Energy use

Inflows	Percent	Massflow [kg]	
Alternative energy	50.000 %	1.627	
Energy, wood		1.194	
Energy, CB		0.433	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (3.253 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 52. Alt. energy production

Outflows	Percent	Massflow [kg]	
Alternative energy		1.627	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (1.627 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Transport Card: 53. Distribution

Inflows	Percent	Massflow [kg]	
Beverage distrib.		1.12e+003	
Outflows			
Beverage distrib.		1.12e+003	
Modes of conveyance	**[km]**		**Reference**

Calculated for a reference flow of 1.12e+003 [kg] which corresponds to distr. of 1000 l
The sum of output flow(s) (1.12e+003 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 54. Retailer

Inflows	Percent	Massflow [kg]	
Beverage distrib.		1.12e+003	
90% of can (recyc.)		72.472	
Outflows			
Return	8.075 %	96.292	
CB recycling (tray)	8.40e-002 %	1.002	
Bever. to consumer		1.10e+003	
Emissions, waste and resources	**[g]**		**Reference**
Plastic ligature (out)	9.57e-003		(1)
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (1.19e+003 kg) is used to calculate emissions and energies

Notes
Retailer

The choice of packaging is assumed to have negligible effect on the environmental impacts of the retailer.

70% of the plastic ligature (0.0057 g/can) is assumed to be recycled to be used in other products (1). We do not expand system boundaries to deal with this recycling, since the outflow is less than 1% of the primary packaging. Instead, the outflow of plastic ligature to recycling is a

--- To be continued ---

non-elementary outflow from the system

Material balance per can:
Inflows:
- Beverage distribution: Can + beverage, secondary packaging, pallet (distribution flow), plastic ligature and glue: 559.3227 g.
- 90% of the can for recycling: 36.18135 g.
Total inflows: 595.50405 g.

Outflows:
- To consumer: Can + beverage, cardboard box, foil for cardboard, corrugated board box, hi-cone, 80% of tray to waste incineration, 30% of plastic ligature to waste incineration: 546.9122 g.
- Return: 90% of the can for recycling, pallet (distribution flow): 48.08615 g.
- CB recycling: 20% of tray for recycling: 0.5 g.
Total outflows: 595.49835 g.

Mass change factor = 1.000.

Reference:
(1) Bryggeriforeningen via Jan Jacobsen, Logisys, 1997.

Transport Card: 55. Trp

Inflows	**Percent**	**Massflow [kg]**
Bever. to consumer		1.10e+003

Outflows		
Bever. to consumer		1.10e+003

Modes of conveyance	**[km]**	**Reference**

The sum of output flow(s) (1.10e+003 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 56. Use (refrigeration)

Inflows	**Percent**	**Massflow [kg]**
Bever. to consumer		1.10e+003

Outflows		
90% of can (recyc.)		72.472
CB recyc. (box 24)	0.755 %	0.709
CB recyc. (box 6)	1.066 %	1.002
Waste	21.053 %	19.783

Energy carrier	**[MJ]**	**E Factor**	**Reference**
Electricity, coal marginal	1.83e-002	Ex	See notes

The sum of output flow(s) (93.966 kg) is used to calculate emissions and energies
Mass change factor 8.58e-002

Notes
Use (refrigeration).

The can is cooled from 20 to 5 degrees celcius. The heat capacitivity of steel is 0.00046 MJ/(kg*°) (1), and the heat capacitivity of aluminium is 0.0009 MJ/(kg*°) (1). This means, that the heat capacitivity for the can (which contains of 35.05 g steel and 2.803 g aluminium) becomes 0.0005 MJ/(kg*°), which gives an energy demand of 0.0005*15=0.0075 MJ/kg steel & aluminium. An efficiency of 33% for the refrigerator has been used (2), which gives a total energy demand of 0.0227 MJ/kg steel & aluminium. The amount of steel and aluminium in the outflow is 37.853 g/can (35.05+2.803). The total outflow is (see below) 46.9122 g/can, which gives 37.853/46.9122 = 0.8069 kg steel and aluminium / kg outflow. This means that the energy demand becomes 0.8069*0.0227 = 0.0183 MJ/kg outflow.

Material balance per can:

Inflows:
- To consumer: Can + beverage, cardboard box, foil for cardboard, corrugated board box, hi-cone, 80% of tray to waste incineration, 30% of plastic ligature for waste incineration, glue: 546.9122 g/can.

Outflows:
- Waste: 10% of can to waste incineration, 80% of cardboard box to waste incineration, foil for cardboard (to waste incineration), 80% of corrugated board box to waste incineration, 80% of tray to waste incineration, 30% of plastic ligature to waste incineration, hi-cone (to waste incineration) and glue (to waste incineration): 9.87665 g.
- 90% of can for recycling: 36.18135 g.
- CB recycling: 20% of corrugated board box for recycling: 0.3542 g.
- Cardboard recycling: 20% of cardboard box for recycling. 0.5 g.
Total outflows: 46.9122 g.

Mass change factor (out/in) = 0.0858.

--- To be continued ---

References:
(1) Nordling Carl, Österman Jonny, Physics handbook.
(2) Pommer, K., Wesnæs, M.S. and Madsen, C. (1995): Miljømæssig kortlægning af emballager til øl og læskedrikke. Delrapport 6: Engangsflasker af PET. Arbeidsrapport fra Miljøstyrelsen., nr. 75.

Transport Card: 57. Trp

Inflows	**Percent**	**Massflow [kg]**	
90% of can (recyc.)		72.472	
Outflows			
90% of can (recyc.)		72.472	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (72.472 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Transport Card: 58. Trp

Inflows	**Percent**	**Massflow [kg]**	
Return		96.292	
Outflows			
Return		96.292	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (96.292 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Transport Card: 59. Trp

Inflows	**Percent**	**Massflow [kg]**	
90% of can (recyc.)		72.454	
Outflows			
90% of can (recyc.)		72.454	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (72.454 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Transport Card: 60. Trp

Inflows	**Percent**	**Massflow [kg]**	
Scraps, can prod.		15.420	
Outflows			
Scraps, can prod.		15.420	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (15.420 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 61. BOF recycling

Inflows	**Percent**	**Massflow [kg]**	
90% of can (recyc.)		72.454	
Scraps, can prod.		15.420	
Outflows			
Displaced scraps	14.028 %	10.687	
Recycled steel, BOF		65.499	
Emissions, waste and resources	**[g]**		**Reference**
Water (r)	32.452		(1) Resource
Particulates	1.08e-002		(1) Air
Alloys (in)	3.554		(1) Non-elementary inflow
Slag (out)	63.359		(1) Non-elementary inflow
Dust (out)	35.543		(1)
Mill scale (out)	8.113		(1)
Waste, slags	10.817		(1) Waste
Waste, sludge	13.908		(1)
Energy carrier	**[MJ]**	**E Factor**	**Reference**

--- To be continued ---

Electricity, coal marginal	0.201	Ex	(6)
Natural gas (<100 kW)	0.149	FU/Ex	(5)(6)
Electricity, coal marginal	2.55e-002	FU/Ex	(7)

The sum of input flow(s) (87.874 kg) is used to calculate emissions and energies
Mass change factor 0.867

Notes
Steel can recycling over BOF.

Steel cans are likely to be recycled in a basic oxygen furnace (BOF) because the tin content of the cans can be dealt with easier in an BOF than in an electric arc furnace (EAF). Data for steel production in a BF+BOF steel plant were delivered by reference (1). The disaggregation of BF and BOF is based on a number of assumptions based on information from reference (1), (2), (3) and some anonymous references.

Material balance per can:
Inflows:
- Steel scraps from can production: 7.7 g.
- 90% of the can (recycling flow):36.18135 g (out of which 2.5227 g is aluminium and 1.4058 g is printing ink and coatings).

Total inflows: 43.88135 g.

Outflows:
- Displaced steel scrap (see material flows below): 5.339 g.
- Recycled steel: 32.71929 g.

Total outflows: 38.05829 g.

Mass change factor (out/in) = 38.05829/43.88135 = 0.867.

Material flows:
The aluminium lid of the can oxidizes to Al2O3, thereby releasing 27 MJ energy per kg Al, which is the enthalpy at BOF temperature 1700 degrees centigrade and which can be used to melt steel scrap. For cooling the 27 MJ released energy 14 kg steel scrap is added (4) meaning that approximately 2.0 MJ of energy is cooled per kg scrap. Since the energy for heating and melting the steel scrap is approximately 1.5 MJ/kg (8) the "efficiency" to melt the steel is 2/1.5 = 0.75 which seems likely. The remaining energy is cooled by temperature loss through convection and outflow of gases and particles. The aluminium content in one can is 2.803 g and the tin-steel content is 35.05 g. The steel scrap from tinplate production is 7.7 g per can produced. The recycling rate is 90%. This means that for each can that is produced and used, the energy from the aluminium lid makes it possible to melt 0.9*2.8*27/2 = 33.9 g of steel scrap. The aluminium energy is not quite sufficient to melt all the steel in recycled cans and the scrap from tinplate production. Since the amount of steel scrap is limited by the energy available, the steel cans displace steel scrap from other sources. The net effect of the 50 cl steel can system is that steel scrap from other sources is displaced to an amount of 5.3 g/can used.

Energy data:
The energy released by oxidation of aluminium lids replace the energy from carbon in the pig iron and therefore the energy available for internal energy production (6). The data from reference (1) included a heat consumption, which has been recalculated to the amount of natural gas needed to produce this amount of heat. An efficiency of 80% for the heat production has been assumed. For this heat production, a furnace size <100 kW has been assumed. The production of natural gas (for heat production) and electricity is not included in the data from reference 1. Therefore the emission factors (extraction/Ex) from the database are used. The emissions associated with the combustion of natural gas are not included in the data from reference (1). Therefore the emission factors (final use/FU) from the database are used.

References and comments:
(1) Hatscher, N (1997) personal communication, Informations-Zentrum Weissblech for APEAL.
(2) Habersatter, K et al. (1996) Ökoinventeare für Verpackungen. Schriftenreihe Umwelt nr. 250, BUWAL, Bern.
(3) Neuhaus, H (1980) Vom Erz zum Klöckner Stahl. Klöckner Werke AG, Duisburg.
(4) Täffner K (1997), Personal communication, Rasselstein Hoesch and APEAL.
(5) A furnace size larger than 100 kW has been assumed.
(6) Material flows:
Each can contains 2.803 g aluminium. The energy from the aluminium is 27 MJ/kg. The energy required to melt tin-steel is 2.0/kg scrap. Thus, the energy in the aluminium is sufficient to melt 2.80*27/2.0 = 37.8 g tin-steel scrap per can.
Energy demand:
The increased scrap input is assumed to replace pig iron on a one to one basis. The amount of carbon available in the BOF is proportional to the pig iron input: the carbon content is 4.3% in the pig iron (eutectically determined) and 0.2% in the steel. This means the aluminium input reduces the amount of available carbon by approximately 37.8*(0.043-0.002) = 1.55 g/collected can. In the BOF, the available carbon is oxidized to CO with an energy content of 23.64 kJ/g C. The CO gas is used in an internal power plant which delivers 0.268 MJ of electricity and 0.143 MJ of heat per MJ of CO. This means the aluminium input reduces the internal energy production by 1.55*23.64*0.268 = 9.81 kJ of electricity (or 17.658 MJ/1000 litres) and 1.55*23.64*0.143 = 5.24 kJ of heat per collected can. The reduction in internal energy production is assumed to be replaced by external electricity and by heat produced from natural gas with an efficiency of 80%. The amount of natural gas thus becomes 5.24/0.8 =6.55 kJ per collected can or 13.10 MJ/1000 litres.
(7) The aluminium input also affects the electricity demand for oxygen production. The oxygen demand for oxidation is 0.89 g O2 per g Al (to Al2O3) and 1.33 g O2 per g C (to CO). This means the aluminium input increases the oxygen demand by 2.80*0.89-1.55*1.33 = 0.43 g per collected can. The electricity demand is 2.62 kJ per g O2. This means the electricity demand is increased by 2.62*0.43 = 1.12 kJ/collected can or 2.24 MJ / 1000 litres.
(8) Calculated from values of thermodynamic properties of iron provided by CRC, Handbook of Chemistry and Physics, 55ed.

Process Card: 62. Steel scrap market

Inflows	**Percent**	**Massflow [kg]**
Displaced scraps		10.687
Outflows		
External scraps		10.096

--- To be continued ---

Scraps from market 0.592

Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (10.687 kg) is used to calculate emissions and energies

Notes
Steel scrap market.

This is a homogenous market which is affected by the steel can system. We assume that there is a scrap shortage, i.e. that all available steel scrap will be used. The recycling of steel cans in BOF means less scrap from other sources can be recycled there. This is almost offset by the fact steel scrap is used for production of tinplate. However, the net effect of the 50 cl steel can system is that the amount of steel scrap available for the marginal steel recycling process: EAF recycling (see main text).

Transport Card: 63. Trp

Inflows	**Percent**	**Massflow [kg]**
Displaced scraps		10.687

Outflows		
Displaced scraps		10.687

Modes of conveyance	**[km]**	**Reference**

The sum of output flow(s) (10.687 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Transport Card: 64. Trp

Inflows	**Percent**	**Massflow [kg]**
Recycled steel, BOF		65.499

Outflows		
Recycled steel, BOF		65.499

Modes of conveyance	**[km]**	**Reference**

The sum of output flow(s) (65.499 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 65. New product

Inflows	**Percent**	**Massflow [kg]**
Recycled steel, EAF		0.563
Virgin steel	50.000 %	66.063
Recycled steel, BOF		65.499

Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (132.125 kg) is used to calculate emissions and energies

Notes
New product.

The effect of the 50 cl steel can system is that BOF and EAF recycling are increased. The recycled steel is assumed to replace the same amount of virgin steel in new products.

Process Card: 66. Avoided steel production (Database)

Outflows	**Percent**	**Massflow [kg]**
Virgin steel		66.063

Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (66.063 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 67. EAF recycling

Inflows	**Percent**	**Massflow [kg]**
Scraps from market		0.592

Outflows		
Recycled steel, EAF		0.563

Emissions, waste and resources	**[g]**	**Reference**
CO2	50.900	(1) Air
CO	0.620	(1)
NOx	8.40e-002	(1)

--- To be continued ---

Particulates	1.34e-002		(1)
Waste, slags & ashes	1.800		(1)
Alloys (in)	4.400		(1) Non-elementary inflow
Oxygen [m3] (in)	15.000		(1)
Slag (out)	38.000		(1) Non-elementary outflow
Dust (out)	14.500		(1)
Refractories (out)	22.500		(1)
SO2	0.182		(2) Air
VOC, coal combustion	6.24e-004		(2)
CH4	4.19e-003		(2)
NMVOC	7.80e-003		(2)
N2O	3.91e-004		(2)
Energy carrier	**[MJ]**	**E Factor**	**Reference**
Electricity, coal marginal	1.126	Ex	(1)(4)
Natural gas (>100 kW)	0.281	Ex	(1)(3)
Hard coal	0.363	Ex	(1)

The sum of input flow(s) (0.592 kg) is used to calculate emissions and energies
Mass change factor 0.952

Notes
EAF recycling caused by BOF recycling of cans.

Recycling in electric arc furnaces (EAF) is slightly increased through the recycling of 50 cl steel cans in basic oxygen furnaces (BOF). The reason is that the steel cans replace steel scrap from other sources in the BOF, and the scrap that is not recycled in BOF is assumed to be recycled in EAF.

Energy data:
The production of natural gas, hard coal and electricity is not included in the data from reference 1. Therefore the emission factors (extraction/Ex) from the database are used. The electricity demand is multiplied by a factor 0.91/0.97 to account for the fact that the grid loss is less than 9%. The average grid loss is estimated to be 3%.

Emissions.
The emissions of CO2, CO and NOx arise from the combustion of natural gas and hard coal.
As a complement to the air emissions in reference 1, emissions from the combustion of natural gas and hard coal have been calculated using emission factors from the database and inserted manually in the process card (2).

Data-gaps:
The production of alloys are not included in the data from reference 1. The alloys have therefore been accounted for as non-elementary inflows.
The landfill disposal of waste from the process is not included in the LCA.

References and comments
(1) Hatscher, N., Informations-Zentrum Weissblech for APEAL, Personal communication, 1997.
(2) Calculated from the emission factors (final use) for natural gas and hard coal (as a complement to the air emissions from reference 1).
(3) For the use of natural gas no information about the furnace size was provided. A furnace size larger than 100 kW has been assumed.
(4) The electricity demand is multiplied by a factor 0.91/0.97 to account for the fact that the grid loss is less than 9%. The average grid loss is estimated to be 3%.

Data were collected by Niels Frees, IPU LCC, Denmark and entered by Anna Ryberg, CIT Ekologik, Sweden.

Transport Card: 68. Trp

Inflows	**Percent**	**Massflow [kg]**	
Scraps from market		0.592	
Outflows			
Scraps from market		0.592	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (0.592 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Transport Card: 69. Trp

Inflows	**Percent**	**Massflow [kg]**	
External scraps		10.096	
Outflows			
External scraps		10.096	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (10.096 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

--- To be continued ---

Transport Card: 70. Trp

Inflows	**Percent**	**Massflow [kg]**	
CB recycling (tray)		1.002	
Outflows			
CB recycling (tray)		1.002	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (1.002 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Transport Card: 71. Trp

Inflows	**Percent**	**Massflow [kg]**	
CB recyc. (box 24)		0.709	
Outflows			
CB recyc. (box 24)		0.709	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (0.709 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Transport Card: 72. Trp

Inflows	**Percent**	**Massflow [kg]**	
CB recyc. (box 6)		1.002	
Outflows			
CB recyc. (box 6)		1.002	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (1.002 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 73. Testliner

Inflows	**Percent**	**Massflow [kg]**	
CB recyc. (box 6)		1.002	
CB recyc. (box 24)		0.709	
CB recycling (tray)		1.002	
Outflows			
Testliner		2.713	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (2.713 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 74. New product

Inflows	**Percent**	**Massflow [kg]**	
Avoided kraftliner	40.000 %	2.170	
Avoided testliner	10.000 %	0.543	
Testliner		2.713	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (5.426 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 75. Avoided kraftliner (Database)

Outflows	**Percent**	**Massflow [kg]**	
Avoided kraftliner		2.170	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (2.170 kg) is used to calculate emissions and energies

Notes

--- To be continued ---

Identical to the 33 cl steel can system, see Annex A.

Process Card: 76. Other products

Outflows	**Percent**	**Massflow [kg]**	
Fibres to landfill	50.000 %	0.543	
Fibres to recycling		0.543	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (1.085 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 77. Avoided testliner

Inflows	**Percent**	**Massflow [kg]**	
Fibres to recycling		0.543	
Outflows			
Avoided testliner		0.543	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (0.543 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 78. Landfill-corrugated board

Inflows	**Percent**	**Massflow [kg]**	
Fibres to landfill		0.543	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (0.543 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Transport Card: 79. Trp

Inflows	**Percent**	**Massflow [kg]**	
Waste		19.783	
Outflows			
Waste		19.783	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (19.783 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 80. Waste management

Inflows	**Percent**	**Massflow [kg]**	
Waste		19.783	
Outflows			
Tinplate waste	37.945 %	7.492	
PE-waste	4.252 %	0.839	
Aluminium waste	2.844 %	0.561	
CB waste		10.851	
Emissions, waste and resources	**[g]**		**Reference**
Glue (out)	2.110		See notes
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (19.743 kg) is used to calculate emissions and energies
Mass change factor 0.998

Notes
Waste management.

This process is only used in order to distribute the different waste flows.

The marginal waste management in Denmark is assumed to be waste incineration with energy recovery (see Main report).

The waste flow of glue has not been followed to the grave. Instead, this flow has been accounted for as a non-elementary outflow from the

--- To be continued ---

system. The amount of glue is 0.0208 g/can or 2.11 g/kg outflow.

Material balance per can:

Inflow:
- 10% of can to waste incineration, 80% of cardboard box to waste incineration, foil for cardboard (to waste incineration), 80% of corrugated board box to waste incineration, 80% of tray to waste incineration, 30% of plastic ligature to waste incineration, hi-cone (to waste incineration) and glue (to waste incineration): 9.87665 g.

Outflows:
- 80% of cardboard box, 80% of tray, 80% of corrugated board box: 5.4166 g.
- 10% of the aluminium lid: 0.2803 g.
- 10% of the rest of the can: 3.73985 g.
- 30% of plastic ligature, foil for cardboard, hi-cone: 0.4191 g.

Total outflows: 9.85585 g.

Mass change factor (out/in) = 0.998.

Process Card: 81. Cardboard/corrugated board inciner.

Inflows	**Percent**	**Massflow [kg]**	
CB waste		10.851	
Outflows			
Energy (CB)		10.851	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (10.851 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 82. Aluminium incineration

Inflows	**Percent**	**Massflow [kg]**	
Aluminium waste		0.561	
Outflows			
Energy (aluminium)		0.561	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (0.561 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 83. PE incineration

Inflows	**Percent**	**Massflow [kg]**	
PE-waste		0.839	
Outflows			
Energy (PE)		0.839	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (0.839 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 84. Tinplate incineration

Inflows	**Percent**	**Massflow [kg]**	
Tinplate waste		7.492	
Outflows			
Remaining scraps	39.826 %	2.984	
Energy (tinplate)		4.508	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (7.492 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system..see Annex A.

Transport Card: 85. Trp

Inflows	**Percent**	**Massflow [kg]**
Remaining scraps		2.984
Outflows		

--- To be continued ---

Remaining scraps		2.984	
Modes of conveyance	**[km]**		**Reference**

The sum of output flow(s) (2.984 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 86. EAF recycling

Inflows	**Percent**	**Massflow [kg]**	
Remaining scraps		2.984	
Outflows			
Recycled steel slab		2.984	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (2.984 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 87. New product

Inflows	**Percent**	**Massflow [kg]**	
Avoided virgin stee	50.000 %	2.984	
Recycled steel slab		2.984	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (5.967 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 88. Avoided steel production (Database)

Outflows	**Percent**	**Massflow [kg]**	
Avoided virgin stee		2.984	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (2.984 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 89. Energy use

Inflows	**Percent**	**Massflow [kg]**	
Energy (CB)		10.851	
Energy (aluminium)		0.561	
Energy (PE)		0.839	
Energy (tinplate)		4.508	
Alternative energy	50.000 %	16.760	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (33.519 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

Process Card: 90. Alt. energy production

Outflows	**Percent**	**Massflow [kg]**	
Alternative energy		16.760	
Energy carrier	**[MJ]**	**E Factor**	**Reference**

The sum of output flow(s) (16.760 kg) is used to calculate emissions and energies

Notes
Identical to the 33 cl steel can system, see Annex A.

C.1 Energy demand [per 1000 litres of beverage]: 33 cl steel cans

	91. Other products	92. Avoided iron production (Database)	1. Tinplate cans, 33 cl	2. Lime	3. Trp
Electricity, coal marginal [MJ]		-5,52E-01	4,01E+02	2,58E+00	1,77E+00
Electricity [MJ]			1,15E+00		
Hydropower [MJelectricity]					
Electricity, total [MJ at final use]	**0,00E+00**	**-5,52E-01**	**4,02E+02**	**2,58E+00**	**1,77E+00**
Coal [MJ]			1,45E+00		
Coal, feedstock [MJ]			2,05E-02		
Diesel, heavy & medium truck (highway) [MJ]		-3,26E-01	9,13E-01		1,49E+00
Diesel, heavy & medium truck (rural) [MJ]					
Diesel, heavy & medium truck (urban) [MJ]		-8,31E-02			
Diesel, ship (4-stroke) [MJ]					
Fuel oil, ship (2-stroke) [MJ]		-1,33E+00			
Fuel, unspecified [MJ]		-6,47E-06	1,12E-03	1,43E-05	3,42E-06
Hard coal [MJ]		-1,93E-01		4,90E+01	
Hard coal, feedstock [MJ]		-2,81E+01	1,80E+03		
LPG, forklift [MJ]					
LPG, thermal [MJ]					
Natural gas (<100 kW) [MJ]					
Natural gas (>100 kW) [MJ]		-6,15E-03	8,46E+02	6,60E-01	
Natural gas [MJ]			2,21E+01		
Natural gas, feedstock [MJ]			6,64E+01		
Oil [MJ]			1,09E+01		
Oil, feedstock [MJ]			6,82E+01		
Oil, heavy fuel [MJ]		-4,16E-01	3,61E+01		
Oil, heavy, feedstock [MJ]		-7,64E-01	9,06E+01		
Oil, light fuel [MJ]		-4,97E-02		1,07E+01	
Peat [MJ]					
Fossil fuel, total [MJ at final use]	**0,00E+00**	**-3,13E+01**	**2,94E+03**	**6,04E+01**	**1,49E+00**
Bark [MJ]					
Renewable fuel, total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Heat [MJ]					
Coke oven gas [MJ]	0,00E+00	1,34E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	0,00E+00	8,23E-01	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**0,00E+00**	**2,16E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**

C.1 Energy demand [per 1000 litres of beverage]: 33 cl steel cans

	4. Limestone	5. Trp	6. Tin	7. Trp	8. H2SO4	9. Trp	10. Iron ore extraction	11. Trp
Electricity, coal marginal [MJ]	2,53E-01	2,46E+00	1,00E+01	3,00E-02			1,65E+01	4,12E+01
Electricity [MJ]								
Hydropower [MJelectricity]								
Electricity, total [MJ at final use]	**2,53E-01**	**2,46E+00**	**1,00E+01**	**3,00E-02**	**0,00E+00**	**0,00E+00**	**1,65E+01**	**4,12E+01**
Coal [MJ]								
Coal, feedstock [MJ]								
Diesel, heavy & medium truck (highway) [MJ]		2,06E+00		1,34E-01		2,24E-01		1,84E+01
Diesel, heavy & medium truck (rural) [MJ]								
Diesel, heavy & medium truck (urban) [MJ]							5,32E+00	
Diesel, ship (4-stroke) [MJ]								
Fuel oil, ship (2-stroke) [MJ]				1,04E-01				8,51E+01
Fuel, unspecified [MJ]	5,05E-07	4,75E-06	1,93E-05	5,79E-08			3,18E-05	7,96E-05
Hard coal [MJ]	8,39E-02							
Hard coal, feedstock [MJ]								
LPG, forklift [MJ]								
LPG, thermal [MJ]								
Natural gas (<100 kW) [MJ]								
Natural gas (>100 kW) [MJ]	2,30E-01							
Natural gas [MJ]								
Natural gas, feedstock [MJ]								
Oil [MJ]								
Oil, feedstock [MJ]								
Oil, heavy fuel [MJ]							2,67E+01	
Oil, heavy, feedstock [MJ]								
Oil, light fuel [MJ]	3,76E-01		2,00E+01					
Peat [MJ]								
Fossil fuel, total [MJ at final use]	**6,90E-01**	**2,06E+00**	**2,00E+01**	**2,38E-01**	**0,00E+00**	**2,24E-01**	**3,20E+01**	**1,03E+02**
Bark [MJ]								
Renewable fuel, total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Heat [MJ]								
Coke oven gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**

C.1 Energy demand [per 1000 litres of beverage]: 33 cl steel cans

	12. Primary aluminium (database)	13. Trp	14. Strip rolling	15. Trp	16. Remelting	17. New product
Electricity, coal marginal [MJ]	5,99E+02		3,30E+01		7,87E+00	
Electricity [MJ]						
Hydropower [MJelectricity]						
Electricity, total [MJ at final use]	**5,99E+02**	**0,00E+00**	**3,30E+01**	**0,00E+00**	**7,87E+00**	**0,00E+00**
Coal [MJ]						
Coal, feedstock [MJ]						
Diesel, heavy & medium truck (highway) [MJ]	2,14E+00	6,02E+00		8,73E-02		
Diesel, heavy & medium truck (rural) [MJ]						
Diesel, heavy & medium truck (urban) [MJ]						
Diesel, ship (4-stroke) [MJ]						
Fuel oil, ship (2-stroke) [MJ]	8,41E+01	2,38E-01		4,69E-03		
Fuel, unspecified [MJ]	1,16E-03		6,38E-05		1,52E-05	
Hard coal [MJ]						
Hard coal, feedstock [MJ]						
LPG, forklift [MJ]						
LPG, thermal [MJ]					1,22E+00	
Natural gas (<100 kW) [MJ]						
Natural gas (>100 kW) [MJ]			2,53E+01			
Natural gas [MJ]						
Natural gas, feedstock [MJ]						
Oil [MJ]						
Oil, feedstock [MJ]						
Oil, heavy fuel [MJ]						
Oil, heavy, feedstock [MJ]						
Oil, light fuel [MJ]						
Peat [MJ]						
Fossil fuel, total [MJ at final use]	**8,63E+01**	**6,26E+00**	**2,53E+01**	**9,20E-02**	**1,22E+00**	**0,00E+00**
Bark [MJ]						
Renewable fuel, total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Heat [MJ]						
Coke oven gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**

C.1 Energy demand [per 1000 litres of beverage]: 33 cl steel cans

	18. Avoided primary aluminium (database)	19. Trp	20. Lid production	21. Trp	22. Trp
Electricity, coal marginal [MJ]	-1,05E+02		5,86E+01		
Electricity [MJ]					
Hydropower [MJelectricity]					
Electricity, total [MJ at final use]	**-1,05E+02**	**0,00E+00**	**5,86E+01**	**0,00E+00**	**0,00E+00**
Coal [MJ]					
Coal, feedstock [MJ]					
Diesel, heavy & medium truck (highway) [MJ]	-3,73E-01	8,38E+00		6,53E-01	4,54E+00
Diesel, heavy & medium truck (rural) [MJ]					
Diesel, heavy & medium truck (urban) [MJ]					
Diesel, ship (4-stroke) [MJ]					1,44E-01
Fuel oil, ship (2-stroke) [MJ]	-1,47E+01	1,72E+00			
Fuel, unspecified [MJ]	-2,02E-04		1,13E-04		
Hard coal [MJ]					
Hard coal, feedstock [MJ]					
LPG, forklift [MJ]					
LPG, thermal [MJ]					
Natural gas (<100 kW) [MJ]					
Natural gas (>100 kW) [MJ]					
Natural gas [MJ]					
Natural gas, feedstock [MJ]					
Oil [MJ]					
Oil, feedstock [MJ]					
Oil, heavy fuel [MJ]					
Oil, heavy, feedstock [MJ]					
Oil, light fuel [MJ]					
Peat [MJ]					
Fossil fuel, total [MJ at final use]	**-1,51E+01**	**1,01E+01**	**1,13E-04**	**6,53E-01**	**4,68E+00**
Bark [MJ]					
Renewable fuel, total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Heat [MJ]					
Coke oven gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**

C.1 Energy demand [per 1000 litres of beverage]: 33 cl steel cans

	23. Corrugated board (Database)	24. Use of recycled fibres (Database)	25. Trp	26. Trp	27. Washing & filling
Electricity, coal marginal [MJ]	1,89E+01	1,74E+01			7,58E+00
Electricity [MJ]					
Hydropower [MJelectricity]					
Electricity, total [MJ at final use]	**1,89E+01**	**1,74E+01**	**0,00E+00**	**0,00E+00**	**7,58E+00**
Coal [MJ]					
Coal, feedstock [MJ]					
Diesel, heavy & medium truck (highway) [MJ]	2,18E+00	2,59E+00	1,64E-01	4,32E+01	
Diesel, heavy & medium truck (rural) [MJ]		-6,13E-02			
Diesel, heavy & medium truck (urban) [MJ]	3,78E+00	5,33E+00			
Diesel, ship (4-stroke) [MJ]	4,80E+00	1,30E+01		7,31E-01	
Fuel oil, ship (2-stroke) [MJ]					
Fuel, unspecified [MJ]	3,68E-05	3,35E-05			1,46E-05
Hard coal [MJ]	1,49E+00				
Hard coal, feedstock [MJ]					
LPG, forklift [MJ]	1,54E-01	-2,12E-01			
LPG, thermal [MJ]					
Natural gas (<100 kW) [MJ]					
Natural gas (>100 kW) [MJ]	7,39E+01	-4,94E+01			5,29E+01
Natural gas [MJ]					
Natural gas, feedstock [MJ]					
Oil [MJ]					
Oil, feedstock [MJ]					
Oil, heavy fuel [MJ]	2,31E+01	1,44E+01			
Oil, heavy, feedstock [MJ]					
Oil, light fuel [MJ]	3,04E+00	6,65E-02			
Peat [MJ]	5,62E+00	7,78E-01			
Fossil fuel, total [MJ at final use]	**1,18E+02**	**-1,34E+01**	**1,64E-01**	**4,39E+01**	**5,29E+01**
Bark [MJ]	3,49E+00	5,81E+00			
Renewable fuel, total [MJ at final use]	**3,49E+00**	**5,81E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Heat [MJ]	-1,53E+00	-2,40E+00			
Coke oven gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**-1,53E+00**	**-2,40E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**

C.1 Energy demand [per 1000 litres of beverage]: 33 cl steel cans

	28. Trp	29. Corrugated board incineration	30. Packaging	31. Secondary packaging	32. Trp
Electricity, coal marginal [MJ]		1,17E-01			
Electricity [MJ]					
Hydropower [MJelectricity]					
Electricity, total [MJ at final use]	**0,00E+00**	**1,17E-01**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Coal [MJ]					
Coal, feedstock [MJ]					
Diesel, heavy & medium truck (highway) [MJ]					
Diesel, heavy & medium truck (rural) [MJ]	2,76E-02				4,11E+00
Diesel, heavy & medium truck (urban) [MJ]					
Diesel, ship (4-stroke) [MJ]					
Fuel oil, ship (2-stroke) [MJ]					
Fuel, unspecified [MJ]		2,26E-07			
Hard coal [MJ]					
Hard coal, feedstock [MJ]					
LPG, forklift [MJ]					
LPG, thermal [MJ]					
Natural gas (<100 kW) [MJ]					
Natural gas (>100 kW) [MJ]					
Natural gas [MJ]					
Natural gas, feedstock [MJ]					
Oil [MJ]					
Oil, feedstock [MJ]					
Oil, heavy fuel [MJ]					
Oil, heavy, feedstock [MJ]					
Oil, light fuel [MJ]					
Peat [MJ]					
Fossil fuel, total [MJ at final use]	**2,76E-02**	**2,26E-07**	**0,00E+00**	**0,00E+00**	**4,11E+00**
Bark [MJ]					
Renewable fuel, total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Heat [MJ]					
Coke oven gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**

C.1 Energy demand [per 1000 litres of beverage]: 33 cl steel cans

	33. Cardboard (Database)	34. Trp	35. Cardboard box (6 cans)	36. Trp	37. Tray	38. Trp
Electricity, coal marginal [MJ]	1,64E+01					
Electricity [MJ]						
Hydropower [MJelectricity]						
Electricity, total [MJ at final use]	**1,64E+01**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Coal [MJ]						
Coal, feedstock [MJ]						
Diesel, heavy & medium truck (highway) [MJ]	2,05E+00	1,27E+00		1,52E+00		8,60E-01
Diesel, heavy & medium truck (rural) [MJ]						
Diesel, heavy & medium truck (urban) [MJ]	4,94E+00					
Diesel, ship (4-stroke) [MJ]	8,67E+00					
Fuel oil, ship (2-stroke) [MJ]						
Fuel, unspecified [MJ]	3,16E-05					
Hard coal [MJ]						
Hard coal, feedstock [MJ]						
LPG, forklift [MJ]						
LPG, thermal [MJ]						
Natural gas (<100 kW) [MJ]						
Natural gas (>100 kW) [MJ]	4,34E+00					
Natural gas [MJ]						
Natural gas, feedstock [MJ]						
Oil [MJ]						
Oil, feedstock [MJ]						
Oil, heavy fuel [MJ]	1,28E+01					
Oil, heavy, feedstock [MJ]						
Oil, light fuel [MJ]	6,29E-02					
Peat [MJ]	6,92E-01					
Fossil fuel, total [MJ at final use]	**3,36E+01**	**1,27E+00**	**0,00E+00**	**1,52E+00**	**0,00E+00**	**8,60E-01**
Bark [MJ]	5,16E+00					
Renewable fuel, total [MJ at final use]	**5,16E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Heat [MJ]	-2,14E+00					
Coke oven gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**-2,14E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**

C.1 Energy demand [per 1000 litres of beverage]: 33 cl steel cans

	39. Corrugated board box (24 cans)	40. LDPE	41. Trp	42. Foil	43. Trp	44. Hi-cone
Electricity, coal marginal [MJ]						
Electricity [MJ]		3,95E+00				
Hydropower [MJelectricity]		6,80E-01				
Electricity, total [MJ at final use]	**0,00E+00**	**4,63E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Coal [MJ]		4,13E+00				
Coal, feedstock [MJ]		1,26E-02				
Diesel, heavy & medium truck (highway) [MJ]			1,67E-01		8,60E-02	
Diesel, heavy & medium truck (rural) [MJ]						
Diesel, heavy & medium truck (urban) [MJ]						
Diesel, ship (4-stroke) [MJ]						
Fuel oil, ship (2-stroke) [MJ]						
Fuel, unspecified [MJ]						
Hard coal [MJ]						
Hard coal, feedstock [MJ]						
LPG, forklift [MJ]						
LPG, thermal [MJ]						
Natural gas (<100 kW) [MJ]						
Natural gas (>100 kW) [MJ]						
Natural gas [MJ]		1,56E+01				
Natural gas, feedstock [MJ]		4,16E+01				
Oil [MJ]		4,77E+00				
Oil, feedstock [MJ]		4,26E+01				
Oil, heavy fuel [MJ]						
Oil, heavy, feedstock [MJ]						
Oil, light fuel [MJ]						
Peat [MJ]						
Fossil fuel, total [MJ at final use]	**0,00E+00**	**1,09E+02**	**1,67E-01**	**0,00E+00**	**8,60E-02**	**0,00E+00**
Bark [MJ]						
Renewable fuel, total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Heat [MJ]						
Coke oven gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**

C.1 Energy demand [per 1000 litres of beverage]: 33 cl steel cans

	45. Planks for pallets (Database)	46. Trp	47. Pallet	48. Trp	49. Trp	50. Wood incineration	51. Energy use
Electricity, coal marginal [MJ]	7,36E-01					2,52E-01	
Electricity [MJ]							
Hydropower [MJelectricity]							
Electricity, total [MJ at final use]	**7,36E-01**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**2,52E-01**	**0,00E+00**
Coal [MJ]							
Coal, feedstock [MJ]							
Diesel, heavy & medium truck (highway) [MJ]	1,65E-01	9,39E-02					
Diesel, heavy & medium truck (rural) [MJ]				2,97E-01	5,94E-02		
Diesel, heavy & medium truck (urban) [MJ]	1,10E+00						
Diesel, ship (4-stroke) [MJ]	8,32E-02						
Fuel oil, ship (2-stroke) [MJ]							
Fuel, unspecified [MJ]	1,42E-06					4,87E-07	
Hard coal [MJ]							
Hard coal, feedstock [MJ]							
LPG, forklift [MJ]							
LPG, thermal [MJ]							
Natural gas (<100 kW) [MJ]							
Natural gas (>100 kW) [MJ]							
Natural gas [MJ]							
Natural gas, feedstock [MJ]							
Oil [MJ]							
Oil, feedstock [MJ]							
Oil, heavy fuel [MJ]							
Oil, heavy, feedstock [MJ]							
Oil, light fuel [MJ]	3,70E-01						
Peat [MJ]							
Fossil fuel, total [MJ at final use]	**1,72E+00**	**9,39E-02**	**0,00E+00**	**2,97E-01**	**5,94E-02**	**4,87E-07**	**0,00E+00**
Bark [MJ]	2,24E+00						
Renewable fuel, total [MJ at final use]	**2,24E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Heat [MJ]							
Coke oven gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**

C.1 Energy demand [per 1000 litres of beverage]: 33 cl steel cans

	52. Alt. energy production	53. Distribution	54. Retailer	55. Trp	56. Use (refrigeration)	57. Trp	58. Trp
Electricity, coal marginal [MJ]	-1,39E+00				1,83E+00		
Electricity [MJ]							
Hydropower [MJelectricity]							
Electricity, total [MJ at final use]	**-1,39E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**1,83E+00**	**0,00E+00**	**0,00E+00**
Coal [MJ]							
Coal, feedstock [MJ]							
Diesel, heavy & medium truck (highway) [MJ]		8,01E+01					
Diesel, heavy & medium truck (rural) [MJ]		8,08E+01					
Diesel, heavy & medium truck (urban) [MJ]		6,62E+01					
Diesel, ship (4-stroke) [MJ]							
Fuel oil, ship (2-stroke) [MJ]							
Fuel, unspecified [MJ]	-2,69E-06				3,52E-06		
Hard coal [MJ]							
Hard coal, feedstock [MJ]							
LPG, forklift [MJ]							
LPG, thermal [MJ]							
Natural gas (<100 kW) [MJ]							
Natural gas (>100 kW) [MJ]	-1,25E+01						
Natural gas [MJ]							
Natural gas, feedstock [MJ]							
Oil [MJ]							
Oil, feedstock [MJ]							
Oil, heavy fuel [MJ]							
Oil, heavy, feedstock [MJ]							
Oil, light fuel [MJ]	-1,87E+01						
Peat [MJ]							
Fossil fuel, total [MJ at final use]	**-3,11E+01**	**2,27E+02**	**0,00E+00**	**0,00E+00**	**3,52E-06**	**0,00E+00**	**0,00E+00**
Bark [MJ]							
Renewable fuel, total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Heat [MJ]							
Coke oven gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**

C.1 Energy demand [per 1000 litres of beverage]: 33 cl steel cans

	59. Trp	60. Trp	61. BOF recycling	62. Steel scrap market	63. Trp	64. Trp	65. New product
Electricity, coal marginal [MJ]*			2,98E+01				
Electricity [MJ]							
Hydropower [MJelectricity]							
Electricity, total [MJ at final use]	**0,00E+00**	**0,00E+00**	**2,98E+01**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Coal [MJ]							
Coal, feedstock [MJ]							
Diesel, heavy & medium truck (highway) [MJ]	1,54E+01	4,68E+00			2,91E+00	1,99E+01	
Diesel, heavy & medium truck (rural) [MJ]							
Diesel, heavy & medium truck (urban) [MJ]							
Diesel, ship (4-stroke) [MJ]							
Fuel oil, ship (2-stroke) [MJ]							
Fuel, unspecified [MJ]			5,75E-05				
Hard coal [MJ]							
Hard coal, feedstock [MJ]							
LPG, forklift [MJ]							
LPG, thermal [MJ]							
Natural gas (<100 kW) [MJ]			1,78E+01				
Natural gas (>100 kW) [MJ]							
Natural gas [MJ]							
Natural gas, feedstock [MJ]							
Oil [MJ]							
Oil, feedstock [MJ]							
Oil, heavy fuel [MJ]							
Oil, heavy, feedstock [MJ]							
Oil, light fuel [MJ]							
Peat [MJ]							
Fossil fuel, total [MJ at final use]	**1,54E+01**	**4,68E+00**	**1,78E+01**	**0,00E+00**	**2,91E+00**	**1,99E+01**	**0,00E+00**
Bark [MJ]							
Renewable fuel, total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Heat [MJ]							
Coke oven gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**

C.1 Energy demand [per 1000 litres of beverage]: 33 cl steel cans

	66. Avoided steel production (Database)	67. EAF recycling	68. Trp	69. Trp	70. Trp	71. Trp	72. Trp
Electricity, coal marginal [MJ]	-2,84E+01	-2,89E+01					
Electricity [MJ]							
Hydropower [MJelectricity]							
Electricity, total [MJ at final use]	**-2,84E+01**	**-2,89E+01**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Coal [MJ]							
Coal, feedstock [MJ]	-1,55E+03						
Diesel, heavy & medium truck (highway) [MJ]	-1,90E+01		5,17E+00	2,26E+00	1,31E-01	7,46E-02	1,10E-01
Diesel, heavy & medium truck (rural) [MJ]							
Diesel, heavy & medium truck (urban) [MJ]	-4,59E+00						
Diesel, ship (4-stroke) [MJ]							
Fuel oil, ship (2-stroke) [MJ]	-7,34E+01						
Fuel, unspecified [MJ]	-6,29E-05	-5,76E-05					
Hard coal [MJ]	-4,24E+01	-9,33E+00					
Hard coal, feedstock [MJ]							
LPG, forklift [MJ]							
LPG, thermal [MJ]							
Natural gas (<100 kW) [MJ]							
Natural gas (>100 kW) [MJ]	-7,67E-01	-7,22E+00					
Natural gas [MJ]							
Natural gas, feedstock [MJ]							
Oil [MJ]							
Oil, feedstock [MJ]							
Oil, heavy fuel [MJ]	-2,30E+01						
Oil, heavy, feedstock [MJ]	-4,40E+01						
Oil, light fuel [MJ]	-1,00E+01						
Peat [MJ]							
Fossil fuel, total [MJ at final use]	**-1,77E+03**	**-1,65E+01**	**5,17E+00**	**2,26E+00**	**1,31E-01**	**7,46E-02**	**1,10E-01**
Bark [MJ]							
Renewable fuel, total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Heat [MJ]							
Coke oven gas [MJ]	7,41E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	4,54E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**1,20E+02**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**

C.1 Energy demand [per 1000 litres of beverage]: 33 cl steel cans

	73. Testliner	74. New product	75. Avoided kraftliner (Database)	76. Other products	77. Avoided testliner
Electricity, coal marginal [MJ]	6,98E-01		-6,92E+00		-1,40E-01
Electricity [MJ]					
Hydropower [MJelectricity]					
Electricity, total [MJ at final use]	**6,98E-01**	**0,00E+00**	**-6,92E+00**	**0,00E+00**	**-1,40E-01**
Coal [MJ]					
Coal, feedstock [MJ]					
Diesel, heavy & medium truck (highway) [MJ]			-8.64E-01		
Diesel, heavy & medium truck (rural) [MJ]					
Diesel, heavy & medium truck (urban) [MJ]	6,65E-02		1,93E+00		-1,33E-02
Diesel, ship (4-stroke) [MJ]			-3,66E+00		
Fuel oil, ship (2-stroke) [MJ]					
Fuel, unspecified [MJ]	1,35E-06		-1,33E-05		-2,69E-07
Hard coal [MJ]					
Hard coal, feedstock [MJ]					
LPG, forklift [MJ]	9,97E-02				-1,99E-02
LPG, thermal [MJ]					
Natural gas (<100 kW) [MJ]					
Natural gas (>100 kW) [MJ]	2,55E+01		-1,84E+00		-5,10E+00
Natural gas [MJ]					
Natural gas, feedstock [MJ]					
Oil [MJ]					
Oil, feedstock [MJ]					
Oil, heavy fuel [MJ]			-5,43E+00		
Oil, heavy, feedstock [MJ]					
Oil, light fuel [MJ]	1,99E-03		-2,66E-02		-3,99E-04
Peat [MJ]			-2,93E-01		
Fossil fuel, total [MJ at final use]	**2,57E+01**	**0,00E+00**	**-1,02E+01**	**0,00E+00**	**-5,13E+00**
Bark [MJ]			-2,18E+00		
Renewable fuel, total [MJ at final use]	**0,00E+00**	**0,00E+00**		**0,00E+00**	**0,00E+00**
Heat [MJ]			9,04E-01		
Coke oven gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**0,00E+00**	**0,00E+00**	**9,04E-01**	**0,00E+00**	**0,00E+00**

C.1 Energy demand [per 1000 litres of beverage]: 33 cl steel cans

	78. Landfill-corrugated board	79. Trp	80. Waste management	81. Cardboard/corrugated board inciner.
Electricity, coal marginal [MJ]	5,08E-04			2,61E+00
Electricity [MJ]				
Hydropower [MJelectricity]				
Electricity, total [MJ at final use]	**5,08E-04**	**0,00E+00**	**0,00E+00**	**2,61E+00**
Coal [MJ]				
Coal, feedstock [MJ]				
Diesel, heavy & medium truck (highway) [MJ]				
Diesel, heavy & medium truck (rural) [MJ]		1,03E+00		
Diesel, heavy & medium truck (urban) [MJ]	2,54E-02			
Diesel, ship (4-stroke) [MJ]				
Fuel oil, ship (2-stroke) [MJ]				
Fuel, unspecified [MJ]	9,80E-10			5,04E-06
Hard coal [MJ]				
Hard coal, feedstock [MJ]				
LPG, forklift [MJ]				
LPG, thermal [MJ]				
Natural gas (<100 kW) [MJ]				
Natural gas (>100 kW) [MJ]				
Natural gas [MJ]				
Natural gas, feedstock [MJ]				
Oil [MJ]				
Oil, feedstock [MJ]				
Oil, heavy fuel [MJ]				
Oil, heavy, feedstock [MJ]				
Oil, light fuel [MJ]				
Peat [MJ]				
Fossil fuel, total [MJ at final use]	**2,54E-02**	**1,03E+00**	**0,00E+00**	**5,04E-06**
Bark [MJ]				
Renewable fuel, total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Heat [MJ]				
Coke oven gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**

C.1 Energy demand [per 1000 litres of beverage]: 33 cl steel cans

	82. Aluminium incineration	83. PE incineration	84. Tinplate incineration	85. Trp	86. EAF recycling
Electricity, coal marginal [MJ]	1,53E-01	2,28E-01	1,38E+00		5,74E+00
Electricity [MJ]					
Hydropower [MJelectricity]					
Electricity, total [MJ at final use]	**1,53E-01**	**2,28E-01**	**1,38E+00**	**0,00E+00**	**5,74E+00**
Coal [MJ]					
Coal, feedstock [MJ]					
Diesel, heavy & medium truck (highway) [MJ]				9,61E-01	
Diesel, heavy & medium truck (rural) [MJ]					
Diesel, heavy & medium truck (urban) [MJ]					
Diesel, ship (4-stroke) [MJ]					
Fuel oil, ship (2-stroke) [MJ]					
Fuel, unspecified [MJ]	2,94E-07	4,40E-07	2,66E-06		1,14E-05
Hard coal [MJ]					1,74E+00
Hard coal, feedstock [MJ]					
LPG, forklift [MJ]					
LPG, thermal [MJ]					
Natural gas (<100 kW) [MJ]					
Natural gas (>100 kW) [MJ]					1,34E+00
Natural gas [MJ]					
Natural gas, feedstock [MJ]					
Oil [MJ]					
Oil, feedstock [MJ]					
Oil, heavy fuel [MJ]					
Oil, heavy, feedstock [MJ]					
Oil, light fuel [MJ]					
Peat [MJ]					
Fossil fuel, total [MJ at final use]	**2,94E-07**	**4,40E-07**	**2,66E-06**	**9,61E-01**	**3,08E+00**
Bark [MJ]					
Renewable fuel, total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Heat [MJ]					
Coke oven gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**

C.1 Energy demand [per 1000 litres of beverage]: 33 cl steel cans

	87. New product	88. Avoided steel production (Database)	89. Energy use	90. Alt. energy production	Total
Electricity, coal marginal [MJ]		-1,82E+00		-1,22E+01	1,09E+03
Electricity [MJ]					5,11E+00
Hydropower [MJelectricity]					6,80E-01
Electricity, total [MJ at final use]	**0,00E+00**	**-1,82E+00**	**0,00E+00**	**-1,22E+01**	**1,10E+03**
Coal [MJ]					5,58E+00
Coal, feedstock [MJ]		-9,98E+01			-1,65E+03
Diesel, heavy & medium truck (highway) [MJ]		-1,22E+00			2,09E+02
Diesel, heavy & medium truck (rural) [MJ]					8,63E+01
Diesel, heavy & medium truck (urban) [MJ]		-2,95E-01			8,37E+01
Diesel, ship (4-stroke) [MJ]					2,38E+01
Fuel oil, ship (2-stroke) [MJ]		-4,71E+00			7,71E+01
Fuel, unspecified [MJ]		-4,04E-06		-2,35E-05	2,45E-03
Hard coal [MJ]		-2,72E+00			-2,25E+00
Hard coal, feedstock [MJ]					1,77E+03
LPG, forklift [MJ]					2,20E-02
LPG, thermal [MJ]					1,22E+00
Natural gas (<100 kW) [MJ]					1,78E+01
Natural gas (>100 kW) [MJ]		-4,92E-02		-1,09E+02	8,44E+02
Natural gas [MJ]					3,77E+01
Natural gas, feedstock [MJ]					1,08E+02
Oil [MJ]					1,57E+01
Oil, feedstock [MJ]					1,11E+02
Oil, heavy fuel [MJ]		-1,48E+00			8,28E+01
Oil, heavy, feedstock [MJ]		-2,83E+00			4,30E+01
Oil, light fuel [MJ]		-6,45E-01		-1,64E+02	-1,59E+02
Peat [MJ]					6,80E+00
Fossil fuel, total [MJ at final use]	**0,00E+00**	**-1,14E+02**	**0,00E+00**	**-2,73E+02**	**1,71E+03**
Bark [MJ]					1,45E+01
Renewable fuel, total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**1,45E+01**
Heat [MJ]					-5,17E+00
Coke oven gas [MJ]	0,00E+00	4,76E+00	0,00E+00	0,00E+00	8,02E+01
BF-gas [MJ]	0,00E+00	2,92E+00	0,00E+00	0,00E+00	4,91E+01
Heat etc., total [MJ at final use]	**0,00E+00**	**7,68E+00**	**0,00E+00**	**0,00E+00**	**1,24E+02**

C.1 Energy demand [per 1000 litres of beverage]: 33 cl steel cans

		Packaging system	Effects on other life cycles	Total
Electricity, coal marginal [MJ]		1,23E+03	-1,41E+02	1,09E+03
Electricity [MJ]		5,11E+00	0,00E+00	5,11E+00
Hydropower [MJelectricity]		6,80E-01	0,00E+00	6,80E-01
Electricity, total [MJ at final use]		**1,24E+03**	**-1,41E+02**	**1,10E+03**
Coal [MJ]		5,58E+00	0,00E+00	5,58E+00
Coal, feedstock [MJ]		3,31E-02	-1,65E+03	-1,65E+03
Diesel, heavy & medium truck (highway) [MJ]		1,81E+02	2,83E+01	2,09E+02
Diesel, heavy & medium truck (rural) [MJ]		8,63E+01	0,00E+00	8,63E+01
Diesel, heavy & medium truck (urban) [MJ]		8,67E+01	-2,97E+00	8,37E+01
Diesel, ship (4-stroke) [MJ]		2,74E+01	-3,66E+00	2,38E+01
Fuel oil, ship (2-stroke) [MJ]		1,71E+02	-9,41E+01	7,71E+01
Fuel, unspecified [MJ]		2,74E-03	-2,87E-04	2,45E-03
Hard coal [MJ]		5,06E+01	-5,29E+01	-2,25E+00
Hard coal, feedstock [MJ]		1,80E+03	-2,81E+01	1,77E+03
LPG, forklift [MJ]		-5,80E-02	7,98E-02	2,18E-02
LPG, thermal [MJ]		0,00E+00	1,22E+00	1,22E+00
Natural gas (<100 kW) [MJ]		0,00E+00	1,78E+01	1,78E+01
Natural gas (>100 kW) [MJ]		9,54E+02	-1,10E+02	8,44E+02
Natural gas [MJ]		3,77E+01	0,00E+00	3,77E+01
Natural gas, feedstock [MJ]		1,08E+02	0,00E+00	1,08E+02
Oil [MJ]		1,57E+01	0,00E+00	1,57E+01
Oil, feedstock [MJ]		1,11E+02	0,00E+00	1,11E+02
Oil, heavy fuel [MJ]		1,13E+02	-3,03E+01	8,28E+01
Oil, heavy, feedstock [MJ]		9,06E+01	-4,76E+01	4,30E+01
Oil, light fuel [MJ]		3,46E+01	-1,93E+02	-1,59E+02
Peat [MJ]		7,09E+00	-2,93E-01	6,79E+00
Fossil fuel, total [MJ at final use]		**3,88E+03**	**-2,16E+03**	**1,72E+03**
Bark [MJ]		1,67E+01	-2,18E+00	1,45E+01
Renewable fuel, total [MJ at final use]		**1,67E+01**	**-2,18E+00**	**1,45E+01**
Heat [MJ]		-6,07E+00	9,04E-01	-5,17E+00
Coke oven gas [MJ]		0,00E+00	8,02E+01	8,02E+01
BF-gas [MJ]		0,00E+00	4,91E+01	4,91E+01
Heat etc., total [MJ at final use]		**-6,07E+00**	**1,30E+02**	**1,24E+02**

C.2 Energy demand [per 1000 litres of beverage]: 50 cl steel cans

	91. Other products	92. Avoided iron production (Database)	1. Tinplate cans, 50cl	2. Lime	3. Trp
Electricity, coal marginal [MJ]		-4,96E-01	3,43E+02	1,79E+00	1,59E+00
Electricity [MJ]			1,19E+00		
Hydropower [MJelectricity]					
Electricity, total [MJ at final use]	**0,00E+00**	**-4,96E-01**	**3,44E+02**	**1,79E+00**	**1,59E+00**
Coal [MJ]			1,50E+00		
Coal, feedstock [MJ]			2,10E-02		
Diesel, heavy & medium truck (highway) [MJ]		-2,93E-01	9,17E-01		1,33E+00
Diesel, heavy & medium truck (rural) [MJ]					
Diesel, heavy & medium truck (urban) [MJ]		-7,47E-02			
Diesel, ship (4-stroke) [MJ]					
Fuel oil, ship (2-stroke) [MJ]		-1,20E+00			
Fuel, unspecified [MJ]		-5,82E-06	9,71E-04	1,19E-05	3,07E-06
Hard coal [MJ]		-1,73E-01		4,41E+01	
Hard coal, feedstock [MJ]		-2,53E+01	1,62E+03		
LPG, forklift [MJ]					
LPG, thermal [MJ]					
Natural gas (<100 kW) [MJ]					
Natural gas (>100 kW) [MJ]		-5,53E-03	7,37E+02	5,93E-01	
Natural gas [MJ]			2,27E+01		
Natural gas, feedstock [MJ]			6,84E+01		
Oil [MJ]			1,13E+01		
Oil, feedstock [MJ]			7,02E+01		
Oil, heavy fuel [MJ]		-3,74E-01	3,56E+01		
Oil, heavy, feedstock [MJ]		-6,87E-01	8,65E+01		
Oil, light fuel [MJ]		-4,47E-02		1,01E+01	
Peat [MJ]					
Fossil fuel, total [MJ at final use]	**0,00E+00**	**-2,81E+01**	**2,65E+03**	**5,48E+01**	**1,33E+00**
Bark [MJ]					
Renewable fuel, total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Heat [MJ]					
Coke oven gas [MJ]	0,00E+00	1,21E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	0,00E+00	7,40E-01	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**0,00E+00**	**1,95E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**

C.2 Energy demand [per 1000 litres of beverage]: 50 cl steel cans

	4. Limestone	5. Trp	6. Tin	7. Trp	8. H2SO4	9. Trp	10. Iron ore extraction	11. Trp
Electricity, coal marginal [MJ]*	2,28E-01	2,21E+00	9,02E+00	2,71E-02			1,48E+01	3,71E+01
Electricity [MJ]								
Hydropower [MJelectricity]								
Electricity, total [MJ at final use]	**2,28E-01**	**2,21E+00**	**9,02E+00**	**2,71E-02**	**0,00E+00**	**0,00E+00**	**1,48E+01**	**3,71E+01**
Coal [MJ]								
Coal, feedstock [MJ]								
Diesel, heavy & medium truck (highway) [MJ]		1,85E+00		1,21E-01		2,01E-01		1,66E+01
Diesel, heavy & medium truck (rural) [MJ]								
Diesel, heavy & medium truck (urban) [MJ]							4,78E+00	
Diesel, ship (4-stroke) [MJ]								
Fuel oil, ship (2-stroke) [MJ]				9,38E-02				7,64E+01
Fuel, unspecified [MJ]	4,54E-07	4,27E-06	1,74E-05	5,22E-08			2,86E-05	7,15E-05
Hard coal [MJ]	7,54E-02							
Hard coal, feedstock [MJ]								
LPG, forklift [MJ]								
LPG, thermal [MJ]								
Natural gas (<100 kW) [MJ]								
Natural gas (>100 kW) [MJ]	2,06E-01							
Natural gas [MJ]								
Natural gas, feedstock [MJ]								
Oil [MJ]								
Oil, feedstock [MJ]								
Oil, heavy fuel [MJ]							2,40E+01	
Oil, heavy, feedstock [MJ]								
Oil, light fuel [MJ]	3,38E-01		1,80E+01					
Peat [MJ]								
Fossil fuel, total [MJ at final use]	**6,19E-01**	**1,85E+00**	**1,80E+01**	**2,15E-01**	**0,00E+00**	**2,01E-01**	**2,87E+01**	**9,30E+01**
Bark [MJ]								
Renewable fuel, total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Heat [MJ]								
Coke oven gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**

C.2 Energy demand [per 1000 litres of beverage]: 50 cl steel cans

	12. Primary aluminium (database)	13. Trp	14. Strip rolling	15. Trp	16. Remelting	17. New product
Electricity, coal marginal [MJ]	3,97E+02		2,19E+01		5,21E+00	
Electricity [MJ]						
Hydropower [MJelectricity]						
Electricity, total [MJ at final use]	**3,97E+02**	**0,00E+00**	**2,19E+01**	**0,00E+00**	**5,21E+00**	**0,00E+00**
Coal [MJ]						
Coal, feedstock [MJ]						
Diesel, heavy & medium truck (highway) [MJ]	1,42E+00	3,99E+00		5,78E-02		
Diesel, heavy & medium truck (rural) [MJ]						
Diesel, heavy & medium truck (urban) [MJ]						
Diesel, ship (4-stroke) [MJ]						
Fuel oil, ship (2-stroke) [MJ]	5,57E+01	1,58E-01		3,10E-03		
Fuel, unspecified [MJ]	7,66E-04		4,22E-05		1,01E-05	
Hard coal [MJ]						
Hard coal, feedstock [MJ]						
LPG, forklift [MJ]						
LPG, thermal [MJ]					8,07E-01	
Natural gas (<100 kW) [MJ]						
Natural gas (>100 kW) [MJ]			1,67E+01			
Natural gas [MJ]						
Natural gas, feedstock [MJ]						
Oil [MJ]						
Oil, feedstock [MJ]						
Oil, heavy fuel [MJ]						
Oil, heavy, feedstock [MJ]						
Oil, light fuel [MJ]						
Peat [MJ]						
Fossil fuel, total [MJ at final use]	**5,71E+01**	**4,15E+00**	**1,67E+01**	**6,09E-02**	**8,07E-01**	**0,00E+00**
Bark [MJ]						
Renewable fuel, total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Heat [MJ]						
Coke oven gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**

C.2 Energy demand [per 1000 litres of beverage]: 50 cl steel cans

	18. Avoided primary aluminium (database)	19. Trp	20. Lid production	21. Trp	22. Trp
Electricity, coal marginal [MJ]	-6,92E+01		3,88E+01		
Electricity [MJ]					
Hydropower [MJelectricity]					
Electricity, total [MJ at final use]	**-6,92E+01**	**0,00E+00**	**3,88E+01**	**0,00E+00**	**0,00E+00**
Coal [MJ]					
Coal, feedstock [MJ]					
Diesel, heavy & medium truck (highway) [MJ]	-2,47E-01	5,55E+00		4,32E-01	3,01E+00
Diesel, heavy & medium truck (rural) [MJ]					
Diesel, heavy & medium truck (urban) [MJ]					
Diesel, ship (4-stroke) [MJ]					9,54E-02
Fuel oil, ship (2-stroke) [MJ]	-9,73E+00	1,14E+00			
Fuel, unspecified [MJ]	-1,34E-04		7,49E-05		
Hard coal [MJ]					
Hard coal, feedstock [MJ]					
LPG, forklift [MJ]					
LPG, thermal [MJ]					
Natural gas (<100 kW) [MJ]					
Natural gas (>100 kW) [MJ]					
Natural gas [MJ]					
Natural gas, feedstock [MJ]					
Oil [MJ]					
Oil, feedstock [MJ]					
Oil, heavy fuel [MJ]					
Oil, heavy, feedstock [MJ]					
Oil, light fuel [MJ]					
Peat [MJ]					
Fossil fuel, total [MJ at final use]	**-9,97E+00**	**6,69E+00**	**7,49E-05**	**4,32E-01**	**3,10E+00**
Bark [MJ]					
Renewable fuel, total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Heat [MJ]					
Coke oven gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**

C.2 Energy demand [per 1000 litres of beverage]: 50 cl steel cans

	23. Corrugated board (Database)	24. Use of recycled fibres (Database)	25. Trp	26. Trp	27. Washing & filling
Electricity, coal marginal [MJ]	1,36E+01	1,25E+01			7,61E+00
Electricity [MJ]					
Hydropower [MJelectricity]					
Electricity, total [MJ at final use]	**1,36E+01**	**1,25E+01**	**0,00E+00**	**0,00E+00**	**7,61E+00**
Coal [MJ]					
Coal, feedstock [MJ]					
Diesel, heavy & medium truck (highway) [MJ]	1,56E+00	1,87E+00	1,09E-01	4,07E+01	
Diesel, heavy & medium truck (rural) [MJ]		-4,41E-02			
Diesel, heavy & medium truck (urban) [MJ]	2,72E+00	3,83E+00			
Diesel, ship (4-stroke) [MJ]	3,45E+00	9,36E+00		6,89E-01	
Fuel oil, ship (2-stroke) [MJ]					
Fuel, unspecified [MJ]	2,64E-05	2,41E-05			1,47E-05
Hard coal [MJ]	1,07E+00				
Hard coal, feedstock [MJ]					
LPG, forklift [MJ]	1,11E-01	-1,53E-01			
LPG, thermal [MJ]					
Natural gas (<100 kW) [MJ]					
Natural gas (>100 kW) [MJ]	5,31E+01	-3,55E+01			5,30E+01
Natural gas [MJ]					
Natural gas, feedstock [MJ]					
Oil [MJ]					
Oil, feedstock [MJ]					
Oil, heavy fuel [MJ]	1,66E+01	1,04E+01			
Oil, heavy, feedstock [MJ]					
Oil, light fuel [MJ]	2,18E+00	4,78E-02			
Peat [MJ]	4,04E+00	5,59E-01			
Fossil fuel, total [MJ at final use]	**8,49E+01**	**-9,66E+00**	**1,09E-01**	**4,14E+01**	**5,30E+01**
Bark [MJ]	2,51E+00	4,17E+00			
Renewable fuel, total [MJ at final use]	**2,51E+00**	**4,17E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Heat [MJ]	-1,10E+00	-1,73E+00			
Coke oven gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**-1,10E+00**	**-1,73E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**

C.2 Energy demand [per 1000 litres of beverage]: 50 cl steel cans

	28. Trp	29. Corrugated board incineration	30. Packaging	31. Secondary packaging	32. Trp
Electricity, coal marginal [MJ]		7,79E-02			
Electricity [MJ]					
Hydropower [MJelectricity]					
Electricity, total [MJ at final use]	**0,00E+00**	**7,79E-02**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Coal [MJ]					
Coal, feedstock [MJ]					
Diesel, heavy & medium truck (highway) [MJ]					
Diesel, heavy & medium truck (rural) [MJ]	1,84E-02				3,05E+00
Diesel, heavy & medium truck (urban) [MJ]					
Diesel, ship (4-stroke) [MJ]					
Fuel oil, ship (2-stroke) [MJ]					
Fuel, unspecified [MJ]		1,50E-07			
Hard coal [MJ]					
Hard coal, feedstock [MJ]					
LPG, forklift [MJ]					
LPG, thermal [MJ]					
Natural gas (<100 kW) [MJ]					
Natural gas (>100 kW) [MJ]					
Natural gas [MJ]					
Natural gas, feedstock [MJ]					
Oil [MJ]					
Oil, feedstock [MJ]					
Oil, heavy fuel [MJ]					
Oil, heavy, feedstock [MJ]					
Oil, light fuel [MJ]					
Peat [MJ]					
Fossil fuel, total [MJ at final use]	**1,84E-02**	**1,50E-07**	**0,00E+00**	**0,00E+00**	**3,05E+00**
Bark [MJ]					
Renewable fuel, total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Heat [MJ]					
Coke oven gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**

C.2 Energy demand [per 1000 litres of beverage]: 50 cl steel cans

	33. Cardboard (Database)	34. Trp	35. Cardboard box (6 cans)	36. Trp	37. Tray	38. Trp
Electricity, coal marginal [MJ]	1,30E+01					
Electricity [MJ]						
Hydropower [MJelectricity]						
Electricity, total [MJ at final use]	**1,30E+01**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Coal [MJ]						
Coal, feedstock [MJ]						
Diesel. heavy & medium truck (highway) [MJ]	1,63E+00	1,01E+00		1,01E+00		7,13E-01
Diesel. heavy & medium truck (rural) [MJ]						
Diesel. heavy & medium truck (urban) [MJ]	3,93E+00					
Diesel, ship (4-stroke) [MJ]	6,90E+00					
Fuel oil, ship (2-stroke) [MJ]						
Fuel, unspecified [MJ]	2,51E-05					
Hard coal [MJ]						
Hard coal, feedstock [MJ]						
LPG, forklift [MJ]						
LPG, thermal [MJ]						
Natural gas (<100 kW) [MJ]						
Natural gas (>100 kW) [MJ]	3,46E+00					
Natural gas [MJ]						
Natural gas, feedstock [MJ]						
Oil [MJ]						
Oil, feedstock [MJ]						
Oil, heavy fuel [MJ]	1,02E+01					
Oil, heavy, feedstock [MJ]						
Oil, light fuel [MJ]	5,01E-02					
Peat [MJ]	5,51E-01					
Fossil fuel, total [MJ at final use]	**2,67E+01**	**1,01E+00**	**0,00E+00**	**1,01E+00**	**0,00E+00**	**7,13E-01**
Bark [MJ]	4,11E+00					
Renewable fuel, total [MJ at final use]	**4,11E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Heat [MJ]	-1,70E+00					
Coke oven gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**-1,70E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**

C.2 Energy demand [per 1000 litres of beverage]: 50 cl steel cans

	39. Corrugated board box (24 cans)	40. LDPE	41. Trp	42. Foil	43. Trp	44. Ill-conc
Electricity, coal marginal [MJ]						
Electricity [MJ]		2,62E+00				
Hydropower [MJelectricity]		4,51E-01				
Electricity, total [MJ at final use]	**0,00E+00**	**3,07E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Coal [MJ]		2,74E+00				
Coal, feedstock [MJ]		8,35E-03				
Diesel, heavy & medium truck (highway) [MJ]			1,11E-01		5,70E-02	
Diesel, heavy & medium truck (rural) [MJ]						
Diesel, heavy & medium truck (urban) [MJ]						
Diesel, ship (4-stroke) [MJ]						
Fuel oil, ship (2-stroke) [MJ]						
Fuel, unspecified [MJ]						
Hard coal [MJ]						
Hard coal, feedstock [MJ]						
LPG, forklift [MJ]						
LPG, thermal [MJ]						
Natural gas (<100 kW) [MJ]						
Natural gas (>100 kW) [MJ]						
Natural gas [MJ]		1,03E+01				
Natural gas, feedstock [MJ]		2,76E+01				
Oil [MJ]		3,16E+00				
Oil, feedstock [MJ]		2,83E+01				
Oil, heavy fuel [MJ]						
Oil, heavy, feedstock [MJ]						
Oil, light fuel [MJ]						
Peat [MJ]						
Fossil fuel, total [MJ at final use]	**0,00E+00**	**7,21E+01**	**1,11E-01**	**0,00E+00**	**5,70E-02**	**0,00E+00**
Bark [MJ]						
Renewable fuel, total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Heat [MJ]						
Coke oven gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**

C.2 Energy demand [per 1000 litres of beverage]: 50 cl steel cans

	45. Planks for pallets (Database)	46. Trp	47. Pallet	48. Trp	49. Trp	50. Wood incineration	51. Energy use
Electricity, coal marginal [MJ]	6,27E-01					2,15E-01	
Electricity [MJ]							
Hydropower [MJelectricity]							
Electricity, total [MJ at final use]	**6,27E-01**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**2,15E-01**	**0,00E+00**
Coal [MJ]							
Coal, feedstock [MJ]							
Diesel, heavy & medium truck (highway) [MJ]	1,41E-01	8,00E-02					
Diesel, heavy & medium truck (rural) [MJ]				2,53E-01	5,06E-02		
Diesel, heavy & medium truck (urban) [MJ]	9,35E-01						
Diesel, ship (4-stroke) [MJ]	7,09E-02						
Fuel oil, ship (2-stroke) [MJ]							
Fuel, unspecified [MJ]	1,21E-06					4,15E-07	
Hard coal [MJ]							
Hard coal, feedstock [MJ]							
LPG, forklift [MJ]							
LPG, thermal [MJ]							
Natural gas (<100 kW) [MJ]							
Natural gas (>100 kW) [MJ]							
Natural gas [MJ]							
Natural gas, feedstock [MJ]							
Oil [MJ]							
Oil, feedstock [MJ]							
Oil, heavy fuel [MJ]							
Oil, heavy, feedstock [MJ]							
Oil, light fuel [MJ]	3,15E-01						
Peat [MJ]							
Fossil fuel, total [MJ at final use]	**1,46E+00**	**8,00E-02**	**0,00E+00**	**2,53E-01**	**5,06E-02**	**4,15E-07**	**0,00E+00**
Bark [MJ]	1,91E+00						
Renewable fuel, total [MJ at final use]	**1,91E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Heat [MJ]							
Coke oven gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**

C.2 Energy demand [per 1000 litres of beverage]: 50 cl steel cans

	52. Alt. energy production	53. Distribution	54. Retailer	55. Trp	56. Use (refrigeration)	57. Trp	58. Trp
Electricity, coal marginal [MJ]	-1,02E+00				1,72E+00		
Electricity [MJ]							
Hydropower [MJelectricity]							
Electricity, total [MJ at final use]	**-1,02E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**1,72E+00**	**0,00E+00**	**0,00E+00**
Coal [MJ]							
Coal, feedstock [MJ]							
Diesel, heavy & medium truck (highway) [MJ]		7,94E+01					
Diesel, heavy & medium truck (rural) [MJ]		8,01E+01					
Diesel, heavy & medium truck (urban) [MJ]		6,57E+01					
Diesel, ship (4-stroke) [MJ]							
Fuel oil, ship (2-stroke) [MJ]							
Fuel, unspecified [MJ]	-1,98E-06				3,32E-06		
Hard coal [MJ]							
Hard coal, feedstock [MJ]							
LPG, forklift [MJ]							
LPG, thermal [MJ]							
Natural gas (<100 kW) [MJ]							
Natural gas (>100 kW) [MJ]	-9,16E+00						
Natural gas [MJ]							
Natural gas, feedstock [MJ]							
Oil [MJ]							
Oil, feedstock [MJ]							
Oil, heavy fuel [MJ]							
Oil, heavy, feedstock [MJ]							
Oil, light fuel [MJ]	-1,37E+01						
Peat [MJ]							
Fossil fuel, total [MJ at final use]	**-2,29E+01**	**2,25E+02**	**0,00E+00**	**0,00E+00**	**3,32E-06**	**0,00E+00**	**0,00E+00**
Bark [MJ]							
Renewable fuel, total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Heat [MJ]							
Coke oven gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**

C.2 Energy demand [per 1000 litres of beverage]: 50 cl steel cans

	59. Trp	60. Trp	61. BOF recycling	62. Steel scrap market	63. Trp	64. Trp	65. New product
Electricity, coal marginal [MJ]*			1,99E+01				
Electricity [MJ]							
Hydropower [MJelectricity]							
Electricity, total [MJ at final use]	**0,00E+00**	**0,00E+00**	**1,99E+01**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Coal [MJ]							
Coal, feedstock [MJ]							
Diesel, heavy & medium truck (highway) [MJ]	1,46E+01	3,10E+00			2,15E+00	1,32E+01	
Diesel, heavy & medium truck (rural) [MJ]							
Diesel, heavy & medium truck (urban) [MJ]							
Diesel, ship (4-stroke) [MJ]							
Fuel oil, ship (2-stroke) [MJ]							
Fuel, unspecified [MJ]			3,84E-05				
Hard coal [MJ]							
Hard coal, feedstock [MJ]							
LPG, forklift [MJ]							
LPG, thermal [MJ]							
Natural gas (<100 kW) [MJ]			1,31E+01				
Natural gas (>100 kW) [MJ]							
Natural gas [MJ]							
Natural gas, feedstock [MJ]							
Oil [MJ]							
Oil, feedstock [MJ]							
Oil, heavy fuel [MJ]							
Oil, heavy, feedstock [MJ]							
Oil, light fuel [MJ]							
Peat [MJ]							
Fossil fuel, total [MJ at final use]	**1,46E+01**	**3,10E+00**	**1,31E+01**	**0,00E+00**	**2,15E+00**	**1,32E+01**	**0,00E+00**
Bark [MJ]							
Renewable fuel, total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Heat [MJ]							
Coke oven gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**

C.2 Energy demand [per 1000 litres of beverage]: 50 cl steel cans

	66. Avoided steel production (Database)	67. EAF recycling	68. Trp	69. Trp	70. Trp	71. Trp	72. Trp
Electricity, coal marginal [MJ]	-2,52E+01	6,66E-01					
Electricity [MJ]							
Hydropower [MJelectricity]							
Electricity, total [MJ at final use]	**-2,52E+01**	**6,66E-01**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Coal [MJ]							
Coal, feedstock [MJ]	-1,38E+03						
Diesel, heavy & medium truck (highway) [MJ]	-1,68E+01		1,19E-01	2,03E+00	8,72E-02	6,18E-02	8,72E-02
Diesel, heavy & medium truck (rural) [MJ]							
Diesel, heavy & medium truck (urban) [MJ]	-4,08E+00						
Diesel, ship (4-stroke) [MJ]							
Fuel oil, ship (2-stroke) [MJ]	-6,51E+01						
Fuel, unspecified [MJ]	-5,58E-05	1,33E-06					
Hard coal [MJ]	-3,76E+01	2,15E-01					
Hard coal, feedstock [MJ]							
LPG, forklift [MJ]							
LPG, thermal [MJ]							
Natural gas (<100 kW) [MJ]							
Natural gas (>100 kW) [MJ]	-6,80E-01	1,66E-01					
Natural gas [MJ]							
Natural gas, feedstock [MJ]							
Oil [MJ]							
Oil, feedstock [MJ]							
Oil, heavy fuel [MJ]	-2,04E+01						
Oil, heavy, feedstock [MJ]	-3,90E+01						
Oil, light fuel [MJ]	-8,92E+00						
Peat [MJ]							
Fossil fuel, total [MJ at final use]	**-1,57E+03**	**3,81E-01**	**1,19E-01**	**2,03E+00**	**8,72E-02**	**6,18E-02**	**8,72E-02**
Bark [MJ]							
Renewable fuel, total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Heat [MJ]							
Coke oven gas [MJ]	6,58E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	4,03E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**1,06E+02**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**

C.2 Energy demand [per 1000 litres of beverage]: 50 cl steel cans

	73. Testliner	74. New product	75. Avoided kraftliner (Database)	76. Other products	77. Avoided testliner
Electricity, coal marginal [MJ]	5,22E-01		-5,17E+00		-1,04E-01
Electricity [MJ]					
Hydropower [MJelectricity]					
Electricity, total [MJ at final use]	**5,22E-01**	**0,00E+00**	**-5,17E+00**	**0,00E+00**	**-1,04E-01**
Coal [MJ]					
Coal, feedstock [MJ]					
Diesel, heavy & medium truck (highway) [MJ]			-6,47E-01		
Diesel, heavy & medium truck (rural) [MJ]					
Diesel, heavy & medium truck (urban) [MJ]	4,98E-02		1,44E+00		-9,95E-03
Diesel, ship (4-stroke) [MJ]			-2,74E+00		
Fuel oil, ship (2-stroke) [MJ]					
Fuel, unspecified [MJ]	1,01E-06		-9,99E-06		-2,02E-07
Hard coal [MJ]					
Hard coal, feedstock [MJ]					
LPG, forklift [MJ]	7,46E-02				-1,49E-02
LPG, thermal [MJ]					
Natural gas (<100 kW) [MJ]					
Natural gas (>100 kW) [MJ]	1,91E+01		-1,37E+00		-3,82E+00
Natural gas [MJ]					
Natural gas, feedstock [MJ]					
Oil [MJ]					
Oil, feedstock [MJ]					
Oil, heavy fuel [MJ]			-4,06E+00		
Oil, heavy, feedstock [MJ]					
Oil, light fuel [MJ]	1,49E-03		-1,99E-02		-2,99E-04
Peat [MJ]			-2,19E-01		
Fossil fuel, total [MJ at final use]	**1,92E+01**	**0,00E+00**	**-7,62E+00**	**0,00E+00**	**-3,84E+00**
Bark [MJ]			-1,63E+00		
Renewable fuel, total [MJ at final use]	**0,00E+00**	**0,00E+00**	**-1,63E+00**	**0,00E+00**	**0,00E+00**
Heat [MJ]			6,77E-01		
Coke oven gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**0,00E+00**	**0,00E+00**	**6,77E-01**	**0,00E+00**	**0,00E+00**

C.2 Energy demand [per 1000 litres of beverage]: 50 cl steel cans

	78. Landfill-corrugated board	79. Trp	80. Waste management	81. Cardboard/corrugated board inciner.
Electricity, coal marginal [MJ]	3,80E-04			1,95E+00
Electricity [MJ]				
Hydropower [MJelectricity]				
Electricity, total [MJ at final use]	**3,80E-04**	**0,00E+00**	**0,00E+00**	**1,95E+00**
Coal [MJ]				
Coal, feedstock [MJ]				
Diesel, heavy & medium truck (highway) [MJ]				
Diesel, heavy & medium truck (rural) [MJ]		8,39E-01		
Diesel, heavy & medium truck (urban) [MJ]	1,90E-02			
Diesel, ship (4-stroke) [MJ]				
Fuel oil, ship (2-stroke) [MJ]				
Fuel, unspecified [MJ]	7,33E-10			3,77E-06
Hard coal [MJ]				
Hard coal, feedstock [MJ]				
LPG, forklift [MJ]				
LPG, thermal [MJ]				
Natural gas (<100 kW) [MJ]				
Natural gas (>100 kW) [MJ]				
Natural gas [MJ]				
Natural gas, feedstock [MJ]				
Oil [MJ]				
Oil, feedstock [MJ]				
Oil, heavy fuel [MJ]				
Oil, heavy, feedstock [MJ]				
Oil, light fuel [MJ]				
Peat [MJ]				
Fossil fuel, total [MJ at final use]	**1,90E-02**	**8,39E-01**	**0,00E+00**	**3,77E-06**
Bark [MJ]				
Renewable fuel, total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Heat [MJ]				
Coke oven gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**

C.2 Energy demand [per 1000 litres of beverage]: 50 cl steel cans

	82. Aluminium incineration	83. PE incineration	84. Tinplate incineration	85. Trp	86. EAF recycling
Electricity, coal marginal [MJ]	1,01E-01	1,51E-01	1,35E+00		5,61E+00
Electricity [MJ]					
Hydropower [MJelectricity]					
Electricity, total [MJ at final use]	**1,01E-01**	**1,51E-01**	**1,35E+00**	**0,00E+00**	**5,61E+00**
Coal [MJ]					
Coal, feedstock [MJ]					
Diesel, heavy & medium truck (highway) [MJ]				9,39E-01	
Diesel, heavy & medium truck (rural) [MJ]					
Diesel, heavy & medium truck (urban) [MJ]					
Diesel, ship (4-stroke) [MJ]					
Fuel oil, ship (2-stroke) [MJ]					
Fuel, unspecified [MJ]	1,95E-07	2,92E-07			1,11E-05
Hard coal [MJ]					1,70E+00
Hard coal, feedstock [MJ]					
LPG, forklift [MJ]					
LPG, thermal [MJ]					
Natural gas (<100 kW) [MJ]					
Natural gas (>100 kW) [MJ]					1,31E+00
Natural gas [MJ]					
Natural gas, feedstock [MJ]					
Oil [MJ]					
Oil, feedstock [MJ]					
Oil, heavy fuel [MJ]					
Oil, heavy, feedstock [MJ]					
Oil, light fuel [MJ]					
Peat [MJ]					
Fossil fuel, total [MJ at final use]	**1,95E-07**	**2,92E-07**	**0,00E+00**	**9,39E-01**	**3,01E+00**
Bark [MJ]					
Renewable fuel, total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**
Heat [MJ]					
Coke oven gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
BF-gas [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Heat etc., total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**

C.2 Energy demand [per 1000 litres of beverage]: 50 cl steel cans

	87. New product	88. Avoided steel production (Database)	89. Energy use	90. Alt. energy production	Total
Electricity, coal marginal [MJ]		-1,78E+00		-8,25E+00	8,41E+02
Electricity [MJ]					3,81E+00
Hydropower [MJelectricity]					4,51E-01
Electricity, total [MJ at final use]	**0,00E+00**	**-1,78E+00**	**0,00E+00**	**-8,25E+00**	**8,45E+02**
Coal [MJ]					4,24E+00
Coal, feedstock [MJ]		-9,75E+01			-1,48E+03
Diesel, heavy & medium truck (highway) [MJ]		-1,19E+00			1,81E+02
Diesel, heavy & medium truck (rural) [MJ]					8,43E+01
Diesel, heavy & medium truck (urban) [MJ]		-2,88E-01			7,89E+01
Diesel, ship (4-stroke) [MJ]					1,78E+01
Fuel oil, ship (2-stroke) [MJ]		-4,61E+00			5,29E+01
Fuel, unspecified [MJ]		-3,94E-06		-1,59E-05	1,93E-03
Hard coal [MJ]		-2,66E+00			6,71E+00
Hard coal, feedstock [MJ]					1,59E+03
LPG, forklift [MJ]					1,82E-02
LPG, thermal [MJ]					8,07E-01
Natural gas (<100 kW) [MJ]					1,31E+01
Natural gas (>100 kW) [MJ]		-4,81E-02		-7,37E+01	7,60E+02
Natural gas [MJ]					3,31E+01
Natural gas, feedstock [MJ]					9,59E+01
Oil [MJ]					1,44E+01
Oil, feedstock [MJ]					9,85E+01
Oil, heavy fuel [MJ]		-1,44E+00			7,04E+01
Oil, heavy, feedstock [MJ]		-2,76E+00			4,41E+01
Oil, light fuel [MJ]		-6,31E-01		-1,11E+02	-1,03E+02
Peat [MJ]					4,93E+00
Fossil fuel, total [MJ at final use]	**0,00E+00**	**-1,11E+02**	**0,00E+00**	**-1,84E+02**	**1,57E+03**
Bark [MJ]					1,11E+01
Renewable fuel, total [MJ at final use]	**0,00E+00**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**1,11E+01**
Heat [MJ]					-3,85E+00
Coke oven gas [MJ]	0,00E+00	4,65E+00	0,00E+00	0,00E+00	7,17E+01
BF-gas [MJ]	0,00E+00	2,85E+00	0,00E+00	0,00E+00	4,39E+01
Heat etc., total [MJ at final use]	**0,00E+00**	**7,50E+00**	**0,00E+00**	**0,00E+00**	**1,12E+02**

C.2 Energy demand [per 1000 litres of beverage]: 50 cl steel cans

		Packaging system	Effects on other life cycles	Total
Electricity, coal marginal [MJ]		9,20E+02	-7,93E+01	8,41E+02
Electricity [MJ]		3,81E+00	0,00E+00	3,81E+00
Hydropower [MJelectricity]		4,51E-01	0,00E+00	4,51E-01
Electricity, total [MJ at final use]		**9,24E+02**	**-7,93E+01**	**8,45E+02**
Coal [MJ]		4,24E+00	0,00E+00	4,24E+00
Coal, feedstock [MJ]		2,94E-02	-1,48E+03	-1,48E+03
Diesel, heavy & medium truck (highway) [MJ]		1,65E+02	1,55E+01	1,81E+02
Diesel, heavy & medium truck (rural) [MJ]		8,43E+01	0,00E+00	8,43E+01
Diesel, heavy & medium truck (urban) [MJ]		8,19E+01	-2,94E+00	7,89E+01
Diesel, ship (4-stroke) [MJ]		2,06E+01	-2,74E+00	1,78E+01
Fuel oil, ship (2-stroke) [MJ]		1,34E+02	-8,07E+01	5,29E+01
Fuel, unspecified [MJ]		2,09E-03	-1,66E-04	1,93E-03
Hard coal [MJ]		4,52E+01	-3,85E+01	6,71E+00
Hard coal, feedstock [MJ]		1,62E+03	-2,53E+01	1,59E+03
LPG, forklift [MJ]		-4,20E-02	5,97E-02	1,77E-02
LPG, thermal [MJ]		0,00E+00	8,07E-01	8,07E-01
Natural gas (<100 kW) [MJ]		0,00E+00	1,31E+01	1,31E+01
Natural gas (>100 kW) [MJ]		8,28E+02	-6,83E+01	7,60E+02
Natural gas [MJ]		3,31E+01	0,00E+00	3,31E+01
Natural gas, feedstock [MJ]		9,59E+01	0,00E+00	9,59E+01
Oil [MJ]		1,44E+01	0,00E+00	1,44E+01
Oil, feedstock [MJ]		9,85E+01	0,00E+00	9,85E+01
Oil, heavy fuel [MJ]		9,67E+01	-2,63E+01	7,04E+01
Oil, heavy, feedstock [MJ]		8,65E+01	-4,25E+01	4,41E+01
Oil, light fuel [MJ]		3,11E+01	-1,34E+02	-1,03E+02
Peat [MJ]		5,15E+00	-2,19E-01	4,93E+00
Fossil fuel, total [MJ at final use]		**3,44E+03**	**-1,87E+03**	**1,58E+03**
Bark [MJ]		1,27E+01	-1,63E+00	1,11E+01
Renewable fuel, total [MJ at final use]		**1,27E+01**	**-1,63E+00**	**1,11E+01**
Heat [MJ]		-4,53E+00	6,77E-01	-3,85E+00
Coke oven gas [MJ]		0,00E+00	7,17E+01	7,17E+01
BF-gas [MJ]		0,00E+00	4,39E+01	4,39E+01
Heat etc., total [MJ at final use]		**-4,53E+00**	**1,16E+02**	**1,12E+02**

D.1 Inventory results for important air emissions [per 1000 litres of beverage]: 33 cl steel cans

Inventory results per 1000 litres	91. Other products	92. Avoided iron production	1. Tinplate cans, 33 cl	2. Lime	3. Trp	4. Limestone	5. Trp	6. Tin
CO2		-2,72E+03	3,12E+05	9,51E+03	5,34E+02	1,13E+02	7,41E+02	4,00E+03
CO2 relative	0,00%	-0,68%	78,39%	2,39%	0,13%	0,03%	0,19%	1,01%
SO2		-5,72E+00	4,16E+02	2,85E+01	8,21E-01	1,78E-01	1,14E+00	5,73E+00
SO2 relative	0,00%	-0,54%	39,59%	2,72%	0,08%	0,02%	0,11%	0,55%
NOx		-6,91E+00	5,66E+02	1,55E+01	2,27E+00	2,27E-01	3,15E+00	7,99E+00
NOx relative	0,00%	-0,46%	37,76%	1,03%	0,15%	0,02%	0,21%	0,53%
NMVOC:s								
NMVOC		-9,35E-02	1,25E+01	2,19E+00	3,03E-01	7,74E-02	4,20E-01	4,09E+00
NMVOC, diesel engines		-1,86E-01	6,90E+00	1,27E-01	1,33E-01	1,97E-03	1,84E-01	7,06E-02
NMVOC, el-coal		-2,56E-03	1,86E+00	1,19E-02	8,23E-03	1,17E-03	1,14E-02	4,64E-02
NMVOC, natural gas combustion								
NMVOC, oil combustion		-5,80E-01	2,93E+01					
NMVOC, petrol engines		-9,59E-12	9,38E-10	1,81E-11	1,60E-12	2,55E-13	2,22E-12	9,01E-12
NMVOC, power plants		-2,70E-02	2,51E+00	5,03E-02	3,97E-03	6,43E-04	5,51E-03	2,24E-02
Total NMVOC	0,00E+00	-8,89E-01	5,31E+01	2,37E+00	4,48E-01	8,12E-02	6,21E-01	4,23E+00
Total NMVOC relative	0,00%	-0,51%	30,54%	1,37%	0,26%	0,05%	0,36%	2,43%
VOC:s								
HC		-1,55E-01	4,18E+01	2,92E-01	2,45E-02	3,93E-03	3,40E-02	1,38E-01
VOC		-3,31E-04		8,43E-02		1,44E-04		
VOC, coal combustion		-1,50E-03	1,40E-01	2,80E-03	2,14E-04	3,49E-05	2,98E-04	1,21E-03
VOC, diesel engines		-3,56E-02	3,48E+00	6,70E-02	5,92E-03	9,46E-04	8,22E-03	3,34E-02
VOC, natural gas combustion		-1,00E-10	9,83E-09	1,89E-10	1,67E-11	2,67E-12	2,32E-11	9,43E-11
Total VOC	0,00E+00	-1,92E-01	4,54E+01	4,46E-01	3,06E-02	-5,05E-03	4,25E-02	1,73E-01
Total VOC relative	0,00%	-0,21%	48,39%	0,48%	0,03%	0,01%	0,05%	0,18%
"Other specified hydrocarbons"								
Acetaldehyde		-6,15E-09	1,68E-04	6,60E-07		2,30E-07		
Acetylene		-9,80E-05		2,49E-02		5,70E-05		8,00E-04
Aldehydes		-3,76E-05	3,49E-03	7,01E-05	5,35E-06	8,71E-07	7,43E-06	3,02E-05
Alkanes		-3,96E-04	2,17E-02	3,52E-02		4,18E-04		2,00E-02
Alkenes		-1,12E-04	1,08E-03	2,54E-02		7,20E-05		1,60E-03
Aromates (C9-C10)		-6,01E-04	5,55E-02	1,85E-03	7,84E-05	4,28E-05	1,09E-04	2,04E-03
Butane		-4,30E-06	1,17E-01	4,62E-04		1,61E-04		
CH4		-1,50E+01	1,39E+03	2,89E+01	2,28E+00	3,86E-01	3,17E+00	1,40E+01
Ethane		-2,92E-04		7,44E-02		1,56E-04		1,60E-03
Ethene		-5,86E-04		1,49E-01		3,27E-04		4,00E-03
Formaldehyde		-2,05E-04	3,30E-02	4,25E-03		3,87E-05		4,80E-04
PAH		-3,67E-07	1,70E-03	1,16E-05	1,07E-08	2,47E-06	1,49E-08	9,26E-06
Pentane		-7,38E-06	2,01E-01	7,91E-04		2,76E-04		
Propane		-2,11E-04	3,45E-02	5,04E-02		1,75E-04		2,40E-03
Propene		-1,00E-04		2,54E-02		7,20E-05		1,60E-03
Xylene		-1,93E-05		4,90E-03		8,39E-06		
Total "other"	0,00E+00	-1,50E+01	1,39E+03	2,93E+01	2,28E+00	3,88E-01	3,17E+00	1,41E+01
Total "other" relative	0,00%	-0,70%	64,95%	1,37%	0,11%	0,02%	0,15%	0,66%

D.1 Inventory results for important air emissions [per 1000 litres of beverage]: 33 cl steel cans

Inventory results per 1000 litres	7. Trp	8. H2SO4	9. Trp	10. Iron ore extraction	11. Trp	12. Primary aluminium	13. Trp	14. Strip rolling	15. Trp
CO2 *	2,77E+01		1,87E+01	6,73E+03	1,89E+04	1,90E+05	5,27E+02	9,20E+03	7,75E+00
CO2 relative	0,01%	0,00%	0,00%	1,69%	4,75%	47,74%	0,13%	2,31%	0,00%
SO2	1,86E-01	1,34E+01	2,09E-02	1,76E+01	1,50E+02	7,10E+02	9,34E-01	1,27E+01	1,55E-02
SO2 relative	0,02%	1,27%	0,00%	1,68%	14,29%	67,64%	0,09%	1,21%	0,00%
NOx	3,52E-01		1,78E-01	2,08E+01	2,25E+02	6,06E+02	5,32E+00	2,18E+01	7,98E-02
NOx relative	0,02%	0,00%	0,01%	1,39%	15,03%	40,38%	0,35%	1,46%	0,01%
NMVOC:s									
NMVOC	2,73E-02		4,56E-02	1,09E+00	3,76E+00	4,35E-01	1,23E+00	4,30E-02	1,78E-02
NMVOC, diesel engines	1,71E-02		1,81E-02	1,02E+00	6,76E+00	9,33E+00	5,02E-01	2,33E-01	7,34E-03
NMVOC, el-coal	1,39E-04			7,65E-02	1,91E-01	2,78E+00		1,53E-01	
NMVOC, natural gas combustion									
NMVOC, oil combustion	2,40E-02			6,16E+00	1,96E+01	1,94E+01	5,50E-02		1,08E-03
NMVOC, petrol engines	2,70E-14			1,49E-11	3,72E-11	5,40E-10		2,98E-11	
NMVOC, power plants	6,72E-05			3,69E-02	9,24E-02	1,34E+00		7,40E-02	
Total NMVOC	6,86E-02	0,00E+00	6,37E-02	8,38E+00	3,04E+01	3,33E+01	1,79E+00	5,03E-01	2,62E-02
Total NMVOC relative	0,04%	0,00%	0,04%	4,82%	17,51%	19,16%	1,03%	0,29%	0,02%
VOC:s									
HC	4,14E-04			2,28E-01	5,69E-01	8,27E+00		4,56E-01	
VOC						6,55E+00		4,00E+00	
VOC, coal combustion	3,63E-06			2,00E-03	4,99E-03	7,25E-02		4,00E-03	
VOC, diesel engines	1,00E-04			5,51E-02	1,38E-01	2,00E+00		1,10E-01	
VOC, natural gas combustion	2,83E-13			1,56E-10	3,89E-10	5,65E-09		3,12E-10	
Total VOC	5,18E-04	0,00E+00	0,00E+00	2,85E-01	7,12E-01	1,69E+01	0,00E+00	4,57E+00	0,00E+00
Total VOC relative	0,00%	0,00%	0,00%	0,30%	0,76%	18,01%	0,00%	4,87%	0,00%
"Other specified hydrocarbons"									
Acetaldehyde								2,53E-05	
Acetylene									
Aldehydes	9,06E-08			4,98E-05	1,25E-04	1,81E-03		9,98E-05	
Alkanes				1,60E-02					
Alkenes				8,00E-04					
Aromates (C9-C10)	1,33E-06			4,73E-03	1,82E-03	2,65E-02		1,46E-03	
Butane								1,77E-02	
CH4	6,22E-02		2,36E-02	2,35E+01	6,13E+01	7,29E+02	6,62E-01	3,97E+01	9,74E-03
Ethane									
Ethene									
Formaldehyde				1,20E-02				2,53E-03	
PAH	1,81E-10			1,34E-05	2,49E-07	5,29E-01		2,53E-04	
Pentane								3,03E-02	
Propane				8,00E-04				5,05E-03	
Propene									
Xylene									
Total "other"	6,22E-02	0,00E+00	2,36E-02	2,36E+01	6,13E+01	7,30E+02	6,62E-01	3,98E+01	9,74E-03
Total "other" relative	0,00%	0,00%	0,00%	1,10%	2,86%	34,08%	0,03%	1,86%	0,00%

D.1 Inventory results for important air emissions [per 1000 litres of beverage]: 33 cl steel cans

Inventory results per 1000 litres	16. Remelting	17. New product	18. Avoided primary aluminium	19. Trp	20. Lid production	21. Trp	22. Trp
CO2	1,92E+03		-3,31E+04	8,61E+02	1,35E+04	5,47E+01	3,93E+02
CO2 relative	0,48%	0,00%	-8,32%	0,22%	3,39%	0,01%	0,10%
SO2	3,16E+00		-1,24E+02	3,46E+00	2,26E+01	6,11E-02	4,42E-01
SO2 relative	0,30%	0,00%	-11,80%	0,33%	2,15%	0,01%	0,04%
NOx	5,28E+00		-1,06E+02	1,04E+01	3,60E+01	5,21E-01	3,82E+00
NOx relative	0,35%	0,00%	-7,05%	0,70%	2,40%	0,03%	0,25%
NMVOC:s							
NMVOC			-7,59E-02	1,71E+00		1,33E-01	9,56E-01
NMVOC, diesel engines	5,56E-02		-1,63E+00	7,79E-01	4,14E-01	5,29E-02	3,76E-01
NMVOC, el-coal	3,65E-02		-4,85E-01		2,72E-01		
NMVOC, natural gas combustion	4,26E-03						
NMVOC, oil combustion	2,81E-01		-3,39E+00	3,97E-01			
NMVOC, petrol engines	7,09E-12		-9,42E-11		5,28E-11		
NMVOC, power plants	1,76E-02		-2,34E-01		1,31E-01		
Total NMVOC	3,95E-01	0,00E+00	-5,82E+00	2,89E+00	8,17E-01	1,86E-01	1,33E+00
Total NMVOC relative	0,23%	0,00%	-3,34%	1,66%	0,47%	0,11%	0,77%
VOC:s							
HC	1,09E-01		-1,44E+00		8,09E-01		
VOC			-1,14E+00				
VOC, coal combustion	9,52E-04		-1,27E-02		7,09E-03		
VOC, diesel engines	2,63E-02		-3,49E-01		1,96E-01		
VOC, natural gas combustion	7,42E-11		-9,86E-10		5,53E-10		
Total VOC	1,36E-01	0,00E+00	-2,95E+00	0,00E+00	1,01E+00	0,00E+00	0,00E+00
Total VOC relative	0,15%	0,00%	-3,14%	0,00%	1,08%	0,00%	0,00%
"Other specified hydrocarbons"							
Acetaldehyde							
Acetylene							
Aldehydes	2,38E-05		-3,16E-04		1,77E-04		
Alkanes							
Alkenes							
Aromates (C9-C10)	3,48E-04		-4,62E-03		2,59E-03		
Butane							
CH4	9,59E+00		-1,27E+02	1,08E+00	7,03E+01	6,88E-02	4,93E-01
Ethane							
Ethene							
Formaldehyde							
PAH	4,76E-08		-9,23E-02		3,55E-07		
Pentane							
Propane							
Propene							
Xylene							
Total "other"	9,59E+00	0,00E+00	-1,27E+02	1,08E+00	7,03E+01	6,88E-02	4,93E-01
Total "other" relative	0,45%	0,00%	-5,95%	0,05%	3,29%	0,00%	0,02%

D.1 Inventory results for important air emissions [per 1000 litres of beverage]: 33 cl steel cans

Inventory results per 1000 litres	23. Corrugated board	24. Use of recycled fibres	25. Trp	26. Trp	27. Washing & filling	28. Trp
CO2	1,26E+04	4,07E+03	1,37E+01	3,68E+03	5,04E+03	2,31E+00
CO2 relative	3,17%	1,02%	0,00%	0,92%	1,27%	0,00%
SO2	2,66E+01	1,46E+01	1,53E-02	4,13E+00	2,96E+00	2,58E-03
SO2 relative	2,53%	1,39%	0,00%	0,39%	0,28%	0,00%
NOx	3,91E+01	3,61E+01	1,31E-01	3,55E+01	7,93E+00	2,20E-02
NOx relative	2,61%	2,40%	0,01%	2,36%	0,53%	0,00%
NMVOC:s						
NMVOC	2,94E+00	4,19E+00	3,34E-02	8,96E+00	8,99E-02	5,62E-03
NMVOC, diesel engines	1,17E+00	1,96E+00	1,33E-02	3,54E+00	5,35E-02	2,23E-03
NMVOC, el-coal	8,78E-02	8,06E-02			3,52E-02	
NMVOC, natural gas combustion						
NMVOC, oil combustion	5,38E+00	3,29E+00				
NMVOC, petrol engines	1,75E-11	1,56E-11			6,83E-12	
NMVOC, power plants	4,37E-02	3,89E-02			1,70E-02	
Total NMVOC	9,62E+00	9,56E+00	4,67E-02	1,25E+01	1,96E-01	7,85E-03
Total NMVOC relative	5,53%	5,49%	0,03%	7,19%	0,11%	0,00%
VOC:s						
HC	2,69E-01	2,40E-01			1,05E-01	
VOC						
VOC, coal combustion	2,36E-03	2,10E-03			9,18E-04	
VOC, diesel engines	6,49E-02	5,80E-02			2,53E-02	
VOC, natural gas combustion	1,83E-10	1,64E-10			7,15E-11	
Total VOC	3,36E-01	3,00E-01	0,00E+00	0,00E+00	1,31E-01	0,00E+00
Total VOC relative	0,36%	0,32%	0,00%	0,00%	0,14%	0,00%
"Other specified hydrocarbons"						
Acetaldehyde	5,69E-06				5,29E-05	
Acetylene	1,01E-05					
Aldehydes	5,90E-05	5,24E-05			2,29E-05	
Alkanes	1,03E-02					
Alkenes	5,21E-04					
Aromates (C9-C10)	3,39E-03	7,68E-04			3,35E-04	
Butane	3,98E-03				3,70E-02	
CH4	2,78E+01	-1,36E+02	1,73E-02	4,63E+00	9,32E+00	2,90E-03
Ethane	2,02E-05					
Ethene	5,06E-05					
Formaldehyde	8,08E-03				5,29E-03	
PAH	6,55E-05	1,05E-07			5,29E-04	
Pentane	6,83E-03				6,34E-02	
Propane	1,67E-03				1,06E-02	
Propene	2,02E-05					
Xylene						
Total "other"	2,78E+01	-1,36E+02	1,73E-02	4,63E+00	9,43E+00	2,90E-03
Total "other" relative	1,30%	-6,33%	0,00%	0,22%	0,44%	0,00%

D.1 Inventory results for important air emissions [per 1000 litres of beverage]: 33 cl steel cans

Inventory results per 1000 litres	29. Corrugated board incineration	30. Packaging	31. Secondary packaging	32. Trp	33. Cardboard	34. Trp
CO2	2,70E+01			3,45E+02	6,65E+03	1,06E+02
CO2 relative	0,01%	0,00%	0,00%	0,09%	1,67%	0,03%
SO2	4,50E-02			3,85E-01	1,38E+01	1,18E-01
SO2 relative	0,00%	0,00%	0,00%	0,04%	1,32%	0,01%
NOx	8,52E-01			3,28E+00	3,39E+01	1,01E+00
NOx relative	0,06%	0,00%	0,00%	0,22%	2,26%	0,07%
NMVOC:s						
NMVOC				8,39E-01	3,21E+00	2,58E-01
NMVOC, diesel engines	8,26E-04			3,33E-01	1,58E+00	1,02E-01
NMVOC, el-coal	5,43E-04				7,59E-02	
NMVOC, natural gas combustion						
NMVOC, oil combustion					2,97E+00	
NMVOC, petrol engines	1,05E-13				1,47E-11	
NMVOC, power plants	2,62E-04				3,67E-02	
Total NMVOC	1,63E-03	0,00E+00	0,00E+00	1,17E+00	7,86E+00	3,60E-01
Total NMVOC relative	0,00%	0,00%	0,00%	0,67%	4,52%	0,21%
VOC:s						
HC	1,61E-03				2,26E-01	
VOC						
VOC, coal combustion	1,42E-05				1,98E-03	
VOC, diesel engines	3,91E-04				5,47E-02	
VOC, natural gas combustion	1,10E-12				1,54E-10	
Total VOC	2,02E-03	0,00E+00	0,00E+00	0,00E+00	2,83E-01	0,00E+00
Total VOC relative	0,00%	0,00%	0,00%	0,00%	0,30%	0,00%
"Other specified hydrocarbons"						
Acetaldehyde						
Acetylene						
Aldehydes	3,53E-07				4,94E-05	
Alkanes						
Alkenes						
Aromates (C9-C10)	5,17E-06				7,23E-04	
Butane						
CH4	1,40E-01			4,33E-01	2,28E+01	1,33E-01
Ethane						
Ethene						
Formaldehyde						
PAH	7,08E-10				9,90E-08	
Pentane						
Propane						
Propene						
Xylene						
Total "other"	1,40E-01	0,00E+00	0,00E+00	4,33E-01	2,28E+01	1,33E-01
Total "other" relative	0,01%	0,00%	0,00%	0,02%	1,06%	0,01%

D.1 Inventory results for important air emissions [per 1000 litres of beverage]: 33 cl steel cans

Inventory results per 1000 litres	35. Cardboard box (6 cans)	36. Trp	37. Tray	38. Trp	39. Corrugated board box (24 cans)	40. LDPE	41. Trp	42. Foil
CO2		1,27E+02		7,21E+01		1,57E+03	1,40E+01	
CO2 relative	0,00%	0,03%	0,00%	0,02%	0,00%	0,39%	0,00%	0,00%
SO2		1,42E-01		8,05E-02		1,13E+01	1,56E-02	
SO2 relative	0,00%	0,01%	0,00%	0,01%	0,00%	1,08%	0,00%	0,00%
NOx		1,21E+00		6,86E-01		1,51E+01	1,33E-01	
NOx relative	0,00%	0,08%	0,00%	0,05%	0,00%	1,01%	0,01%	0,00%
NMVOC:s								
NMVOC		3,10E-01		1,76E-01			3,41E-02	
NMVOC, diesel engines		1,23E-01		6,97E-02			1,35E-02	
NMVOC, el-coal								
NMVOC, natural gas combustion								
NMVOC, oil combustion								
NMVOC, petrol engines								
NMVOC, power plants								
Total NMVOC	0,00E+00	4,33E-01	0,00E+00	2,46E-01	0,00E+00	0,00E+00	4,76E-02	0,00E+00
Total NMVOC relative	0,00%	0,25%	0,00%	0,14%	0,00%	0,00%	0,03%	0,00%
VOC:s								
HC						2,64E+01		
VOC								
VOC, coal combustion								
VOC, diesel engines								
VOC, natural gas combustion								
Total VOC	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,64E+01	0,00E+00	0,00E+00
Total VOC relative	0,00%	0,00%	0,00%	0,00%	0,00%	28,20%	0,00%	0,00%
"Other specified hydrocarbons"								
Acetaldehyde								
Acetylene								
Aldehydes								
Alkanes								
Alkenes								
Aromates (C9-C10)								
Butane								
CH4		1,60E-01		9,07E-02			1,76E-02	
Ethane								
Ethene								
Formaldehyde								
PAH								
Pentane								
Propane								
Propene								
Xylene								
Total "other"	0,00E+00	1,60E-01	0,00E+00	9,07E-02	0,00E+00	0,00E+00	1,76E-02	0,00E+00
Total "other" relative	0,00%	0,01%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%

D.1 Inventory results for important air emissions [per 1000 litres of beverage]: 33 cl steel cans

Inventory results per 1000 litres	43. Trp	44. Hi-cone	45. Planks for pallets	46. Trp	47. Pallet	48. Trp	49. Trp	50. Wood incineration	51. Energy use
CO2	7,21E+00		3,14E+02	7,87E+00		2,49E+01	4,98E+00	5,83E+01	
CO2 relative	0,00%	0,00%	0,08%	0,00%	0,00%	0,01%	0,00%	0,01%	0,00%
SO2	8,05E-03		4,79E-01	8,79E-03		2,78E-02	5,56E-03	9,71E-02	
SO2 relative	0,00%	0,00%	0,05%	0,00%	0,00%	0,00%	0,00%	0,01%	0,00%
NOx	6,86E-02		1,92E+00	7,49E-02		2,37E-01	4,74E-02	1,84E+00	
NOx relative	0,00%	0,00%	0,13%	0,00%	0,00%	0,02%	0,00%	0,12%	0,00%
NMVOC:s									
NMVOC	1,76E-02		3,50E-01	1,92E-02		6,06E-02	1,21E-02		
NMVOC, diesel engines	6,97E-03		2,10E-01	7,60E-03		2,41E-02	4,81E-03	1,78E-03	
NMVOC, el-coal			3,41E-03					1,17E-03	
NMVOC, natural gas combustion									
NMVOC, oil combustion									
NMVOC, petrol engines			6,63E-13					2,27E-13	
NMVOC, power plants			1,65E-03					5,65E-04	
Total NMVOC	2,46E-02	0,00E+00	5,65E-01	2,68E-02	0,00E+00	8,47E-02	1,69E-02	3,52E-03	0,00E+00
Total NMVOC relative	0,01%	0,00%	0,32%	0,02%	0,00%	0,05%	0,01%	0,00%	0,00%
VOC:s									
HC			8,10E-01					3,48E-03	
VOC									
VOC, coal combustion			8,90E-05					3,05E-05	
VOC, diesel engines			2,46E-03					8,42E-04	
VOC, natural gas combustion			6,94E-12					2,38E-12	
Total VOC	0,00E+00	0,00E+00	8,13E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	4,35E-03	0,00E+00
Total VOC relative	0,00%	0,00%	0,87%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
"Other specified hydrocarbons"									
Acetaldehyde									
Acetylene			1,49E-05						
Aldehydes			2,22E-06					7,62E-07	
Alkanes			3,70E-04						
Alkenes			2,96E-05						
Aromates (C9-C10)			6,21E-05					1,11E-05	
Butane									
CH4	9,07E-03		1,07E+00	9,90E-03		3,13E-02	6,26E-03	3,03E-01	
Ethane			2,96E-05						
Ethene			7,40E-05						
Formaldehyde			8,88E-06						
PAH			1,74E-07					1,53E-09	
Pentane									
Propane			4,44E-05						
Propene			2,96E-05						
Xylene									
Total "other"	9,07E-03	0,00E+00	1,07E+00	9,90E-03	0,00E+00	3,13E-02	6,26E-03	3,03E-01	0,00E+00
Total "other" relative	0,00%	0,00%	0,05%	0,00%	0,00%	0,00%	0,00%	0,01%	0,00%

D.1 Inventory results for important air emissions [per 1000 litres of beverage]: 33 cl steel cans

Inventory results per 1000 litres	52. Alt. energy production	53. Distribution	54. Retailer	55. Trp	56. Use (refrigeration)	57. Trp	58. Trp	59. Trp	60. Trp
CO2	-2,68E+03	1,90E+04			4,22E+02			1,29E+03	3,92E+02
CO2 relative	-0,67%	4,77%	0,00%	0,00%	0,11%	0,00%	0,00%	0,32%	0,10%
SO2	-2,30E+00	2,13E+01			7,03E-01			1,44E+00	4,38E-01
SO2 relative	-0,22%	2,03%	0,00%	0,00%	0,07%	0,00%	0,00%	0,14%	0,04%
NOx	-3,36E+00	1,81E+02			1,12E+00			1,23E+01	3,73E+00
NOx relative	-0,22%	12,08%	0,00%	0,00%	0,07%	0,00%	0,00%	0,82%	0,25%
NMVOC:s									
NMVOC	-3,84E+00	4,64E+01						3,14E+00	9,54E-01
NMVOC, diesel engines	-9,83E-03	2,43E+01			1,29E-02			1,25E+00	3,79E-01
NMVOC, el-coal	-6,46E-03				8,47E-03				
NMVOC, natural gas combustion									
NMVOC, oil combustion									
NMVOC, petrol engines	-1,25E-12				1,64E-12				
NMVOC, power plants	-3,12E-03				4,09E-03				
Total NMVOC	-3,86E+00	7,07E+01	0,00E+00	0,00E+00	2,55E-02	0,00E+00	0,00E+00	4,39E+00	1,33E+00
Total NMVOC relative	-2,22%	40,63%	0,00%	0,00%	0,01%	0,00%	0,00%	2,52%	0,77%
VOC:s									
HC	-1,92E-02				2,52E-02				
VOC									
VOC, coal combustion	-1,69E-04				2,21E-04				
VOC, diesel engines	-4,65E-03				6,10E-03				
VOC, natural gas combustion	-1,31E-11				1,72E-11				
Total VOC	-2,40E-02	0,00E+00	0,00E+00	0,00E+00	3,15E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total VOC relative	-0,03%	0,00%	0,00%	0,00%	0,03%	0,00%	0,00%	0,00%	0,00%
"Other specified hydrocarbons"									
Acetaldehyde	-1,24E-05								
Acetylene	-7,48E-04								
Aldehydes	-4,21E-06				5,51E-06				
Alkanes	-1,87E-02								
Alkenes	-1,50E-03								
Aromates (C9-C10)	-1,56E-03				8,07E-05				
Butane	-8,71E-03								
CH4	-3,64E+00	2,42E+01			2,19E+00			1,62E+00	4,93E-01
Ethane	-1,50E-03								
Ethene	-3,74E-03								
Formaldehyde	-1,69E-03								
PAH	-1,33E-04				1,10E-08				
Pentane	-1,49E-02								
Propane	-4,73E-03								
Propene	-1,50E-03								
Xylene									
Total "other"	-3,70E+00	2,42E+01	0,00E+00	0,00E+00	2,19E+00	0,00E+00	0,00E+00	1,62E+00	4,93E-01
Total "other" relative	-0,17%	1,13%	0,00%	0,00%	0,10%	0,00%	0,00%	0,08%	0,02%

D.1 Inventory results for important air emissions [per 1000 litres of beverage]: 33 cl steel cans

Inventory results per 1000 litres	61. BOF recycling	62. Steel scrap market	63. Trp	64. Trp	65. New product	66. Avoided steel production	67. EAF recycling
CO2	7,94E+03		2,44E+02	1,67E+03		-1,62E+05	-8,06E+03
CO2 relative	1,99%	0,00%	0,06%	0,42%	0,00%	-40,70%	-2,03%
SO2	1,15E+01		2,72E-01	1,86E+00		-2,68E+02	-1,62E+01
SO2 relative	1,09%	0,00%	0,03%	0,18%	0,00%	-25,56%	-1,54%
NOx	1,91E+01		2,32E+00	1,59E+01		-2,94E+02	-2,06E+01
NOx relative	1,27%	0,00%	0,15%	1,06%	0,00%	-19,58%	-1,37%
NMVOC:s							
NMVOC			5,93E-01	4,06E+00		-6,86E+00	-2,13E-01
NMVOC, diesel engines	2,10E-01		2,36E-01	1,61E+00		-6,91E+00	-2,25E-01
NMVOC, el-coal	1,38E-01					-1,32E-01	-1,34E-01
NMVOC, natural gas combustion	3,03E-02						
NMVOC, oil combustion						-3,25E+01	
NMVOC, petrol engines	2,69E-11					-3,92E-11	-2,91E-11
NMVOC, power plants	6,68E-02					-1,02E-01	-7,33E-02
Total NMVOC	4,45E-01	0,00E+00	8,29E-01	5,67E+00	0,00E+00	-4,65E+01	-6,45E-01
Total NMVOC relative	0,26%	0,00%	0,48%	3,26%	0,00%	-26,71%	-0,37%
VOC:s							
HC	4,11E-01					-6,12E-01	-4,48E-01
VOC						-7,29E-02	
VOC, coal combustion	3,61E-03					-5,58E-03	-2,00E-02
VOC, diesel engines	9,96E-02					-1,45E-01	-1,08E-01
VOC, natural gas combustion	2,81E-10					-4,10E-10	-3,04E-10
Total VOC	5,14E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-8,35E-01	-5,76E-01
Total VOC relative	0,55%	0,00%	0,00%	0,00%	0,00%	-0,89%	-0,61%
"Other specified hydrocarbons"							
Acetaldehyde	1,78E-05					-7,67E-07	
Acetylene						-2,16E-02	
Aldehydes	9,00E-05					-1,39E-04	-9,92E-05
Alkanes						-4,50E-02	
Alkenes						-2,27E-02	
Aromates (C9-C10)	1,32E-03					-6,27E-03	-1,45E-03
Butane	1,25E-02					-5,37E-04	
CH4	3,58E+01		3,06E-01	2,10E+00		-7,53E+01	-3,95E+01
Ethane						-6,44E-02	
Ethene						-1,30E-01	
Formaldehyde	1,78E-03					-1,41E-02	
PAH	1,79E-04					-2,41E-05	-1,99E-07
Pentane	2,14E-02					-9,23E-04	
Propane	3,57E-03					-4,44E-02	
Propene						-2,20E-02	
Xylene						-4,24E-03	
Total "other"	3,59E+01	0,00E+00	3,06E-01	2,10E+00	0,00E+00	-7,57E+01	-3,95E+01
Total "other" relative	1,68%	0,00%	0,01%	0,10%	0,00%	-3,54%	-1,84%

D.1 Inventory results for important air emissions [per 1000 litres of beverage]: 33 cl steel cans

Inventory results per 1000 litres	68. Trp	69. Trp	70. Trp	71. Trp	72. Trp	73. Testliner	74. New product	75. Avoided kraftliner	76. Other products
CO2	4,33E+02	1,89E+02	1,10E+01	6,255	9,199	1790		-2470	
CO2 relative	0,11%	0,05%	0,00%	0,00%	0,00%	0,45%	0,00%	-0,62%	0,00%
SO2	4,83E-01	2,11E-01	1,23E-02	0,00699	0,0103	0,688		-5,463	
SO2 relative	0,05%	0,02%	0,00%	0,00%	0,00%	0,07%	0,00%	-0,52%	0,00%
NOx	4,12E+00	1,80E+00	1,05E-01	0,0595	0,0875	3,281		-11,105	
NOx relative	0,27%	0,12%	0,01%	0,00%	0,01%	0,22%	0,00%	-0,74%	0,00%
NMVOC:s									
NMVOC	1,05E+00	4,61E-01	2,68E-02	0,0152	0,0224	0,0573		-0,54	
NMVOC, diesel engines	4,18E-01	1,83E-01	1,06E-02	0,00605	0,00889	0,00493		0,0169	
NMVOC, el-coal						0,00324		-0,0321	
NMVOC, natural gas combustion									
NMVOC, oil combustion						0,023		-1,253	
NMVOC, petrol engines						6,29E-13		-6,23E-12	
NMVOC, power plants						0,00156		-0,0155	
Total NMVOC	1,47E+00	6,44E-01	3,74E-02	2,13E-02	3,13E-02	9,00E-02	0,00E+00	-1,82E+00	0,00E+00
Total NMVOC relative	0,85%	0,37%	0,02%	0,01%	0,02%	0,05%	0,00%	-1,05%	0,00%
VOC:s									
HC						0,00963		-0,0954	
VOC									
VOC, coal combustion						0,0000845		-0,000837	
VOC, diesel engines						0,00233		-0,0231	
VOC, natural gas combustion						6,58E-12		-6,52E-11	
Total VOC	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,20E-02	0,00E+00	-1,19E-01	0,00E+00
Total VOC relative	0,00%	0,00%	0,00%	0,00%	0,00%	0,01%	0,00%	-0,13%	0,00%
"Other specified hydrocarbons"									
Acetaldehyde									
Acetylene									
Aldehydes						0,00000211		-0,0000209	
Alkanes									
Alkenes									
Aromates (C9-C10)						0,0000309		-0,000306	
Butane									
CH4	5,44E-01	2,38E-01	1,38E-02	0,00787	0,0116	0,91		-9,189	
Ethane									
Ethene									
Formaldehyde									
PAH						4,22E-09		-4,18E-08	
Pentane									
Propane									
Propene									
Xylene									
Total "other"	5,44E-01	2,38E-01	1,38E-02	7,87E-03	1,16E-02	9,10E-01	0,00E+00	-9,19E+00	0,00E+00
Total "other" relative	0,03%	0,01%	0,00%	0,00%	0,00%	0,04%	0,00%	-0,43%	0,00%

D.1 Inventory results for important air emissions [per 1000 litres of beverage]: 33 cl steel cans

Inventory results per 1000 litres	77. Avoided testliner	78. Landfill-corrugated board	79. Trp	80. Waste management	81. Cardboard/corrugated board inciner.
CO2	-357,269	2,25E+00	8,66E+01		6,03E+02
CO2 relative	-0,09%	0,00%	0,02%	0,00%	0,15%
SO2	-0,138	2,57E-03	9,67E-02		1,01E+00
SO2 relative	-0,01%	0,00%	0,01%	0,00%	0,10%
NOx	-0,656	2,05E-02	8,24E-01		1,90E+01
NOx relative	-0,04%	0,00%	0,05%	0,00%	1,27%
NMVOC:s					
NMVOC	-0,0115	5,18E-03	2,11E-01		
NMVOC, diesel engines	-0,000986	4,32E-03	8,37E-02		1,84E-02
NMVOC, el-coal	-0,000648	2,36E-06			1,21E-02
NMVOC, natural gas combustion					
NMVOC, oil combustion	-0,00461				
NMVOC, petrol engines	-1,26E-13	4,57E-16			2,35E-12
NMVOC, power plants	-0,000313	1,14E-06			5,85E-03
Total NMVOC	-1,81E-02	9,50E-03	2,95E-01	0,00E+00	3,64E-02
Total NMVOC relative	-0,01%	0,01%	0,17%	0,00%	0,02%
VOC:s					
HC	-0,00193	7,00E-06			3,60E-02
VOC					
VOC, coal combustion	-0,0000169	6,14E-08			3,16E-04
VOC, diesel engines	-0,000466	1,70E-06			8,72E-03
VOC, natural gas combustion	-1,32E-12	4,79E-15			2,46E-11
Total VOC	-2,41E-03	8,76E-06	0,00E+00	0,00E+00	4,50E-02
Total VOC relative	0,00%	0,00%	0,00%	0,00%	0,05%
"Other specified hydrocarbons"					
Acetaldehyde					
Acetylene					
Aldehydes	-0,000000422	1,53E-09			7,89E-06
Alkanes					
Alkenes					
Aromates (C9-C10)	-0,00000617	2,24E-08			1,15E-04
Butane					
CH4	-0,182	6,02E+01	1,09E-01		3,13E+00
Ethane					
Ethene					
Formaldehyde					
PAH	-8,45E-10	3,07E-12			1,58E-08
Pentane					
Propane					
Propene					
Xylene					
Total "other"	-1,82E-01	6,02E+01	1,09E-01	0,00E+00	3,13E+00
Total "other" relative	-0,01%	2,81%	0,01%	0,00%	0,15%

D.1 Inventory results for important air emissions [per 1000 litres of beverage]: 33 cl steel cans

Inventory results per 1000 litres	82. Aluminium incineration	83. PE incineration	84. Tinplate incineration	85. Trp	86. EAF recycling	87. New product
CO2	3,52E+01	3,94E+03	3,19E+02	8,05E+01	1,58E+03	
CO2 relative	0,01%	0,99%	0,08%	0,02%	0,40%	0,00%
SO2	5,87E-02	8,77E-02	5,31E-01	8,99E-02	3,15E+00	
SO2 relative	0,01%	0,01%	0,05%	0,01%	0,30%	0,00%
NOx	1,11E+00	1,66E+00	1,00E+01	7,66E-01	4,05E+00	
NOx relative	0,07%	0,11%	0,67%	0,05%	0,27%	0,00%
NMVOC:s						
NMVOC				1,96E-01	3,96E-02	
NMVOC, diesel engines	1,08E-03	1,61E-03	9,74E-03	7,78E-02	4,44E-02	
NMVOC, el-coal	7,08E-04	1,06E-03	6,40E-03		2,66E-02	
NMVOC, natural gas combustion						
NMVOC, oil combustion						
NMVOC, petrol engines	1,37E-13	2,05E-13	1,24E-12		5,73E-12	
NMVOC, power plants	3,42E-04	5,10E-04	3,09E-03		1,44E-02	
Total NMVOC	2,13E-03	3,18E-03	1,92E-02	2,74E-01	1,25E-01	0,00E+00
Total NMVOC relative	0,00%	0,00%	0,01%	0,16%	0,07%	0,00%
VOC:s						
HC	2,10E-03	3,14E-03	1,90E-02		8,82E-02	
VOC						
VOC, coal combustion	1,85E-05	2,76E-05	1,67E-04		3,77E-03	
VOC, diesel engines	5,09E-04	7,61E-04	4,61E-03		2,12E-02	
VOC, natural gas combustion	1,44E-12	2,15E-12	1,30E-11		5,99E-11	
Total VOC	2,63E-03	3,93E-03	2,38E-02	0,00E+00	-1,13E-01	0,00E+00
Total VOC relative	0,00%	0,00%	0,03%	0,00%	0,12%	0,00%
"Other specified hydrocarbons"						
Acetaldehyde						
Acetylene						
Aldehydes	4,61E-07	6,88E-07	4,17E-06		1,95E-05	
Alkanes						
Alkenes						
Aromates (C9-C10)	6,74E-06	1,01E-05	6,10E-05		2,85E-04	
Butane						
CH4	1,83E-01	2,73E-01	1,66E+00	1,01E-01	7,77E+00	
Ethane						
Ethene						
Formaldehyde						
PAH	9,23E-10	1,38E-09	8,35E-09		3,91E-08	
Pentane						
Propane						
Propene						
Xylene						
Total "other"	1,83E-01	2,73E-01	1,66E+00	1,01E-01	7,77E+00	0,00E+00
Total "other" relative	0,01%	0,01%	0,08%	0,00%	0,36%	0,00%

D.1 Inventory results for important air emissions [per 1000 litres of beverage]: 33 cl steel cans

Inventory results per 1000 litres	88. Avoided steel production	89. Energy use	90. Alt. energy production	Total
CO2	-1,04E+04		-2,35E+04	3,98E+05
CO2 relative	-2,61%	0,00%	-5,90%	100,00%
SO2	-1,72E+01		-2,01E+01	1,05E+03
SO2 relative	-1,64%	0,00%	-1,92%	100,00%
NOx	-1,89E+01		-2,94E+01	1,50E+03
NOx relative	-1,26%	0,00%	-1,96%	100,00%
NMVOC:s				
NMVOC	-4,41E-01		-3,37E+01	6,20E+01
NMVOC, diesel engines	-4,44E-01		-8,61E-02	5,56E+01
NMVOC, el-coal	-8,45E-03		-5,66E-02	5,07E+00
NMVOC, natural gas combustion				3,46E-02
NMVOC, oil combustion	-2,08E+00			4,72E+01
NMVOC, petrol engines	-2,52E-12		-1,10E-11	1,55E-09
NMVOC, power plants	-6,55E-03		-2,73E-02	4,05E+00
Total NMVOC	-2,98E+00	0,00E+00	-3,38E+01	1,74E+02
Total NMVOC relative	-1,72%	0,00%	-19,45%	100,00%
VOC:s				
HC	-3,93E-02		-1,68E-01	7,84E+01
VOC	-4,68E-03			9,41E+00
VOC, coal combustion	-3,58E-04		-1,48E-03	2,09E-01
VOC, diesel engines	-9,33E-03		-4,07E-02	5,75E+00
VOC, natural gas combustion	-2,63E-11		-1,15E-10	1,63E-08
Total VOC	-5,37E-02	0,00E+00	-2,10E-01	9,38E+01
Total VOC relative	-0,06%	0,00%	-0,22%	100,00%
"Other specified hydrocarbons"				
Acetaldehyde	-4,92E-08		-1,09E-04	1,48E-04
Acetylene	-1,39E-03		-6,54E-03	-4,54E-03
Aldehydes	-8,96E-06		-3,68E-05	5,54E-03
Alkanes	-2,89E-03		-1,64E-01	-1,27E-01
Alkenes	-1,46E-03		-1,31E-02	-9,38E-03
Aromates (C9-C10)	-4,03E-04		-1,36E-02	7,54E-02
Butane	-3,45E-05		-7,63E-02	1,04E-01
CH4	-4,84E+00		-3,19E+01	2,14E+03
Ethane	-4,14E-03		-1,31E-02	-7,19E-03
Ethene	-8,32E-03		-3,27E-02	-2,12E-02
Formaldehyde	-9,04E-04		-1,48E-02	3,57E-02
PAH	-1,55E-06		-1,17E-03	4,38E-01
Pentane	-5,93E-05		-1,31E-01	1,78E-01
Propane	-2,85E-03		-4,14E-02	1,56E-02
Propene	-1,42E-03		-1,31E-02	-1,10E-02
Xylene	-2,72E-04			3,85E-04
Total "other"	-4,86E+00	0,00E+00	-3,24E+01	2,14E+03
Total "other" relative	-0,23%	0,00%	-1,51%	100,00%

D.2 Inventory results for important air emissions [per 1000 litres of beverage]: 50 cl steel cans

Inventory results per 1000 litres	91. Other products	92. Avoided iron production	1. Tinplate cans, 33 cl	2. Lime	3. Trp	4. Limestone	5. Trp	6. Tin
CO_2		-2,45E+03	2,76E+05	8,47E+03	4,80E+02	1,01E+02	6,66E+02	3,61E+03
CO_2 relative	0,00%	-0,77%	86,52%	2,66%	0,15%	0,03%	0,21%	1,13%
SO_2		-5,14E+00	3,73E+02	2,55E+01	7,38E-01	1,60E-01	1,03E+00	5,17E+00
SO_2 relative	0,00%	-0,64%	46,68%	3,19%	0,09%	0,02%	0,13%	0,65%
NO_x		-6,21E+00	5,00E+02	1,36E+01	2,04E+00	2,04E-01	2,84E+00	7,21E+00
NO_x relative	0,00%	-0,51%	41,31%	1,13%	0,17%	0,02%	0,23%	0,60%
NMVOC:s								
NMVOC		-8,41E-02	1,12E+01	2,07E+00	2,72E-01	6,95E-02	3,78E-01	3,69E+00
NMVOC, diesel engines		-1,67E-01	6,09E+00	1,11E-01	1,19E-01	1,77E-03	1,66E-01	6,37E-02
NMVOC, el-coal		-2,30E-03	1,59E+00	8,32E-03	7,39E-03	1,06E-03	1,03E-02	4,18E-02
NMVOC, natural gas combustion								
NMVOC, oil combustion		-5,21E-01	2,83E+01					
NMVOC, petrol engines		-8,62E-12	8,28E-10	1,58E-11	1,44E-12	2,29E-13	1,99E-12	8,12E-12
NMVOC, power plants		-2,43E-02	2,24E+00	4,41E-02	3,57E-03	5,78E-04	4,95E-03	2,02E-02
Total NMVOC	0,00E+00	-7,99E-01	4,93E+01	2,23E+00	4,02E-01	7,29E-02	5,59E-01	3,81E+00
Total NMVOC relative	0,00%	-0,50%	31,15%	1,41%	0,25%	0,05%	0,35%	2,41%
VOC:s								
HC		-1,40E-01	4,08E+01	2,55E-01	2,20E-02	3,53E-03	3,05E-02	1,24E-01
VOC		-2,98E-04		7,58E-02		1,30E-04		
VOC, coal combustion		-1,35E-03	1,23E-01	2,45E-03	1,93E-04	3,14E-05	2,68E-04	1,09E-03
VOC, diesel engines		-3,20E-02	3,07E+00	5,84E-02	5,32E-03	8,50E-04	7,39E-03	3,01E-02
VOC, natural gas combustion		-9,02E-11	8,67E-09	1,65E-10	1,50E-11	2,40E-12	2,09E-11	8,50E-11
Total VOC	0,00E+00	-1,74E-01	4,40E+01	3,92E-01	2,75E-02	4,54E-03	3,82E-02	1,55E-01
Total VOC relative	0,00%	-0,23%	57,22%	0,51%	0,04%	0,01%	0,05%	0,20%
"Other specified hydrocarbons"								
Acetaldehyde		-5,53E-09	1,65E-04	5,93E-07		2,06E-07		
Acetylene		-8,82E-05		2,24E-02		5,12E-05		7,21E-04
Aldehydes		-3,38E-05	3,09E-03	6,14E-05	4,81E-06	7,83E-07	6,68E-06	2,72E-05
Alkanes		-3,56E-04	2,13E-02	3,21E-02		3,76E-04		1,80E-02
Alkenes		-1,01E-04	1,07E-03	2,28E-02		6,47E-05		1,44E-03
Aromates (C9-C10)		-5,40E-04	4,96E-02	1,68E-03	7,04E-05	3,85E-05	9,77E-05	1,84E-03
Butane		-3,87E-06	1,16E-01	4,15E-04		1,44E-04		
CH_4		-1,35E+01	1,23E+03	2,54E+01	2,05E+00	3,47E-01	2,85E+00	1,27E+01
Ethane		-2,63E-04		6,69E-02		1,40E-04		1,44E-03
Ethene		-5,27E-04		1,34E-01		2,94E-04		3,61E-03
Formaldehyde		-1,84E-04	3,25E-02	3,83E-03		3,48E-05		4,33E-04
PAH		-3,30E-07	1,67E-03	1,07E-05	9,64E-09	2,22E-06	1,34E-08	8,35E-06
Pentane		-6,64E-06	1,98E-01	7,11E-04		2,48E-04		
Propane		-1,90E-04	3,41E-02	4,54E-02		1,57E-04		2,16E-03
Propene		-9,00E-05		2,28E-02		6,47E-05		1,44E-03
Xylene		-1,73E-05		4,41E-03		7,54E-06		
Total "other"	0,00E+00	-1,35E+01	1,23E+03	2,58E+01	2,05E+00	3,49E-01	2,85E+00	1,27E+01
Total "other" relative	0,00%	-0,76%	69,10%	1,45%	0,12%	0,02%	0,16%	0,71%

D.2 Inventory results for important air emissions [per 1000 litres of beverage]: 50 cl steel cans

Inventory results per 1000 litres	7. Trp	8. H2SO4	9. Trp	10. Iron ore extraction	11. Trp	12. Primary aluminium	13. Trp	14. Strip rolling	15. Trp
CO2	2,50E+01		1,69E+01	6,05E+03	1,70E+04	1,26E+05	3,49E+02	6,09E+03	5,13E+00
CO2 relative	0,01%	0,00%	0,01%	1,90%	5,33%	39,50%	0,11%	1,91%	0,00%
SO2	1,68E-01	1,20E+01	1,88E-02	1,58E+01	1,35E+02	4,70E+02	6,19E-01	8,44E+00	1,02E-02
SO2 relative	0,02%	1,50%	0,00%	1,98%	16,86%	58,79%	0,08%	1,05%	0,00%
NOx	3,17E-01		1,60E-01	1,87E+01	2,03E+02	4,01E+02	3,53E+00	1,45E+01	5,29E-02
NOx relative	0,03%	0,00%	0,01%	1,54%	16,75%	33,15%	0,29%	1,20%	0,00%
NMVOC:s									
NMVOC	2,46E-02		4,10E-02	9,76E-01	3,38E+00	2,88E-01	8,14E-01	2,84E-02	1,18E-02
NMVOC, diesel engines	1,55E-02		1,63E-02	9,17E-01	6,07E+00	6,18E+00	3,32E-01	1,54E-01	4,86E-03
NMVOC, el-coal	1,26E-04			6,88E-02	1,72E-01	1,84E+00		1,02E-01	
NMVOC, natural gas combustion									
NMVOC, oil combustion	2,17E-02			5,54E+00	1,77E+01	1,29E+01	3,64E-02		7,17E-04
NMVOC, petrol engines	2,44E-14			1,34E-11	3,34E-11	3,57E-10		1,97E-11	
NMVOC, power plants	6,06E-05			3,32E-02	8,30E-02	8,89E-01		4,90E-02	
Total NMVOC	6,20E-02	0,00E+00	5,73E-02	7,53E+00	2,74E+01	2,21E+01	1,18E+00	3,33E-01	1,74E-02
Total NMVOC relative	0,04%	0,00%	0,04%	4,75%	17,28%	13,93%	0,75%	0,21%	0,01%
VOC:s									
HC	3,73E-04			2,05E-01	5,11E-01	5,48E+00		3,02E-01	
VOC						4,34E+00		2,65E+00	
VOC, coal combustion	3,27E-06			1,79E-03	4,48E-03	4,80E-02		2,65E-03	
VOC, diesel engines	9,03E-05			4,95E-02	1,24E-01	1,33E+00		7,31E-02	
VOC, natural gas combustion	2,55E-13			1,40E-10	3,49E-10	3,74E-09		2,06E-10	
Total VOC	4,67E-04	0,00E+00	0,00E+00	2,56E-01	6,39E-01	1,12E+01	0,00E+00	3,03E+00	0,00E+00
Total VOC relative	0,00%	0,00%	0,00%	0,33%	0,83%	14,55%	0,00%	3,94%	0,00%
"Other specified hydrocarbons"									
Acetaldehyde								1,67E-05	
Acetylene									
Aldehydes	8,17E-08			4,48E-05	1,12E-04	1,20E-03		6,61E-05	
Alkanes				1,44E-02					
Alkenes				7,19E-04					
Aromates (C9-C10)	1,20E-06			4,25E-03	1,64E-03	1,75E-02		9,67E-04	
Butane								1,17E-02	
CH4	5,61E-02		2,12E-02	2,12E+01	5,51E+01	4,83E+02	4,39E-01	2,63E+01	6,45E-03
Ethane									
Ethene									
Formaldehyde				1,08E-02				1,67E-03	
PAH	1,64E-10			1,21E-05	2,24E-07	3,50E-01		1,67E-04	
Pentane								2,01E-02	
Propane				7,19E-04				3,35E-03	
Propene									
Xylene									
Total "other"	5,61E-02	0,00E+00	2,12E-02	2,12E+01	5,51E+01	4,83E+02	4,39E-01	2,64E+01	6,45E-03
Total "other" relative	0,00%	0,00%	0,00%	1,19%	3,09%	27,13%	0,02%	1,48%	0,00%

D.2 Inventory results for important air emissions [per 1000 litres of beverage]: 50 cl steel cans

Inventory results per 1000 litres	16. Remelting	17. New product	18. Avoided primary aluminium	19. Trp	20. Lid production	21. Trp	22. Trp
CO2	1,27E+03		-2,19E+04	5,70E+02	8,97E+03	3,62E+01	2,60E+02
CO2 relative	0,40%	0,00%	-6,87%	0,18%	2,81%	0,01%	0,08%
SO2	2,09E+00		-8,21E+01	2,29E+00	1,49E+01	4,05E-02	2,93E-01
SO2 relative	0,26%	0,00%	-10,26%	0,29%	1,87%	0,01%	0,04%
NOx	3,50E+00		-7,00E+01	6,91E+00	2,38E+01	3,45E-01	2,53E+00
NOx relative	0,29%	0,00%	-5,79%	0,57%	1,97%	0,03%	0,21%
NMVOC:s							
NMVOC			-5,02E-02	1,13E+00		8,82E-02	6,33E-01
NMVOC, diesel engines	3,68E-02		-1,08E+00	5,16E-01	2,74E-01	3,50E-02	2,49E-01
NMVOC, el-coal	2,42E-02		-3,21E-01		1,80E-01		
NMVOC, natural gas combustion	2,82E-03						
NMVOC, oil combustion	1,86E-01		-2,25E+00	2,63E-01			
NMVOC, petrol engines	4,70E-12		-6,24E-11		3,50E-11		
NMVOC, power plants	1,17E-02		-1,55E-01		8,69E-02		
Total NMVOC	2,62E-01	0,00E+00	-3,85E+00	1,91E+00	5,41E-01	1,23E-01	8,82E-01
Total NMVOC relative	0,17%	0,00%	-2,43%	1,21%	0,34%	0,08%	0,56%
VOC:s							
HC	7,19E-02		-9,56E-01		5,36E-01		
VOC			-7,57E-01				
VOC, coal combustion	6,31E-04		-8,38E-03		4,70E-03		
VOC, diesel engines	1,74E-02		-2,31E-01		1,30E-01		
VOC, natural gas combustion	4,92E-11		-6,53E-10		3,66E-10		
Total VOC	8,99E-02	0,00E+00	-1,95E+00	0,00E+00	6,71E-01	0,00E+00	0,00E+00
Total VOC relative	0,12%	0,00%	-2,54%	0,00%	0,87%	0,00%	0,00%
"Other specified hydrocarbons"							
Acetaldehyde							
Acetylene							
Aldehydes	1,57E-05		-2,09E-04		1,17E-04		
Alkanes							
Alkenes							
Aromates (C9-C10)	2,30E-04		-3,06E-03		1,72E-03		
Butane							
CH4	6,35E+00		-8,43E+01	7,17E-01	4,66E+01	4,56E-02	3,27E-01
Ethane							
Ethene							
Formaldehyde							
PAH	3,15E-08		-6,11E-02		2,35E-07		
Pentane							
Propane							
Propene							
Xylene							
Total "other"	6,35E+00	0,00E+00	-8,43E+01	7,17E-01	4,66E+01	4,56E-02	3,27E-01
Total "other" relative	0,36%	0,00%	-4,74%	0,04%	2,62%	0,00%	0,02%

D.2 Inventory results for important air emissions [per 1000 litres of beverage]: 50 cl steel cans

Inventory results per 1000 litres	23. Corrugated board	24. Use of recycled fibres	25. Trp	26. Trp	27. Washing & filling	28. Trp
CO2	9,05E+03	2,93E+03	9,11E+00	3,47E+03	5,06E+03	1,54E+00
CO2 relative	2,84%	0,92%	0,00%	1,09%	1,59%	0,00%
SO2	1,91E+01	1,05E+01	1,02E-02	3,89E+00	2,97E+00	1,72E-03
SO2 relative	2,39%	1,32%	0,00%	0,49%	0,37%	0,00%
NOx	2,81E+01	2,59E+01	8,67E-02	3,34E+01	7,95E+00	1,46E-02
NOx relative	2,33%	2,14%	0,01%	2,76%	0,66%	0,00%
NMVOC:s						
NMVOC	2,11E+00	3,02E+00	2,22E-02	8,45E+00	9,01E-02	3,74E-03
NMVOC, diesel engines	8,44E-01	1,41E+00	8,81E-03	3,34E+00	5,37E-02	1,49E-03
NMVOC, el-coal	6,31E-02	5,79E-02			3,53E-02	
NMVOC, natural gas combustion						
NMVOC, oil combustion	3,87E+00	2,36E+00				
NMVOC, petrol engines	1,26E-11	1,12E-11			6,85E-12	
NMVOC, power plants	3,14E-02	2,80E-02			1,70E-02	
Total NMVOC	6,91E+00	6,87E+00	3,10E-02	1,18E+01	1,96E-01	5,23E-03
Total NMVOC relative	4,37%	4,34%	0,02%	7,44%	0,12%	0,00%
VOC:s						
HC	1,93E-01	1,72E-01			1,05E-01	
VOC						
VOC, coal combustion	1,70E-03	1,51E-03			9,21E-04	
VOC, diesel engines	4,67E-02	4,17E-02			2,54E-02	
VOC, natural gas combustion	1,32E-10	1,18E-10			7,17E-11	
Total VOC	2,41E-01	2,15E-01	0,00E+00	0,00E+00	1,31E-01	0,00E+00
Total VOC relative	0,31%	0,28%	0,00%	0,00%	0,17%	0,00%
"Other specified hydrocarbons"						
Acetaldehyde	4,09E-06				5,30E-05	
Acetylene	7,28E-06					
Aldehydes	4,24E-05	3,77E-05			2,30E-05	
Alkanes	7,38E-03					
Alkenes	3,75E-04					
Aromates (C9-C10)	2,44E-03	5,52E-04			3,36E-04	
Butane	2,86E-03				3,71E-02	
CH4	2,00E+01	-9,74E+01	1,15E-02	4,36E+00	9,35E+00	1,93E-03
Ethane	1,46E-05					
Ethene	3,64E-05					
Formaldehyde	5,81E-03				5,30E-03	
PAH	4,71E-05	7,55E-08			5,30E-04	
Pentane	4,91E-03				6,36E-02	
Propane	1,20E-03				1,06E-02	
Propene	1,46E-05					
Xylene						
Total "other"	2,00E+01	-9,74E+01	1,15E-02	4,36E+00	9,46E+00	1,93E-03
Total "other" relative	1,12%	-5,47%	0,00%	0,25%	0,53%	0,00%

D.2 Inventory results for important air emissions [per 1000 litres of beverage]: 50 cl steel cans

Inventory results per 1000 litres	29. Corrugated board incineration	30. Packaging	31. Secondary packaging	32. Trp	33. Cardboard	34. Trp
CO2	1,80E+01			2,56E+02	5,29E+03	8,43E+01
CO2 relative	0,01%	0,00%	0,00%	0,08%	1,66%	0,03%
SO2	3,00E-02			2,86E-01	1,10E+01	9,42E-02
SO2 relative	0,00%	0,00%	0,00%	0,04%	1,37%	0,01%
NOx	5,67E-01			2,43E+00	2,69E+01	8,03E-01
NOx relative	0,05%	0,00%	0,00%	0,20%	2,23%	0,07%
NMVOC:s						
NMVOC				6,23E-01	2,55E+00	2,05E-01
NMVOC, diesel engines	5,50E-04			2,47E-01	1,25E+00	8,15E-02
NMVOC, el-coal	3,62E-04				6,04E-02	
NMVOC, natural gas combustion						
NMVOC, oil combustion					2,36E+00	
NMVOC, petrol engines	7,02E-14				1,17E-11	
NMVOC, power plants	1,75E-04				2,92E-02	
Total NMVOC	1,09E-03	0,00E+00	0,00E+00	8,70E-01	6,26E+00	2,87E-01
Total NMVOC relative	0,00%	0,00%	0,00%	0,55%	3,95%	0,18%
VOC:s						
HC	1,08E-03				1,80E-01	
VOC						
VOC, coal combustion	9,43E-06				1,58E-03	
VOC, diesel engines	2,60E-04				4,35E-02	
VOC, natural gas combustion	7,35E-13				1,23E-10	
Total VOC	1,35E-03	0,00E+00	0,00E+00	0,00E+00	2,25E-01	0,00E+00
Total VOC relative	0,00%	0,00%	0,00%	0,00%	0,29%	0,00%
"Other specified hydrocarbons"						
Acetaldehyde						
Acetylene						
Aldehydes	2,35E-07				3,93E-05	
Alkanes						
Alkenes						
Aromates (C9-C10)	3,44E-06				5,75E-04	
Butene						
CH4	9,35E-02			3,22E-01	1,81E+01	1,06E-01
Ethane						
Ethene						
Formaldehyde						
PAH	4,71E-10				7,88E-08	
Pentane						
Propane						
Propene						
Xylene						
Total "other"	9,35E-02	0,00E+00	0,00E+00	3,22E-01	1,81E+01	1,06E-01
Total "other" relative	0,01%	0,00%	0,00%	0,02%	1,02%	0,01%

D.2 Inventory results for important air emissions [per 1000 litres of beverage]: 50 cl steel cans

Inventory results per 1000 litres	35. Cardboard box (6 cans)	36. Trp	37. Tray	38. Trp	39. Corrugated board box (24 cans)	40. LDPE	41. Trp	42. Foil
CO2		8,43E+01		5,97E+01		1,04E+03	9,28E+00	
CO2 relative	0,00%	0,03%	0,00%	0,02%	0,00%	0,33%	0,00%	0,00%
SO2		9,42E-02		6,67E-02		7,51E+00	1,04E-02	
SO2 relative	0,00%	0,01%	0,00%	0,01%	0,00%	0,94%	0,00%	0,00%
NOx		8,03E-01		5,69E-01		1,00E+01	8,83E-02	
NOx relative	0,00%	0,07%	0,00%	0,05%	0,00%	0,83%	0,01%	0,00%
NMVOC:s								
NMVOC		2,05E-01		1,45E-01			2,26E-02	
NMVOC, diesel engines		8,15E-02		5,77E-02			8,97E-03	
NMVOC, el-coal								
NMVOC, natural gas combustion								
NMVOC, oil combustion								
NMVOC, petrol engines								
NMVOC, power plants								
Total NMVOC	0,00E+00	2,87E-01	0,00E+00	2,03E-01	0,00E+00	0,00E+00	3,16E-02	0,00E+00
Total NMVOC relative	0,00%	0,18%	0,00%	0,13%	0,00%	0,00%	0,02%	0,00%
VOC:s								
HC						1,75E+01		
VOC								
VOC, coal combustion								
VOC, diesel engines								
VOC, natural gas combustion								
Total VOC	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,75E+01	0,00E+00	0,00E+00
Total VOC relative	0,00%	0,00%	0,00%	0,00%	0,00%	22,80%	0,00%	0,00%
"Other specified hydrocarbons"								
Acetaldehyde								
Acetylene								
Aldehydes								
Alkanes								
Alkenes								
Aromates (C9-C10)								
Butane								
CH4		1,06E-01		7,51E-02			1,17E-02	
Ethane								
Ethene								
Formaldehyde								
PAH								
Pentane								
Propane								
Propene								
Xylene								
Total "other"	0,00E+00	1,06E-01	0,00E+00	7,51E-02	0,00E+00	0,00E+00	1,17E-02	0,00E+00
Total "other" relative	0,00%	0,01%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%

D.2 Inventory results for important air emissions [per 1000 litres of beverage]: 50 cl steel cans

Inventory results per 1000 litres	43. Trp	44. Hi-cone	45. Planks for pallets	46. Trp	47. Pallet	48. Trp	49. Trp	50. Wood incineration	51. Energy use
CO2	4,78E+00		2,68E+02	6,70E+00		2,12E+01	4,24E+00	4,96E+01	
CO2 relative	0,00%	0,00%	0,08%	0,00%	0,00%	0,01%	0,00%	0,02%	0,00%
SO2	5,34E-03		4,08E-01	7,49E-03		2,37E-02	4,74E-03	8,27E-02	
SO2 relative	0,00%	0,00%	0,05%	0,00%	0,00%	0,00%	0,00%	0,01%	0,00%
NOx	4,55E-02		1,64E+00	6,38E-02		2,02E-01	4,04E-02	1,56E+00	
NOx relative	0,00%	0,00%	0,14%	0,01%	0,00%	0,02%	0,00%	0,13%	0,00%
NMVOC:s									
NMVOC	1,16E-02		2,98E-01	1,63E-02		5,16E-02	1,03E-02		
NMVOC, diesel engines	4,62E-03		1,79E-01	6,48E-03		2,05E-02	4,10E-03	1,52E-03	
NMVOC, el-coal			2,91E-03					9,97E-04	
NMVOC, natural gas combustion									
NMVOC, oil combustion									
NMVOC, petrol engines			5,65E-13					1,94E-13	
NMVOC, power plants			1,40E-03					4,81E-04	
Total NMVOC	1,62E-02	0,00E+00	4,81E-01	2,28E-02	0,00E+00	7,21E-02	1,44E-02	3,00E-03	0,00E+00
Total NMVOC relative	0,01%	0,00%	0,30%	0,01%	0,00%	0,05%	0,01%	0,00%	0,00%
VOC:s									
HC			6,90E-01					2,97E-03	
VOC									
VOC, coal combustion			7,58E-05					2,60E-05	
VOC, diesel engines			2,09E-03					7,18E-04	
VOC, natural gas combustion			5,91E-12					2,03E-12	
Total VOC	0,00E+00	0,00E+00	6,92E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,71E-03	0,00E+00
Total VOC relative	0,00%	0,00%	0,90%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
"Other specified hydrocarbons"									
Acetaldehyde									
Acetylene			1,27E-05						
Aldehydes			1,89E-06					6,49E-07	
Alkanes			3,15E-04						
Alkenes			2,52E-05						
Aromates (C9-C10)			5,29E-05					9,50E-06	
Butane									
CH4	6,01E-03		9,08E-01	8,43E-03		2,67E-02	5,33E-03	2,58E-01	
Ethane			2,52E-05						
Ethene			6,30E-05						
Formaldehyde			7,57E-06						
PAH			1,48E-07					1,30E-09	
Pentane									
Propane			3,78E-05						
Propene			2,52E-05						
Xylene									
Total "other"	6,01E-03	0,00E+00	9,09E-01	8,43E-03	0,00E+00	2,67E-02	5,33E-03	2,58E-01	0,00E+00
Total "other" relative	0,00%	0,00%	0,05%	0,00%	0,00%	0,00%	0,00%	0,01%	0,00%

D.2 Inventory results for important air emissions [per 1000 litres of beverage]: 50 cl steel cans

Inventory results per 1000 litres	52. Alt. energy production	53. Distribution	54. Retailer	55. Trp	56. Use (refrigeration)	57. Trp	58. Trp	59. Trp	60. Trp
CO2	-1,97E+03	1,89E+04			3,97E+02			1,22E+03	2,60E+02
CO2 relative	-0,62%	5,92%	0,00%	0,00%	0,12%	0,00%	0,00%	0,38%	0,08%
SO2	-1,69E+00	2,11E+01			6,62E-01			1,36E+00	2,90E-01
SO2 relative	-0,21%	2,63%	0,00%	0,00%	0,08%	0,00%	0,00%	0,17%	0,04%
NOx	-2,47E+00	1,80E+02			1,06E+00			1,16E+01	2,47E+00
NOx relative	-0,20%	14,84%	0,00%	0,00%	0,09%	0,00%	0,00%	0,96%	0,20%
NMVOC:s									
NMVOC	-2,83E+00	4,60E+01						2,97E+00	6,32E-01
NMVOC, diesel engines	-7,23E-03	2,41E+01			1,21E-02			1,18E+00	2,51E-01
NMVOC, el-coal	-4,75E-03				7,98E-03				
NMVOC, natural gas combustion									
NMVOC, oil combustion									
NMVOC, petrol engines	-9,23E-13				1,55E-12				
NMVOC, power plants	-2,29E-03				3,85E-03				
Total NMVOC	-2,84E+00	7,00E+01	0,00E+00	0,00E+00	2,39E-02	0,00E+00	0,00E+00	4,15E+00	8,83E-01
Total NMVOC relative	-1,79%	44,22%	0,00%	0,00%	0,02%	0,00%	0,00%	2,62%	0,56%
VOC:s									
HC	-1,41E-02				2,37E-02				
VOC									
VOC, coal combustion	-1,24E-04				2,08E-04				
VOC, diesel engines	-3,42E-03				5,74E-03				
VOC, natural gas combustion	-9,66E-12				1,62E-11				
Total VOC	-1,76E-02	0,00E+00	0,00E+00	0,00E+00	2,96E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total VOC relative	-0,02%	0,00%	0,00%	0,00%	0,04%	0,00%	0,00%	0,00%	0,00%
"Other specified hydrocarbons"									
Acetaldehyde	-9,16E-06								
Acetylene	-5,50E-04								
Aldehydes	-3,09E-06				5,19E-06				
Alkanes	-1,37E-02								
Alkenes	-1,10E-03								
Aromates (C9-C10)	-1,15E-03				7,60E-05				
Butane	-6,41E-03								
CH4	-2,68E+00	2,39E+01			2,06E+00			1,54E+00	3,27E-01
Ethane	-1,10E-03								
Ethene	-2,75E-03								
Formaldehyde	-1,25E-03								
PAH	-9,79E-05				1,04E-08				
Pentane	-1,10E-02								
Propane	-3,48E-03								
Propene	-1,10E-03								
Xylene									
Total "other"	-2,72E+00	2,39E+01	0,00E+00	0,00E+00	2,06E+00	0,00E+00	0,00E+00	1,54E+00	3,27E-01
Total "other" relative	-0,15%	1,34%	0,00%	0,00%	0,12%	0,00%	0,00%	0,09%	0,02%

D.2 Inventory results for important air emissions [per 1000 litres of beverage]: 50 cl steel cans

Inventory results per 1000 litres	61. BOF recycling	62. Steel scrap market	63. Trp	64. Trp	65. New product	66. Avoided steel production	67. EAF recycling
CO2	5,37E+03		1,80E+02	1,10E+03		-1,44E+05	1,86E+02
CO2 relative	1,68%	0,00%	0,06%	0,34%	0,00%	-45,14%	0,06%
SO2	7,67E+00		2,01E-01	1,23E+00		-2,38E+02	3,73E-01
SO2 relative	0,96%	0,00%	0,03%	0,15%	0,00%	-29,78%	0,05%
NOx	1,28E+01		1,71E+00	1,05E+01		-2,61E+02	4,75E-01
NOx relative	1,06%	0,00%	0,14%	0,87%	0,00%	-21,54%	0,04%
NMVOC:s							
NMVOC			4,38E-01	2,69E+00		-6,09E+00	4,90E-03
NMVOC, diesel engines	1,41E-01		1,74E-01	1,07E+00		-6,13E+00	5,18E-03
NMVOC, el-coal	9,24E-02					-1,17E-01	3,09E-03
NMVOC, natural gas combustion	2,23E-02						
NMVOC, oil combustion						-2,88E+01	
NMVOC, petrol engines	1,79E-11					-3,48E-11	6,69E-13
NMVOC, power plants	4,46E-02					-9,05E-02	1,69E-03
Total NMVOC	3,00E-01	0,00E+00	6,12E-01	3,75E+00	0,00E+00	-4,12E+01	1,49E-02
Total NMVOC relative	0,19%	0,00%	0,39%	2,37%	0,00%	-26,03%	0,01%
VOC:s							
HC	2,75E-01					-5,44E-01	1,03E-02
VOC						-6,47E-02	
VOC, coal combustion	2,41E-03					-4,95E-03	4,61E-04
VOC, diesel engines	6,65E-02					-1,29E-01	2,48E-03
VOC, natural gas combustion	1,88E-10					-3,64E-10	7,00E-12
Total VOC	3,44E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-7,43E-01	1,32E-02
Total VOC relative	0,45%	0,00%	0,00%	0,00%	0,00%	-0,97%	0,02%
"Other specified hydrocarbons"							
Acetaldehyde	1,31E-05					-6,80E-07	
Acetylene						-1,92E-02	
Aldehydes	6,01E-05					-1,24E-04	2,28E-06
Alkanes						-4,00E-02	
Alkenes						-2,01E-02	
Aromates (C9-C10)	8,80E-04					-5,57E-03	3,33E-05
Butane	9,17E-03					-4,77E-04	
CH4	2,39E+01		2,26E-01	1,39E+00		-6,69E+01	9,09E-01
Ethane						-5,71E-02	
Ethene						-1,15E-01	
Formaldehyde	1,31E-03					-1,25E-02	
PAH	1,31E-04					-2,14E-05	4,57E-09
Pentane	1,57E-02					-8,19E-04	
Propane	2,62E-03					-3,94E-02	
Propene						-1,96E-02	
Xylene						-3,76E-03	
Total "other"	2,40E+01	0,00E+00	2,26E-01	1,39E+00	0,00E+00	-6,72E+01	9,09E-01
Total "other" relative	1,35%	0,00%	0,01%	0,08%	0,00%	-3,77%	0,05%

D.2 Inventory results for important air emissions [per 1000 litres of beverage]: 50 cl steel cans

Inventory results per 1000 litres	68. Trp	69. Trp	70. Trp	71. Trp	72. Trp	73. Testliner	74. New product	75. Avoided kraftliner	76. Other products
CO2	9,97E+00	1,70E+02	7,31E+00	5,179	7,312	1340		-1850	
CO2 relative	0,00%	0,05%	0,00%	0,00%	0,00%	0,42%	0,00%	-0,58%	0,00%
SO2	1,11E-02	1,90E-01	8,17E-03	0,00578	0,00817	0,515		-4,088	
SO2 relative	0,00%	0,02%	0,00%	0,00%	0,00%	0,06%	0,00%	-0,51%	0,00%
NOx	9,49E-02	1,62E+00	6,96E-02	0,0493	0,0696	2,455		-8,31	
NOx relative	0,01%	0,13%	0,01%	0,00%	0,01%	0,20%	0,00%	-0,69%	0,00%
NMVOC:s									
NMVOC	2,43E-02	4,14E-01	1,78E-02	0,0126	0,0178	0,0429		-0,404	
NMVOC, diesel engines	9,63E-03	1,64E-01	7,07E-03	0,00501	0,00707	0,00369		0,0126	
NMVOC, el-coal						0,00242		-0,024	
NMVOC, natural gas combustion									
NMVOC, oil combustion						0,0172		-0,937	
NMVOC, petrol engines						4,71E-13		-4,66E-12	
NMVOC, power plants						0,00117		-0,0116	
Total NMVOC	3,39E-02	5,78E-01	2,49E-02	1,76E-02	2,49E-02	6,74E-02	0,00E+00	-1,36E+00	0,00E+00
Total NMVOC relative	0,02%	0,36%	0,02%	0,01%	0,02%	0,04%	0,00%	-0,86%	0,00%
VOC:s									
HC						0,00721		-0,0714	
VOC									
VOC, coal combustion						0,0000632		-0,000626	
VOC, diesel engines						0,00174		-0,0173	
VOC, natural gas combustion						4,93E-12		-4,88E-11	
Total VOC	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	9,01E-03	0,00E+00	-8,93E-02	0,00E+00
Total VOC relative	0,00%	0,00%	0,00%	0,00%	0,00%	0,01%	0,00%	-0,12%	0,00%
"Other specified hydrocarbons"									
Acetaldehyde									
Acetylene									
Aldehydes						0,00000158		-0,0000156	
Alkanes									
Alkenes									
Aromates (C9-C10)						0,0000231		-0,000229	
Butane									
CH4	1,25E-02	2,14E-01	9,20E-03	0,00651	0,0092	0,681		-6,876	
Ethane									
Ethene									
Formaldehyde									
PAH						3,16E-09		-3,13E-08	
Pentane									
Propane									
Propene									
Xylene									
Total "other"	1,25E-02	2,14E-01	9,20E-03	6,51E-03	9,20E-03	6,81E-01	0,00E+00	-6,88E+00	0,00E+00
Total "other" relative	0,00%	0,01%	0,00%	0,00%	0,00%	0,04%	0,00%	-0,39%	0,00%

D.2 Inventory results for important air emissions [per 1000 litres of beverage]: 50 cl steel cans

Inventory results per 1000 litres	77. Avoided testliner	78. Landfill-corrugated board	79. Trp	80. Waste management	81. Cardboard/corrugated board inciner.
CO2	-267,34	1,68E+00	7,03E+01		4,51E+02
CO2 relative	-0,08%	0,00%	0,02%	0,00%	0,14%
SO2	-0,103	1,92E-03	7,85E-02		7,52E-01
SO2 relative	-0,01%	0,00%	0,01%	0,00%	0,09%
NOx	-0,491	1,54E-02	6,69E-01		1,42E+01
NOx relative	-0,04%	0,00%	0,06%	0,00%	1,18%
NMVOC:s					
NMVOC	-0,00858	3,88E-03	1,71E-01		
NMVOC, diesel engines	-0,000738	3,23E-03	6,79E-02		1,38E-02
NMVOC, el-coal	-0,000485	1,76E-06			9,06E-03
NMVOC, natural gas combustion					
NMVOC, oil combustion	-0,00345				
NMVOC, petrol engines	-9,41E-14	3,42E-16			1,76E-12
NMVOC, power plants	-0,000234	8,51E-07			4,37E-03
Total NMVOC	-1,35E-02	7,11E-03	2,39E-01	0,00E+00	2,72E-02
Total NMVOC relative	-0,01%	0,00%	0,15%	0,00%	0,02%
VOC:s					
HC	-0,00144	5,24E-06			2,70E-02
VOC					
VOC, coal combustion	-0,0000126	4,60E-08			2,36E-04
VOC, diesel engines	-0,000349	1,27E-06			6,52E-03
VOC, natural gas combustion	-9,85E-13	3,58E-15			1,84E-11
Total VOC	-1,80E-03	6,56E-06	0,00E+00	0,00E+00	3,38E-02
Total VOC relative	0,00%	0,00%	0,00%	0,00%	0,04%
"Other specified hydrocarbons"					
Acetaldehyde					
Acetylene					
Aldehydes	-0,000000316	1,15E-09			5,90E-06
Alkanes					
Alkenes					
Aromates (C9-C10)	-0,00000462	1,68E-08			8,63E-05
Butane					
CH4	-0,136	4,50E+01	8,84E-02		2,34E+00
Ethane					
Ethene					
Formaldehyde					
PAH	-6,32E-10	2,30E-12			1,18E-08
Pentane					
Propane					
Propene					
Xylene					
Total "other"	-1,36E-01	4,50E+01	8,84E-02	0,00E+00	2,34E+00
Total "other" relative	-0,01%	2,53%	0,00%	0,00%	0,13%

D.2 Inventory results for important air emissions [per 1000 litres of beverage]: 50 cl steel cans

Inventory results per 1000 litres	82. Aluminium incineration	83. PE incineration	84. Tinplate incineration	85. Trp	86. EAF recycling	87. New product
CO2	2,33E+01	2,61E+03		7,87E+01	1,55E+03	
CO2 relative	0,01%	0,82%	0,00%	0,02%	0,49%	0,00%
SO2	3,89E-02	5,82E-02		8,79E-02	3,08E+00	
SO2 relative	0,00%	0,01%	0,00%	0,01%	0,38%	0,00%
NOx	7,36E-01	1,10E+00	8,99E+00	7,49E-01	3,96E+00	
NOx relative	0,06%	0,09%	0,74%	0,06%	0,33%	0,00%
NMVOC:s						
NMVOC				1,92E-01	3,87E-02	
NMVOC, diesel engines	7,14E-04	1,07E-03		7,61E-02	4,34E-02	
NMVOC, el-coal	4,69E-04	7,01E-04			2,60E-02	
NMVOC, natural gas combustion						
NMVOC, oil combustion						
NMVOC, petrol engines	9,11E-14	1,36E-13			5,60E-12	
NMVOC, power plants	2,26E-04	3,38E-04			1,41E-02	
Total NMVOC	1,41E-03	2,11E-03	0,00E+00	2,68E-01	1,22E-01	0,00E+00
Total NMVOC relative	0,00%	0,00%	0,00%	0,17%	0,08%	0,00%
VOC:s						
HC	1,39E-03	2,09E-03			8,62E-02	
VOC						
VOC, coal combustion	1,22E-05	1,83E-05			3,68E-03	
VOC, diesel engines	3,38E-04	5,05E-04			2,07E-02	
VOC, natural gas combustion	9,53E-13	1,42E-12			5,86E-11	
Total VOC	1,74E-03	2,61E-03	0,00E+00	0,00E+00	1,11E-01	0,00E+00
Total VOC relative	0,00%	0,00%	0,00%	0,00%	0,14%	0,00%
"Other specified hydrocarbons"						
Acetaldehyde						
Acetylene						
Aldehydes	3,05E-07	4,56E-07			1,91E-05	
Alkanes						
Alkenes						
Aromates (C9-C10)	4,47E-06	6,68E-06			2,78E-04	
Butane						
CH4	1,21E-01	1,81E-01		9,90E-02	7,59E+00	
Ethane						
Ethene						
Formaldehyde						
PAH	6,11E-10	9,14E-10			3,82E-08	
Pentane						
Propane						
Propene						
Xylene						
Total "other"	1,21E-01	1,81E-01	0,00E+00	9,90E-02	7,59E+00	0,00E+00
Total "other" relative	0,01%	0,01%	0,00%	0,01%	0,43%	0,00%

D.2 Inventory results for important air emissions [per 1000 litres of beverage]: 50 cl steel cans

Inventory results per 1000 litres	88. Avoided steel production	89. Energy use	90. Alt. energy production	Total
CO2	-1,02E+04		-1,59E+04	3,19E+05
CO2 relative	-3,20%	0,00%	-4,98%	100,00%
SO2	-1,68E+01		-1,36E+01	8,00E+02
SO2 relative	-2,11%	0,00%	-1,70%	100,00%
NOx	-1,84E+01		-1,99E+01	1,21E+03
NOx relative	-1,52%	0,00%	-1,64%	100,00%
NMVOC:s				
NMVOC	-4,31E-01		-2,28E+01	6,38E+01
NMVOC, diesel engines	-4,34E-01		-5,82E-02	4,84E+01
NMVOC, el-coal	-8,26E-03		-3,83E-02	3,90E+00
NMVOC, natural gas combustion				2,51E-02
NMVOC, oil combustion	-2,04E+00			3,89E+01
NMVOC, petrol engines	-2,46E-12		-7,43E-12	1,27E-09
NMVOC, power plants	-6,40E-03		-1,85E-02	3,34E+00
Total NMVOC	-2,92E+00	0,00E+00	-2,29E+01	1,58E+02
Total NMVOC relative	-1,84%	0,00%	-14,45%	100,00%
VOC:s				
HC	-3,84E-02		-1,14E-01	6,58E+01
VOC	-4,57E-03			6,23E+00
VOC, coal combustion	-3,50E-04		-9,98E-04	1,86E-01
VOC, diesel engines	-9,11E-03		-2,75E-02	4,71E+00
VOC, natural gas combustion	-2,57E-11		-7,78E-11	1,33E-08
Total VOC	-5,24E-02	0,00E+00	-1,42E-01	7,69E+01
Total VOC relative	-0,07%	0,00%	-0,19%	100,00%
"Other specified hydrocarbons"				
Acetaldehyde	-4,81E-08		-7,37E-05	1,69E-04
Acetylene	-1,35E-03		-4,43E-03	-2,35E-03
Aldehydes	-8,75E-06		-2,49E-05	4,57E-03
Alkanes	-2,83E-03		-1,11E-01	-7,36E-02
Alkenes	-1,43E-03		-8,86E-03	-5,09E-03
Aromates (C9-C10)	-3,94E-04		-9,22E-03	6,49E-02
Butane	-3,37E-05		-5,16E-02	1,18E-01
CH4	-4,73E+00		-2,16E+01	1,78E+03
Ethane	-4,04E-03		-8,86E-03	-2,87E-03
Ethene	-8,13E-03		-2,21E-02	-1,03E-02
Formaldehyde	-8,83E-04		-1,00E-02	3,69E-02
PAH	-1,51E-06		-7,88E-04	2,91E-01
Pentane	-5,79E-05		-8,85E-02	2,03E-01
Propane	-2,79E-03		-2,80E-02	2,64E-02
Propene	-1,38E-03		-8,86E-03	-6,59E-03
Xylene	-2,66E-04			3,72E-04
Total "other"	-4,75E+00	0,00E+00	-2,19E+01	1,78E+03
Total "other" relative	-0,27%	0,00%	-1,23%	100,00%

REGISTRERINGSBLAD

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Titel:
Life Cycle Assessment of Packaging Systems for Beer and Soft Drinks : Steel Cans

Undertitel:
Technical Report 4

Forfatter(e):
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Udførende institution(er):
Chalmers Industriteknik; Instituttet for Produktudvikling

Resumé:
Rapporten er en del af en livscyklusvurdering, hvor potentielle miljøeffekter fra forskellige eksisterende og alternative emballagesystemer til øl og læskedrikke, påfyldt og solgt i Danmark, sammenlignes. Miljøvurderingen sammenligner retur- og engangsflasker af hhv. glas og PET samt aluminiums- og ståldåser. Denne delrapport handler om ståldåser.

Emneord:
livscyklusvurdering; emballage; drikkevarer; øl; stål

Andre oplysninger:
Hører sammen med en hovedrapport: Main Report (Miljøprojekt, 399),
5 andre tekniske delrapporter om de enkelte emballagetyper:
Refillable Glass Bottles (Miljøprojekt, 400), Disposable Glass Bottles (Miljøprojekt, 401),
Aluminium Cans (Miljøprojekt, 402), Refillable PET Bottles (Miljøprojekt, 404),
Disposable PET Bottles (Miljøprojekt, 405) og en delrapport om de anvendte energi- og transportscenarier: Energy and Transport Scenarios (Miljøprojekt, 406).
Opdatering af: Miljømæssig kortlægning af emballager til øl og læskedrikke
(Arbejdsrapport fra Miljøstyrelsen, 62/1995 og 70/1995-76/1995) og
Miljøvurdering af emballager til øl og læskedrikke (Arbejdsrapport fra Miljøstyrelsen, 21/1996)

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Life Cycle Assessment of Packaging Systems for Beer and Soft Drinks : Steel Cans

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Abstract:
This report is part of a life cycle assessment (LCA) comparing the potential environmental impacts associated with different existing or alternative packaging systems for beer and carbonated soft drinks that are filled and sold in Denmark. The study compares refillable and disposable glass and PET bottles and steel and aluminium cans and is an update of a previous study carried out in 1992-1996. This report is the technical report on steel cans.

Terms:
life cycle assessment; packaging systems; beer; soft drinks; steel cans

Supplementary notes:
The project comprises the main report (Environmental Project, 399), and 7 supplementary reports:
Refillable Glass Bottles (Environmental Project, 400), Disposable Glass Bottles (Environmental Project, 401),
Aluminium Cans (Environmental Project, 402), Steel Cans (Environmental Project, 403),
Refillable PET Bottles (Miljøprojekt, 404), Disposable PET Bottles (Miljøprojekt, 405),
Energy and Transport Scenarios (Miljøprojekt, 406).
The previous reports were published in Danish: Miljømæssig kortlægning af emballager til øl og læskedrikke (Arbejdsrapport fra Miljøstyrelsen, 62/1995 and 70 - 76/1995),
and Miljøvurdering af emballager til øl og læskedrikke (Arbejdsrapport fra Miljøstyrelsen, 21/1996)

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