Appendix 1.1 Processes and data sources - Printed Newspaper

In the table below the processes and data sources used for the studied system "Printed Newspaper" are presented.

Process	Input	Description	Source of data
Newsprint DIP containing	Newsprint DIP	Newsprint containing de-inked pulp (DIP) from post consumer recycled paper. The dataset is based on several European LCA studies made 2000-2002. The used electricity mix in the process is European scenario: Nordel 45%, UCTE 45% and GB 10%. Swedish scenario: Nordel 100%, Raw material consumption for 1kg paper: ▪ 744 g wood (140 % moisture) ▪ 302 g wood chips (70 % moisture) ▪ 18 g sulphate pulp ▪ 757 g waste paper for DIP	Ecoinvent 1.2
Transport of paper	Transport of paper	Transport of paper from paper mill to printer. European scenario: Assumption 400 km lorry, 400km train Swedish scenario: Assumption 250 km lorry, 250km train	Estimation based on CEPI statistics in Ecoinvent 1.2
	Lorry	Transport, lorry 32t, Europe, 2000. Including the entire transport life cycle.	Ecoinvent 1.2
	Train	European scenario: Transport, freight, rail, Europe, 2000. Including the entire transport life cycle. Swedish scenario: Operation, freight train, electricity, Europe, 2003	Ecoinvent 1.2
	Diesel in Train, SE	*Diesel, at regional storage, Europe, 2000*	*Ecoinvent 1.2*
	Electricity in Train, SE	*Electricity, medium voltage, production NORDEL, at grid, 2000*	*Ecoinvent 1.2*
Prepress		Data from LCA studies by STFI-Packforsk (former IMT/Framkom) on Swedish newspaper companies 1995-2002. The older data sets have been adapted to current plate	STFI-Packforsk

Process	Input	Description	Source of data
		production technology, computer to-plate (CTP).	
	Electricity	European scenario: A mix of the three electricity systems UCTE, Nordel and GB 76:12:12 .	Ecoinvent 1.2
		Swedish scenario: 100% Nordel.	
		Electricity, medium voltage, production UCTE, at grid.	
		Electricity, medium voltage, production Nordel, at grid.	
		Electricity, medium voltage, production GB, at grid.	
	Gumming	EU average 2000. Only data on energy use	STFI-Packforsk
	Energy in Gumming	*See Electricity prepress, European scenario.*	*STFI-Packforsk*
	Offset plate	Production of offset plate, EU average 2002.	STFI-Packforsk
		Data on aluminium from Ecoinvent 1.2. Plate from 68% virgin aluminium. The waste plates are assumed to be recycled into new plates (closed-loop). The amount of recycled aluminium which will not be part of the loop (approximately 68%) is not credited through avoided production of aluminium from virgin resources.	Ecoinvent 1.2
	Energy in Offset Plate	*See Electricity prepress, European scenario*	Ecoinvent 1.2
	Aluminum in Offset Plate	*Data on aluminium from Ecoinvent 1.2. Plate from 68% virgin aluminium. The waste plates are assumed to be recycled into new plates (closed-loop). The amount of recycled aluminium which will not be part of the loop (approximately 68%) is not credited through avoided production of aluminium from virgin resources*	Ecoinvent 1.2
	Plate developer	EU average 2000. Only data on energy use.	STFI-Packforsk
	Energy in Plate developer	*See Electricity prepress, European scenario*	Ecoinvent 1.2
Editorial work		Data from LCA studies by STFI-Packforsk (former IMT/Framkom) on Swedish newspaper companies 1995-2002. Total energy needed for the editorial office. Heat and electricity used are not separately reported and the energy use is modelled as electricity.	STFI-Packforsk
	Electricity	See prepress/electricity.	Ecoinvent 1.2

Appendix 1.1
Processes and data sources - Printed Newspaper

Process	Input	Description	Source of data
Printing		Data from LCA studies by STFI-Packforsk (former IMT/Framkom) on Swedish newspaper companies 1995-2002.	STFI-Packforsk
	Electricity	See prepress/electricity.	Ecoinvent 1.2
	Ink	Data from earlier LCA performed by STFI-Packforsk (former IMT/Framkom) on ink 1998-2002. Based on Swedish production data with EU electricity mix.	STFI-Packforsk
	Vegetable oil in Ink	*Data from earlier LCA performed by STFI-Packforsk (former IMT/Framkom) on ink 1998-2002*	*STFI-Packforsk*
	Rapeseed oil in vegetable oil	*Rapeseed oil, Germany, 1998. Data from GaBi professional database GaBi ver 4.2.*	*GaBi*
	Electricity in Vegetable oil	*Electricity, medium voltage, production UCTE, at grid.*	*Ecoinvent 1.2*
	Refining of mineral oil in Ink	*Data from earlier LCA performed by STFI-Packforsk (former IMT/Framkom) on ink 1998-2002*	*STFI-Packforsk*
	Nafta in Refining of mineral oil	*Nafta at regional storage, Europe, 2000*	*Ecoinvent 1.2*
	Light fuel oil in Refining of mineral oil	*Light fuel oil at regional storage, Europe, 2000*	*Ecoinvent 1.2*
	Electricity in Refining of min.oil	*Electricity, medium voltage, production UCTE, at grid.*	*Ecoinvent 1.2*
	Binder, mineral ink in Ink	*Data from earlier LCA performed by STFI-Packforsk (former IMT/Framkom) on ink, Europe 2001*	*STFI-Packforsk*
	Nafta in Binder, mineral ink	*Nafta at regional storage, Europe, 2000*	*Ecoinvent 1.2*
	Soy been oil in Binder, mineral ink	*Soy been oil, US, 1997. Data from GaBi professional database GaBi ver 4.2.*	*GaBi*
	Natural gas in Binder, mineral ink	*Natural gas, high pressure, at consumer, Europe, 2000*	*Ecoinvent 1.2*
	Polyester resin in Binder, mineral ink	*Polyester resin, unsaturated, at plant, Europe, 2002*	*Ecoinvent 1.2*
	Pigment in Ink	*Data from earlier LCA performed by STFI-Packforsk (former IMT/Framkom) on ink, Europe 2001.*	*STFI-Packforsk*
	Light fuel oil in Pigment	*Light fuel oil at regional storage, Europe, 2000*	*Ecoinvent 1.2*

Appendix 1.1
Processes and data sources - Printed Newspaper

Process	Input	Description	Source of data
	Natural gas in Pigment	*Natural gas, high pressure, at consumer, Europe, 2000*	*Ecoinvent 1.2*
	Electricity in Pigment	*Electricity, medium voltage, production UCTE, at grid.*	*Ecoinvent 1.2*
	Thermal energy in Pigment	*Thermal energy from light fuel oil BUWAL, 1996. . Data from GaBi professional database GaBi ver 4.2.*	*GaBi*
	Other supply material in Ink	*Data from earlier LCA performed by STFI-Packforsk (former IMT/Framkom) on ink, Europe 2001.*	*STFI-Packforsk*
	Kaolin in Other supply material	*Kaolin at plant, Europe, 2000*	*Ecoinvent 1.2*
	Alkyd resin in Other supply material	*Alkyd resin, long oil, 70% in white spirit, at plant, Europe, 2001*	*Ecoinvent 1.2*
	Natural gas in Other supply material	*Natural gas, high pressure, at consumer, Europe, 2000*	*Ecoinvent 1.2*
	Electricity in Other supply material	*Electricity, medium voltage, production UCTE, at grid.*	*Ecoinvent 1.2*
	Thermal energy in Other supply material	*Thermal energy from light fuel oil BUWAL, 1996. . Data from GaBi professional database GaBi ver 4.2.*	*GaBi*
	Isopropanol (IPA)	Data on Nafta production Sweden, 1993. Allocation to the part of the production that represents IPA and Cleaning agent respectively.	STFI-Packforsk
	Electricity in IPA	*Electricity, high voltage, Sweden, at grid.*	*Ecoinvent 1.2*
	Crude oil	*Crude oil, production, Norway, at long distance transport, Europe*	*Ecoinvent 1.2*
	Heat from oil	*Thermal energy from light fuel oil (0,2%S), Sweden*	*Ecoinvent 1.2*
	Cleaning agent	See IPA.	
	Water	EU average 2000, tap water at user.	Ecoinvent 1.2
Distribution		Average data from 20 Swedish newspaper companies 2005 (Mint project). Divided into urban (European scenario) and rural (Swedish scenario) distribution.	STFI-Packforsk
	Transport	Small transporter/3.5t total cap./2t payload local, German data 1995. Only data on emissions of CO_2, CO, dust, methane, NO_x, NMVOC and SO_2 from the use of the van.	GaBi

Process	Input	Description	Source of data
		Modified by STFI-Packforsk with data for urban and rural distribution, see above.	
	Diesel	Diesel free refinery. German data 1997.	GaBi
Reading		No environmental impact from reading.	
Incineration with energy recovery		Modified data from Ecoinvent 1.2; "Disposal, newspaper, 14.7% water, incineration CH". Including avoided energy production. Net energy produced through incineration of waste paper: • electric energy: 1.32 MJ/kg waste • thermal energy: 2.77 MJ/kg waste The avoided energy production (68% heat and 32% electricity) is assumed to replace European mixes of electricity and heat. Data on avoided electric energy see prepress/electricity. European scenario: Avoided heat as European district heating mix, coal 34%, natural gas 34%, oil 18%, wood 14%. Swedish scenario: Avoided heat as Swedish district heating mix, wood 60%, oil 22%, coal 9%, natural gas 8%. Data on avoided thermal energy from: ▪ Hard coal, Germany 1996, GaBi data ▪ Natural gas, Germany 1996, GaBi data ▪ Light fuel oil, Germany 1996, GaBi data ▪ Wood, EU 1996, BUWAL data in GaBi database	Ecoinvent 1.2 GaBi GaBi GaBi BUWAL
Landfill		Swiss data for landfilling, without energy recovery, "Disposal, newspaper, 14.7% water, to sanitary landfill CH". The time perspective for emissions from the landfill is 100 years.	Ecoinvent 1.2
Recycling of fibre		Closed-loop recycling (impacts of recycling is included in the process "Newsprint DIP containing".	

Appendix 1.2 Processes and data sources – Web based Newspaper

In the table below the processes and data sources used for the studied system "Web based Newspaper" are presented.

Process	Input	Description	Source of data
Editorial work		Data from LCA studies by STFI-Packforsk (former IMT/Framkom) on Swedish newspaper companies 1995-2002. Total energy needed for the editorial office. Heat and electricity used are not separately reported and the energy use was modelled as electricity.	STFI-Packforsk
	Electricity	European scenario: A mix of the three electricity systems UCTE, Nordel and GB 76:12:12.	Ecoinvent 1.2
		Swedish scenario: 100% Nordel.	
		Electricity, medium voltage, production UCTE, at grid.	
		Electricity, medium voltage, production Nordel, at grid.	
		Electricity, medium voltage, production GB, at grid.	
Formatting web based newspaper		Energy needed for formatting. Data from Sundsvalls Tidning.	Sundsvalls Tidning
	Electricity	See Editorial work/Electricity.	Ecoinvent 1.2
Downloading web based newspaper		Energy needed for down-loading the newspaper to the home computer.	Assumption
	Electricity	See Editorial work/Electricity.	Ecoinvent 1.2
Production PC		The dataset contains screening life cycle inventories (LCIs) of the devices: • Housing • Drives (Hard disc drive, Floppy, CD-Rom) • PCI cards (Graphic card, Sound card, Network card) • Power supply module and cables • Populated Motherboard The reference year is 2002. No transportation or distribution included. According to LBP, in the context of a screening LCA most relevant flows are captured.	LBP, University of Stuttgart

Appendix 1.2
Data sources – Web based Newspaper

Process	Input	Description	Source of data
Production TFT screen		The dataset contains screening life cycle inventories (LCIs) of the devices: • Stand (ABS/PC parts, Steel Sheet) • Power Supply Unit (PSU) (populated printed wiring boards, PWB) • Housing (ABS/PC parts) • Backlight assembly (PMMA, Steel, Polyester, Glass) • LCD Panel • Metal Frames • Soundcard (populated PWB) • Inverter (populated PWB) • Other PWBs • Other parts (Steel, PS, PVC, PE, Copper) For all assemblies, except the LCD panel, the most important material production and average manufacturing processes are considered, according to LBP. For the LCD panel the electricity consumption for manufacturing processes and clean room are considered. The reference year is 2002. Transportation and distribution are not included. According to LBP, in the context of a screening LCA most relevant flows are captured.	LBP, University of Stuttgart
Transportation of PC and screen		Transport from China to European user. Assumption 15 000 km ship, 500 km lorry	
	Transoceanic freight ship	Transport, transoceanic tanker, including entire transport life cycle. Data from one port in Netherlands as an estimate for international water transportation. HFE based steam turbine and diesel engines.	Ecoinvent 1.2
	Lorry	Transport, lorry, 32 t., including the entire transport life cycle. Data from 2000. Represents average transport conditions in Europe (EU15)	Ecoinvent 1.2
Energy use for Reading information on computer screen		Energy needed for the computer and screen while reading the newspaper. Reading time 10 and 30 minutes/day respectively.	Assumption
	Electricity	See Editorial work/Electricity.	Ecoinvent 1.2

Appendix 1.2
Data sources – Web based Newspaper

Process	Input	Description	Source of data
Waste management electronics	Disposal, plastic, consumer electronics, with energy recovery	Incineration of waste (100% plastics from electronic consumer goods) with energy recovery. "Disposal, plastic, consumer electronics, 15.3% water, to municipal incineration" modified by STFI-Packforsk. Upper heating value 36.29 MJ/kg; lower heating value 34.78 MJ/kg. Net energy produced through incineration of waste plastics: • electric energy: 4 MJ/kg waste • thermal energy: 8.05 MJ/kg waste One kg of this waste produces 0.037 kg of slag and 0.019 kg of residues, which are modelled as landfilled. Material recycling of waste PC and screen were not covered due to lack of data.	Ecoinvent 1.2
	Avoided Electricity	The avoided energy production (68% heat and 32% electricity) is assumed to replace European mixes of electricity and heat (see 2.5). See Editorial work/Electricity.	Ecoinvent 1.2
	Avoided heat	European scenario: Avoided heat as European district heating mix, coal 34%, natural gas 34%, oil 18%, wood 14%. Swedish scenario: Avoided heat as Swedish district heating mix, wood 60%, oil 22%, coal 9%, natural gas 8%.	
	Thermal energy from hard coal	*Hard coal, Germany 1996, GaBi data*	*GaBi*
	Thermal energy from natural gas	*Natural gas, Germany 1996, GaBi data*	*GaBi*
	Thermal energy from light fuel oil	*Light fuel oil 0.2%S, Germany 1996, GaBi data*	*GaBi*
	Thermal energy from wood	*Wood, EU 1996, BUWAL data in GaBi database*	*BUWAL*

Appendix 1.3 Processes and data sources - Web based Newspaper with printout, additional processes

In the table below the additional processes and data sources used for the studied system "Web based Newspaper with Print" are presented.

Process	Input	Description	Source of data
Uncoated woodfree paper		Uncoated wood free paper for the home printer.	Ecoinvent 1.2
		Wood free means that this paper contains at least 90% of the fibres in form of chemical pulp. The dataset is based on several European studies made 2000-2002. The used electricity mix in the process is UCTE 64%, Nordel 27%, and GB 9%.	
		Raw material consumption for 1kg paper:	
		▪ 1985 g hardwood (80% moisture)	
		▪ 1228 g softwood (140% moisture)	
		▪ 236 g wood chips (70% moisture)	
		▪ 35 g sulphate pulp	
Laser home printing		Printing using an hp colour LaserJet 4550. This process includes energy use for computer and screen for reading and printing.	STFI-Packforsk
	Toner Cyan	Toner production data from Xerox, 2001. Only input data. No energy use included.	STFI-Packforsk
	Silica sand	*German data. Reference year 2001.*	*Ecoinvent 1.2*
	Titanium dioxide	*Production mix, theoretical – 50% TiO2 from the sulphate process and 50% from the chloride process. Reference year 2000.*	*Ecoinvent 1.2*
	Bisphenol A	*Dutch data. Reference year 1998.*	*GaBi*
	Polyester resin	*Unsaturated. Reference year 2002*	*Ecoinvent 1.2*
	Pigment Cyan	*Based on data for production of Black pigment. EU. Reference year 2001.*	*STFI-Packforsk*
	Natural gas	*Natural gas, high pressure at consumer.*	*Ecoinvent 1.2*
	Electricity	*Electricity, high voltage, production UCTE, at grid. Reference year 2000.*	*Ecoinvent 1.2*
	Thermal energy	*Thermal energy from light fuel oil.. Reference year 1996.*	*BUWAL*
	Light fuel oil	*Light fuel oil, at regional storage.*	*Ecoinvent 1.2*

Appendix 1.3
Processes and data sources - Web based Newspaper with Print, additional processes

Process	Input	Description	Source of data
	Toner Magenta, Yellow and Black	Toner production data from Xerox, 2001. Only input data. No energy use included.	STFI-Packforsk
	Silica sand	*German data. Reference year 2001.*	*Ecoinvent 1.2*
	Titanium dioxide	*Production mix, theoretical – 50% TiO2 from the sulphate process and 50% from the chloride process. Reference year 2000.*	*Ecoinvent 1.2*
	Bisphenol A	*Dutch data. Reference year 1998.*	*GaBi*
	Polyester resin	*Unsaturated. Reference year 2002.*	*Ecoinvent 1.2*
	Pigment Magenta, Yellow and Black	*Based on data for production of Black pigment. EU. Reference year 2001.*	*STFI-Packforsk*
	Natural gas	*Natural gas, high pressure at consumer.*	*Ecoinvent 1.2*
	Electricity	*Electricity, high voltage, production UCTE, at grid. Reference year 2000.*	*Ecoinvent 1.2*
	Thermal energy	*Thermal energy from light fuel oil.. Reference year 1996.*	*BUWAL*
	Light fuel oil	*Light fuel oil, at regional storage.*	*Ecoinvent 1.2*
	Electricity	A mix of the three electricity systems UCTE, Nordel and GB; 76:12:12.	Ecoinvent 1.2
		Electricity, medium voltage, production UCTE, at grid.	
		Electricity, medium voltage, production Nordel, at grid.	
		Electricity, medium voltage, production GB, at grid.	
Reading		No environmental impact from reading on paper.	
Incineration with energy recovery		Modified data from Ecoinvent 1.2; "Disposal, newspaper, 14.7% water, incineration CH". Including avoided energy production.	Ecoinvent 1.2
		Net energy produced through incineration of waste paper:	
		• electric energy: 1.32 MJ/kg waste	
		• thermal energy: 2.77 MJ/kg waste	
		The avoided energy production (68% heat and 32% electricity) is assumed to replace European mixes of electricity and heat (see 2.5).	
	Avoided Electricity	See Laser home printing/Electricity.	

Appendix 1.3
Processes and data sources - Web based Newspaper with Print, additional processes

Process	Input	Description	Source of data
	Avoided heat	Avoided heat as European district heating mix, coal 34%, natural gas 34%, oil 18%, wood 14%.	Ecoinvent 1.2
	Thermal energy from hard coal	*Hard coal, Germany 1996, GaBi data*	*GaBi*
	Thermal energy from natural gas	*Natural gas, Germany 1996, GaBi data*	*GaBi*
	Thermal energy from light fuel oil	*Light fuel oil 0.2%S, Germany 1996, GaBi data*	*GaBi*
	Thermal energy from wood	*Wood, EU 1996, BUWAL data in GaBi database*	*BUWAL*
Landfill		Swiss data for landfilling, without energy recovery, "Disposal, paper, 11.2 % water, to sanitary landfill CH". The time perspective for emissions from the landfill was 100 years.	Ecoinvent 1.2
Recycling of fibre		The part of the fine paper that is recycled was assumed to replace newsprint produced from virgin fibre.	
	Paper recycling with deinking	Newsprint production from recovered fibre. Includes de-inking process, paper machine, on-site energy production, flue gas cleaning technology and waste water treatment plant. The dataset is based on several European studies made 2000-2002. The used electricity mix in the process is UCTE 100%. Raw material consumption for 1kg paper: ▪ 1173.4 g recovered paper	Ecoinvent 1.2
	Avoided newsprint production	Newsprint production from virgin fibre. The dataset is based on several European studies made 2000-2002. The used electricity mix in the process is UCTE 44%, Nordel 45%, and GB 10% . Raw material consumption for 1kg paper: ▪ 1428 g wood (140%moisture) ▪ 1048.9 g wood chips (70% moisture) ▪ 25.7 g sulphate pulp	Ecoinvent 1.2

Appendix 1.4 Processes and data sources – Tablet E-paper

In the table below the processes and data sources used for the studied system "Tablet E-paper" are presented.

Process	Input	Description	Source of data
Editorial work		Data from LCA studies by STFI-Packforsk (former IMT/Framkom) on Swedish newspaper companies 1995-2002. Total energy needed for the editorial office. Heat and electricity used are not separately reported and the energy use was modelled as electricity.	STFI-Packforsk
	Electricity	European scenario: A mix of the three electricity systems UCTE, Nordel and GB 76:12:12.	Ecoinvent 1.2
		Swedish scenario: 100% Nordel.	
		Electricity, medium voltage, production UCTE, at grid.	
		Electricity, medium voltage, production Nordel, at grid.	
		Electricity, medium voltage, production GB, at grid.	
Formatting tablet e-newspaper		Energy needed for formatting. Data from Sundsvalls Tidning.	Sundsvalls Tidning
	Electricity	See Editorial work/Electricity.	Ecoinvent 1.2
Uploading tablet e-newspaper		Energy needed for up-loading the newspaper to a central server, which distributes the newspaper electronically to tablet e-paper readers.	Assumption
	Electricity	See Editorial work/Electricity.	Ecoinvent 1.2
Downloading tablet e-newspaper		Energy needed for down-loading the newspaper to the tablet e-paper.	Assumption
	Electricity	See Editorial work/Electricity.	Ecoinvent 1.2

Appendix 1.4
Processes and data sources – Tablet E-paper

Process	Input	Description	Source of data
Production tablet e-paper		The model was based on available data, see below.	LBP University of Stuttgart
		For the PWBs (printed wiring boards) the component mix was taken from the electronic component configuration of a personal computer motherboard.	
		Assembly specific manufacturing processes, transportation and distribution were not included.	
		The E-ink screen was not included.	
		The Chinese power grid mix was used for all production processes	
		According to LBP, in the context of a screening LCA most relevant flows were captured.	
	Illiad module		
	Housing		
	Bottom cover	*Plastic injection moulding of Polycarbonate/Acrylonitrile-butadiene-styrene (PC/ABS) mix, 50/50.*	*GaBi*
	Keys and flipbar	*Plastic injection moulding of Polycarbonate/Acrylonitrile-butadiene-styrene (PC/ABS) mix 50/50.*	*GaBi*
	Lightguide	*Plastic injection moulding of Polymethylmethacrylate (PMMA) mix.*	*GaBi*
	Middle frame	*Plastic injection moulding of Polycarbonate/Acrylonitrile-butadiene-styrene (PC/ABS) mix, 50/50.*	*GaBi*
	Top cover	*Plastic injection moulding of Polycarbonate/Acrylonitrile-butadiene-styrene (PC/ABS) mix, 50/50.*	*GaBi*
	Populated PWB Illiad module		
	Assembly line SMD (simple)	*The assembly line merges all pre-products and products for a populated PWB (solder process and assembly).Throughput 2000/day. Reference year 1999.*	*GaBi*
	PWB FR4	*4I; 2s; AuNi finishing, Reference year 1998.*	*GaBi*
	Diode SMD	*Average data. Reference year 1999.*	*GaBi*
	Resistor SMD	*Average data. Reference year 1999.*	*GaBi*

Appendix 1.4
Processes and data sources – Tablet E-paper

Process	Input	Description	Source of data
	Coil SMD chip coil	*Average data. Reference year 1999.*	*GaBi*
	Capacitor SMD ceramic	*Average data. Reference year 1999.*	*GaBi*
	Capacitor SMD tantal	*Average data. Reference year 1999.*	*GaBi*
	Oscillator SMD	*Average data. Reference year 1999.*	*GaBi*
	Filter SMD	*Average data. Reference year 1999.*	*GaBi*
	Transistor SMD power large	*Average data. Reference year 1999.*	*GaBi*
	IC SO/SIL	*Average data. Reference year 1999.*	*GaBi*
	IC unspecific	*Average data. Reference year 1999.*	*GaBi*
	IC SQFP	*Average data. Reference year 1999.*	*GaBi*
	IC PLCC	*Average data. Reference year 1999.*	*GaBi*
	Solder paste	*$Sn_{62}Pb_{36}Ag_2$. Average industrial data. Reference year 1998.*	*GaBi*
	Li-Ion Cell	*Lithium manganese oxide cell. Contains screening data on housing, separators, wound core, connectors, electrolyte and electrodes.*	*GaBi*
	Voyager module	Contains no TCP's, interconnection foil or E-ink dsplay.	
	Wacomsensor		
	Shielding (EMS)	*Often used material mix. Reference year 1998.*	*GaBi*
	Plastic extrusion profile	*Glass/Epoxy resin is plasticised in an extruder followed by a die which has the shape of the extrusion profile. This process includes inputs of lubricating oil, thermal energy from natural gas, electricity and compressed air 7 bar. Reference year 1998.*	*GaBi*
	Populated PWB		*GaBi*
	Assembly line SMD (simple)	*he assembly line merges all pre-products and products for a populated PWB (solder process and assembly).Throughput 2000/day. Reference year 1999.*	*GaBi*
	PWB FR4	*4I; 2s; AuNi finishing, Reference year 1998.*	*GaBi*

Appendix 1.4
Processes and data sources – Tablet E-paper

Process	Input	Description	Source of data
	Diode SMD	*Average data. Reference year 1999.*	*GaBi*
	Resistor SMD	*Average data. Reference year 1999.*	*GaBi*
	Coil SMD chip coil	*Average data. Reference year 1999.*	*GaBi*
	Capacitor SMD ceramic	*Average data. Reference year 1999.*	*GaBi*
	Capacitor SMD tantal	*Average data. Reference year 1999.*	*GaBi*
	Oscillator SMD	*Average data. Reference year 1999*	*GaBi*
	Filter SMD	*Average data. Reference year 1999.*	*GaBi*
	Transistor SMD power large	*Average data. Reference year 1999.*	*GaBi*
	IC SO/SIL	*Average data. Reference year 1999.*	*GaBi*
	IC unspecific	*Average data. Reference year 1999.*	*GaBi*
	IC SQFP	*Average data. Reference year 1999.*	*GaBi*
	IC PLCC	*Average data. Reference year 1999.*	*GaBi*
	Solder paste	$Sn_{62}Pb_{36}Ag_2$. *Average industrial data. Reference year 1998.*	*GaBi*
Transportation of tablet e-paper device.		Transport from China to European user. Assumption 15 000 km ship, 500 km lorry	
	Transoceanic freight ship	Transport, transoceanic tanker, including entire transport life cycle. Data from one port in Netherlands as an estimate for international water transportation. HFE based steam turbine and diesel engines.	Ecoinvent 1.2
	Lorry	Transport, lorry, 32 t., including the entire transport life cycle. Data from 2000. Represents average transport conditions in Europe (EU15)	Ecoinvent 1.2
Energy use for Reading information on e-paper		Energy needed for the tablet e-paper while reading the newspaper. Reading time 30 minutes/day.	Assumption
	Electricity	See Editorial work/Electricity.	Ecoinvent 1.2

Appendix 1.4
Processes and data sources – Tablet E-paper

Process	Input	Description	Source of data
Waste management electronics	Disposal, plastic, consumer electronics, with energy recovery	Incineration of waste (100% plastics from electronic consumer goods) with energy recovery. "Disposal, plastic, consumer electronics, 15.3% water, to municipal incineration" modified by STFI-Packforsk. Upper heating value 36.29 MJ/kg; lower heating value 34.78 MJ/kg. Net energy produced through incineration of waste plastics: • electric energy: 4 MJ/kg waste • thermal energy: 8.05 MJ/kg waste One kg of this waste produces 0.037 kg of slag and 0.019 kg of residues, which are modelled as landfilled. Material recycling of waste PC and screen were not covered due to lack of data. The avoided energy production (68% heat and 32% electricity) is assumed to replace European mixes of electricity and heat (see 2.5).	Ecoinvent 1.2
	Avoided Electricity	See Editorial work/Electricity.	Ecoinvent 1.2
	Avoided heat	European scenario: Avoided heat as European district heating mix, coal 34%, natural gas 34%, oil 18%, wood 14%. Swedish scenario: Avoided heat as Swedish district heating mix, wood 60%, oil 22%, coal 9%, natural gas 8%.	
	Thermal energy from hard coal	*Hard coal, Germany 1996, GaBi data*	*GaBi*
	Thermal energy from natural gas	*Natural gas, Germany 1996, GaBi data*	*GaBi*
	Thermal energy from light fuel oil	*Light fuel oil 0.2%S, Germany 1996, GaBi data*	*GaBi*
	Thermal energy from wood	*Wood, EU 1996, BUWAL data in GaBi database*	*BUWAL*