ecoinvent

Trust in Transparency

ecoinvent 3.8 Dataset Documentation

'computer production, laptop - GLO'

Note: This document contains only an extract of the information in the dataset. Additional data about properties of exchanges, mathematical relations, parameters, and contact information for authors and reviewers are available in the full dataset, i.e. in ecoSpold format. Amount and identity of the exchanges in an undefined dataset are independent of modeling choices of the different system models. Linked dataset are available in separate documents.

Link to the dataset on ecoquery website

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Dataset Identification

Activity name	computer production, laptop
Geography	GLO (Global)
Time period	2011-01-01 to 2024-12-31 - Valid for the entire period
Synonyms	Notebook
ISIC rev.4 ecoinvent	2620: Manufacture of computers and peripheral equipment
Reference product	computer, laptop
CPC classification	45220: Portable automatic data processing machines weighing not more than 10 kg, such as laptops, notebooks and sub-n[…]
Dataset type	Ordinary transforming activity
Technology level	Current
Version - system model	3.8 - Undefined

Dataset Authorship

Data generator	Johannes Müller, ecoinvent Centre
Data entry	Johannes Müller, ecoinvent Centre
Review	David FitzGerald, ecoinvent Centre
Review	Avraam Symeonidis, ecoinvent Centre

Exchange Summary

Reference product	Material for treatment	Byproduct classification	Amount
computer, laptop	no	allocatable product	1 unit

By-products	Material for treatment	Byproduct classification	Amount
used cable	yes	Waste	0.0683 kg
used laptop computer	yes	Waste	2.04 kg
wastewater, unpolluted	yes	Waste	1.52 m3

Inputs from technosphere	Amount
acrylonitrile-butadiene-styrene copolymer	0.3 kg
aluminium, cast alloy	0.14 kg

aluminium, wrought alloy	0.28 kg
battery, Li-ion, NCA, rechargeable, prismatic	0.333 kg
cable, connector for computer, without plugs	0.15 m
copper, cathode	0.0305 kg
electricity, medium voltage	1.67 kWh
extrusion, plastic pipes	0.463 kg
fan, for power supply unit, desktop computer	0.021 kg
flat glass, coated	0.022 kg
integrated circuit, logic type	0.0111 kg
integrated circuit, memory type	0.012 kg
liquid crystal display, unmounted, mobile device	0.428 kg
magnesium-alloy, AZ91, diecast	0.0673 kg
photovoltaic cell factory	3.04e-08 unit
plug, inlet and outlet, for computer cable	1 unit
polycarbonate	0.163 kg
power adapter, for laptop	0.742 unit
printed wiring board, mounted mainboard, laptop computer, Pb free	0.168 kg
section bar extrusion, aluminium	0.42 kg
sheet rolling, aluminium	0.0673 kg
sheet rolling, copper	0.0305 kg
sheet rolling, steel	0.0613 kg
steel, chromium steel 18/8, hot rolled	0.0613 kg
tap water	1.62e+3 kg

Emissions to air	Amount
Water	0.0988 m3

Dataset Description

General comment

This dataset represents the production of 1 unit of a laptop computer (without packaging). The exchanges are a weighted average of four sources (Hischier (2014), Ciroth (2011), Busa (2019), Apple Environment Report) and represent the production of an average Laptop in the given time period.
Data on water and electricity consumption and factory usage are taken from (Hischier, 2007). The datasets represents the current technology, the CD-Drive is therefore excluded and a solid state drive is included for computer storage.
Sources:

- Hischier, R., Coroama, V. C., Schien, D., & Achachlouei, M. A. (2015). Grey energy and environmental impacts of ICT hardware. In ICT Innovations for Sustainability (pp. 171-189). Springer, Cham.
- Ciroth, A., & Franze, J. (2011). LCA of an ecolabeled notebook: consideration of social and environmental impacts along the entire life cycle. Lulu. com.
- Busa, A., Hegeman, M. (2019). Life Cycle Assessment of Dell Latitude 7300 25th Anniversary Edition.
- Apple Environment Report, 13-inch MacBook Pro, 15-inch MacBook Pro (2019), https://www.apple.com/lae/environment/.
- 2007, Hischier R., Classen M., Lehmann M., Scharnhorst W., Life Cycle Inventories of Electric and Electronic Equipment - Production, Use & Disposal, Final report ecoinvent Data v2.0, 18, Duebendorf and St. Gallen, CH, Swiss Centre for LCI, Empa - TSL, 3 - SeparatePublication.
This dataset is meant to replace the following datasets: - computer production, laptop, GLO, 2001 - 2006 (b525f1a4-59ef-4da0-b6e1-f188c4358881).

Included activities start
From reception of raw materials and auxiliares at the factory gate.

Included activities end
This dataset includes materials (mainly metals and plastics) with their respective manufacturing processes (e.g. sheet rolling, press moulding). Further inventoried is the infrastructure (factory), the electricity for the assembly of the laptop computer, the water consumption and industrial waste water plus the dataset includes the exchange "used laptop computer" to take into account the disposal.

Sampling procedure
Literature and own assumptions for processing and electricity consumption calculations.

Technology comment
The production of a laptop computer includes the metal processing step sheet rolling and press moulding of the magnesium parts. Plastic parts are blow moulded or extruded into required shapes. The process technology of the parts (capacitors, resistors, microchips etc.) mounted on to the printed wiring board are described in individual datasets.

Geography comment
Such a laptop computer may be assembled anywhere in the world. Therefore a global dataset is justifiable.

Time period comment
Data for material composition is between 2007 and 2019.

Detailed Information For Exchanges

Reference product	Annual prod.vol.	Amount
computer, laptop	1.64e+8 unit	1 unit

Comment: Laptops can be considered to be system units. Laptop computers are constructed with similar components as desktop ones. Though compared to the desktop computer, shape and performance of these components vary.
Production volume: 1.64e+8 unit
Production volume comment: Units sold in year 2017. Source: Trendforce Corp, (2018, February 12). Apple Surpassed ASUS, Recording 9.6% Market Share in 2017 Global Notebook Market, Says TrendForce [Press Release]. Retrieved from https://press.trendforce.com/press/20180212-3065.html

By-products	Annual prod.vol.	Amount
used cable	1.12e+7 kg	0.0683 kg

Comment: Calculated Value. Dry mass of "cable, connector for computer, without plugs" * length of cable + dry mass of "plug, inlet and outlet, for computer cable".
Production volume: 1.12e+7 kg
Production volume comment: Calculated from production volume of reference product using the relative outputs.
Uncertainty distribution: lognormal; **GSD2:** 1.14; **Pedigree matrix:** [1, 4, 3, 3, 3]

used laptop computer	3.34e+8 kg	2.04 kg

Comment: Calculated Value. Sum of all materials used for the production of the laptop.
Production volume: 3.34e+8 kg
Production volume comment: Calculated from the production volume of computer, laptop in proportion to the respective output amounts.
Uncertainty distribution: lognormal; **GSD2:** 1.14; **Pedigree matrix:** [1, 4, 3, 3, 3]

wastewater, unpolluted	2.49e+8 m3	1.52 m3

Comment: Literature Value. Source: 2003, Fujitsu L., EcoLeaf Product Environmental Aspects Declaration. , http://www.jemai.or.jp/english/ecoleaf/pdf/AS_03_001_e.pdf.
Production volume: 2.49e+8 m3
Production volume comment: Calculated from the production volume of computer, laptop in proportion to the respective output amounts.
Uncertainty distribution: lognormal; **GSD2:** 1.3; **Pedigree matrix:** [1, 4, 5, 3, 3]
Source: Fujitsu L. (2003)

Inputs from technosphere	Amount
acrylonitrile-butadiene-styrene copolymer	0.3 kg

Comment: Literature value. Based on literature, the plastics used for the manifacturing of laptop casing, Keyboard & Trackpad (0.136933kg ABS) are PC and ABS. Based on the weighted average of the sources cited in the general comment, the amount of ABS is (0.100667kg), the amount of PC is (0.100667kg) and the amount of 50/50 ABS/PC mixture is (0.13kg).
Uncertainty distribution: lognormal; **GSD2:** 1.14; **Pedigree matrix:** [1, 4, 3, 3, 3]

aluminium, cast alloy	0.14 kg

Comment: Weighted average of Sources mentionend in "General Comment".
Uncertainty distribution: lognormal; **GSD2:** 1.14; **Pedigree matrix:** [1, 4, 3, 3, 3]

aluminium, wrought alloy	0.28 kg

Comment: Weighted average of Sources mentionend in "General Comment".
Uncertainty distribution: lognormal; **GSD2:** 1.14; **Pedigree matrix:** [1, 4, 3, 3, 3]

battery, Li-ion, NCA, rechargeable, prismatic	0.333 kg

Comment: Weighted average of Sources mentionend in "General Comment".
Uncertainty distribution: lognormal; **GSD2:** 1.14; **Pedigree matrix:** [1, 4, 3, 3, 3]

cable, connector for computer, without plugs	0.15 m

Comment: Literature Value. Represents the power cable of the laptop.
Uncertainty distribution: lognormal; **GSD2:** 1.28; **Pedigree matrix:** [1, 4, 5, 3, 3]
Source: Hischier R. (2004)

copper, cathode	0.0305 kg

Comment: Weighted average of Sources mentionend in "General Comment".
Uncertainty distribution: lognormal; **GSD2:** 1.14; **Pedigree matrix:** [1, 4, 3, 3, 3]

electricity, medium voltage	1.67 kWh

Comment: Literature Value: Source: 2007, Hischier R., Classen M., Lehmann M., Scharnhorst W., Life Cycle Inventories of Electric and Electronic Equipment - Production, Use & Disposal, Final report ecoinvent Data v2.0, 18, Duebendorf and St. Gallen, CH, Swiss Centre for LCI, Empa - TSL, 3 - SeparatePublication.
Uncertainty distribution: lognormal; **GSD2:** 1.3; **Pedigree matrix:** [1, 4, 5, 3, 3]
Source: Hischier R. (2007)

extrusion, plastic pipes	0.463 kg

Comment: Service representing the processing ABS (0.3001kg) and PC (0.163167kg).
Uncertainty distribution: lognormal; **GSD2:** 1.14; **Pedigree matrix:** [1, 4, 3, 3, 3]

fan, for power supply unit, desktop computer	0.021 kg

Comment: Used as proxy for laptop fan.
Uncertainty distribution: lognormal; **GSD2:** 1.14; **Pedigree matrix:** [1, 4, 3, 3, 3]

flat glass, coated	0.022 kg

Comment: Weighted average of Sources mentionend in "General Comment".
Uncertainty distribution: lognormal; **GSD2:** 1.14; **Pedigree matrix:** [1, 4, 3, 3, 3]

integrated circuit, logic type	0.0111 kg

Comment: Additional Integrated Circuits not accounted for in printed wiring board exchange. Total amount of integrated circuit is scaled to fit the amount of wafer as in US, Q. (2018). Life Cycle Assessment of the HP Pro x2 612 G2 Tablet in the United States.
Uncertainty distribution: lognormal; **GSD2:** 1.59; **Pedigree matrix:** [5, 5, 5, 5, 5]

integrated circuit, memory type	0.012 kg

Comment: The SSD is here approximated with the exchange "integrated circuit, memory type". This choice is justified based on literature information reporting that more than 90% of LCIA Impact of SSD is due to the integrated circuit. Source: Seagate Life Cycle Assessments & Corporate Sustainability, LCA of Enterprise SSD (https://www.seagate.com/global).Scaled to result in 228mm2 of wafer as in.US, Q. (2018). Life Cycle Assessment of the HP Pro x2 612 G2 Tablet in the United States.
Uncertainty distribution: lognormal; **GSD2:** 1.14; **Pedigree matrix:** [1, 4, 3, 3, 3]

liquid crystal display, unmounted, mobile device	0.428 kg

Comment: Weighted average of Sources mentionend in "General Comment".
Uncertainty distribution: lognormal; **GSD2:** 1.14; **Pedigree matrix:** [1, 4, 3, 3, 3]

magnesium-alloy, AZ91, diecast	0.0673 kg

Comment: Weighted average of Sources mentionend in "General Comment".
Uncertainty distribution: lognormal; **GSD2:** 1.14; **Pedigree matrix:** [1, 4, 3, 3, 3]

photovoltaic cell factory	3.04e-08 unit

Comment: To represent computer production photovoltaic cell factory is used as a proxy. It is based on a annual production of 7.9 mio pieces and life-span of 25 years.
Uncertainty distribution: lognormal; **GSD2:** 1.84; **Pedigree matrix:** [1, 4, 5, 3, 3]
Source: Hischier R. (2007)

plug, inlet and outlet, for computer cable	1 unit

Comment: Literature Value. Represents the plugs of the power cable.
Uncertainty distribution: lognormal; **GSD2:** 1.14; **Pedigree matrix:** [1, 4, 3, 3, 3]

polycarbonate	0.163 kg

Comment: Literature Value. Based on literature, the plastics used for the manifacturing of laptop casing, Keyboard & Trackpad (0.136933kg ABS) are PC and ABS. Based on the weighted average of the sources cited in the general comment, the amount of ABS is (0.100667kg), the amount of PC is (0.100667kg) and the amount of 50/50 ABS/PC mixture is (0.13kg).
Uncertainty distribution: lognormal; **GSD2:** 1.14; **Pedigree matrix:** [1, 4, 3, 3, 3]

power adapter, for laptop	0.742 unit

Comment: Calculated value. The product power adaptor in ecoinvent (accessed Jan 2020) has a weight of 0.531kg. According to current literature (see Sources in "General Comment" the weight is of roughly 0.394 kg. 0.742 of a unit of power adaptor is therefore used for this dataset.
Uncertainty distribution: lognormal; **GSD2:** 1.14; **Pedigree matrix:** [1, 4, 3, 3, 3]

printed wiring board, mounted mainboard, laptop computer, Pb free	0.168 kg

Comment: Literature value. As of 2007 the use of lead-containing solder is resitricted by RoHs (https://www.rohsguide.com/).
Uncertainty distribution: lognormal; **GSD2:** 1.14; **Pedigree matrix:** [1, 4, 3, 3, 3]

section bar extrusion, aluminium	0.42 kg

Comment: Service representing the processing of the material.
Uncertainty distribution: lognormal; **GSD2:** 1.14; **Pedigree matrix:** [1, 4, 3, 3, 3]

sheet rolling, aluminium	0.0673 kg

Comment: Service representing the processing of the material. Proxy for the processing of magnesium.
Uncertainty distribution: lognormal; **GSD2:** 1.14; **Pedigree matrix:** [1, 4, 3, 3, 3]

sheet rolling, copper	0.0305 kg

Comment: Service representing the processing of copper.
Uncertainty distribution: lognormal; **GSD2:** 1.14; **Pedigree matrix:** [1, 4, 3, 3, 3]

sheet rolling, steel	0.0613 kg

Comment: Service representing the processing of steel.
Uncertainty distribution: lognormal; **GSD2:** 1.14; **Pedigree matrix:** [1, 4, 3, 3, 3]

steel, chromium steel 18/8, hot rolled	0.0613 kg

Comment: Weighted average of Sources mentionend in "General Comment".
Uncertainty distribution: lognormal; **GSD2:** 1.14; **Pedigree matrix:** [1, 4, 3, 3, 3]

tap water	1.62e+3 kg

Comment: Literature Value. Source: 2003, Fujitsu L., EcoLeaf Product Environmental Aspects Declaration. , http://www.jemai.or.jp/english/ecoleaf/pdf/AS_03_001_e.pdf, 0 - Undefined.
Uncertainty distribution: lognormal; **GSD2:** 1.3; **Pedigree matrix:** [1, 4, 5, 3, 3]
Source: Fujitsu L. (2003)

Emissions to air	Subcompartment	Amount
Water	unspecified	0.0988 m3

Comment: Calculated value based on literature values and expert opinion. See comments in the parametres" comment field.
Uncertainty distribution: lognormal; **GSD2:** 1.22; **Pedigree matrix:** [2, 2, 1, 1, 1]

Source

First author	Fujitsu L.
Title	EcoLeaf Product Environmental Aspects Declaration.
Year	2003

First author	Hischier R.
Additional author(s)	Classen M., Lehmann M., Scharnhorst W.
Title	Life Cycle Inventories of Electric and Electronic Equipment - Production, Use & Disposal
Year	2007
Volume number	18

First author	Hischier R.
Title	Life Cycle Inventories of Packaging and Graphical Paper
Year	2004
Volume number	11

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