

The top half of the slide features a background image of a mountain valley with green hills and a forested valley floor. The sky is overcast. The text 'GreenDelta' is overlaid in white, with 'Green' in a smaller font and 'Delta' in a larger font. Below it, the tagline 'sustainability consulting + software' is written in a smaller white font.

GreenDelta

sustainability consulting + software

Addressing data quality challenges for Open Source LCA software developers

77th LCA Discussion Forum

April 21, 2021

Dr. Andreas Ciroth

GreenDelta GmbH

Content

- “open source LCA” = openLCA
- Data quality: some notes
- How data quality is addressed in openLCA
- Outlook

A landscape photograph of a mountain valley with green hills and a forest. A purple semi-transparent banner is overlaid across the middle of the image, containing white text. The foreground shows a rocky, light-colored slope.

“open source LCA” = openLCA

“open source LCA” = openLCA

(for this presentation)



- openLCA: powerful, versatile, free and open source LCA and sustainability assessment software, developed by GreenDelta since 2007
- www.openLCA.org
- Most users worldwide of all LCA software systems (we think..), growing
- But of course:
 - “SimaPro is the leading LCA software solution” (<https://simapro.com/about/>)
 - “GaBi ist die meist verwendete Nachhaltigkeitssoftware für die Ökobilanzierung von Produkten“ (<http://www.gabi-software.com/deutsch/software/gabi-software/>)

A scenic mountain landscape with a purple overlay containing the text "Data quality". The background shows a valley with dense evergreen forests, rolling hills, and distant mountain peaks under a cloudy sky. In the foreground, there is a rocky, light-colored slope. A semi-transparent purple banner is positioned horizontally across the middle of the image, with the text "Data quality" written in white, sans-serif font.

Data quality

Data quality

(some notes)

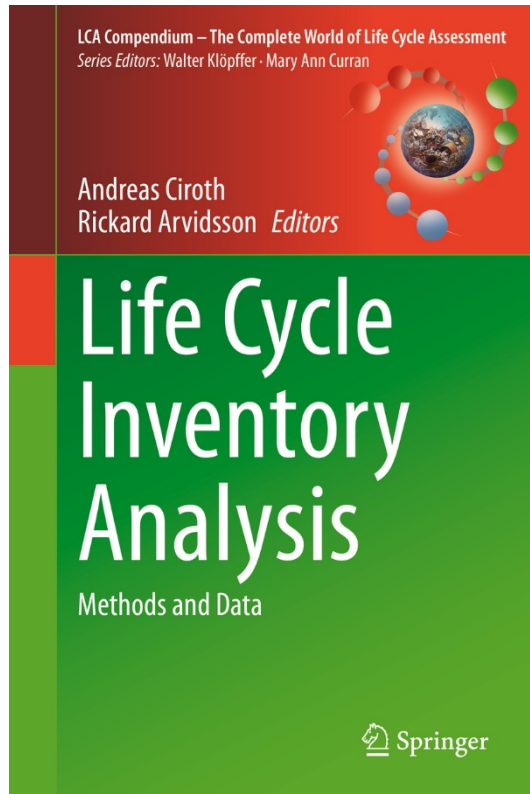
- ISO 14040: fit for purpose
- For datasets, two faces:
 - When creating the dataset
 - When using the dataset



(→ Janus face)

Ciroth, A.: Data Quality, ch. 5 in Life Cycle Inventory Analysis, Giroth / Arvidsson (eds.), Springer, 2021

(data quality, some more details)



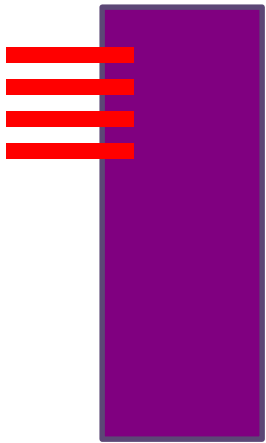
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Data quality indicators from the database are not the full picture

- Different application cases (different location, reference year, carbon accounting method, ..)
- Inter-dataset inconsistency cannot be documented per dataset
- E.g., ecoinvent: tyre wear emissions not provided for some street transport processes

Where is data quality measured and documented?

- 1 All the exchanges of a unit process → ecoinvent

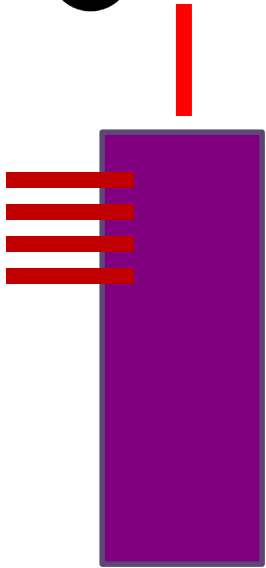


a unit process dataset

Where is data quality measured and documented?

2

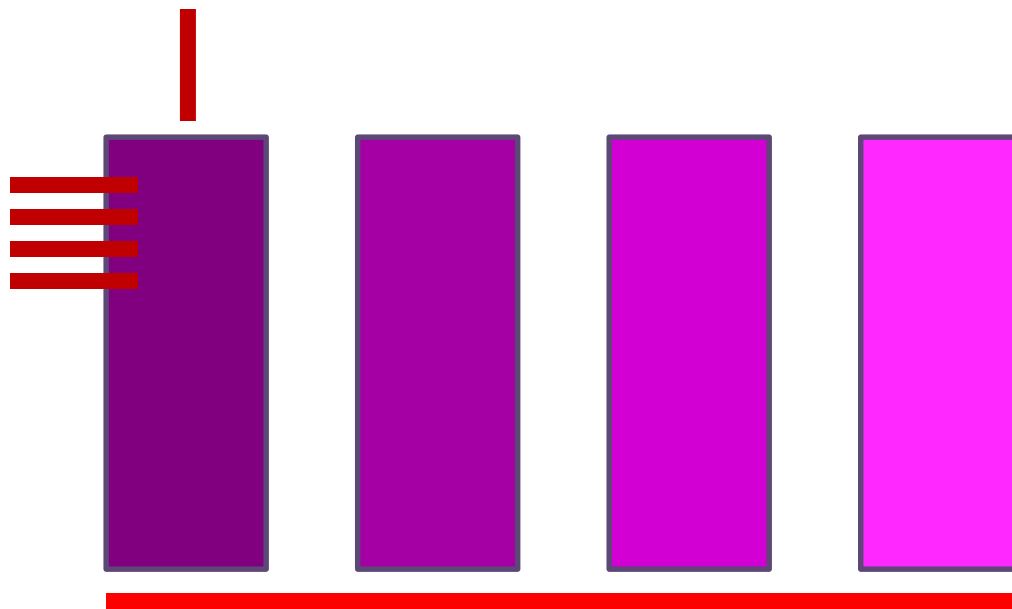
A process dataset, meta data → US EPA



a unit process dataset

Where is data quality measured and documented?

- 3 A process dataset against other process datasets
(→ UN GLAD; underdeveloped)



unit process datasets

E.g., ecoinvent: tyre wear emissions not provided for some street transport processes

- Provided

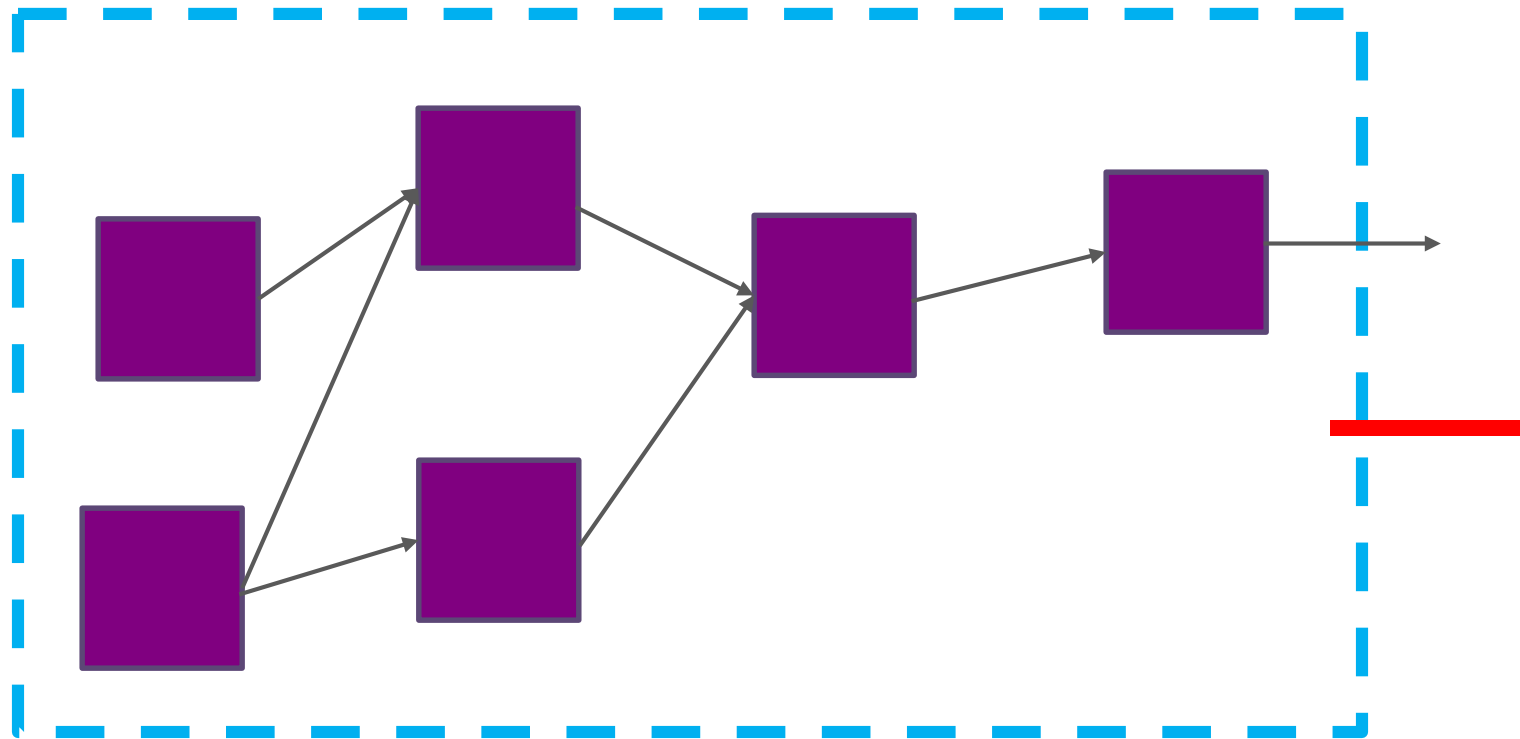
not provided

REF_ID	PNAME	FNAME	IS_INPUT	RESULTING	NAME
787cc269-d2	transport, freight, light commercial vehicle, EURO1 transport, freight, light commercial vehicle, EURO1	tyre wear emissions, lorry	0	0.00012	kg
01e5d570-6e	transport, freight, light commercial vehicle, EURO2 transport, freight, light commercial vehicle, EURO2	tyre wear emissions, lorry	0	0.00012	kg
05610e24-bd	transport, freight, light commercial vehicle, unregulated transport, freight, light commercial vehicle, unregulated	tyre wear emissions, lorry	0	0.00012	kg
5f2a6b2e-e6	transport, freight, lorry >32 metric ton, EURO1 transport, freight, lorry >32 metric ton, EURO1 APOS, U	tyre wear emissions, lorry	0	0.00015	kg
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15dd710-e2	transport, freight, lorry 3.5-7.5 metric ton, EURO1 transport, freight, lorry 3.5-7.5 metric ton, EURO1 APOS, U	tyre wear emissions, lorry	0	0.00015	kg
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108f29a6-c0	transport, freight, lorry 3.5-7.5 metric ton, EURO6 transport, freight, lorry 3.5-7.5 metric ton, EURO6 APOS, U	tyre wear emissions, lorry	0	0.00041	kg
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eafe548d-c2	transport, freight, lorry 3.5-7.5 metric ton, unregulated transport, freight, lorry 3.5-7.5 metric ton, unregulated	tyre wear emissions, lorry	0	0.00015	kg
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1174e725-27	transport, freight, lorry 7.5-16 metric ton, EURO3 transport, freight, lorry 7.5-16 metric ton, EURO3 APOS, U	tyre wear emissions, lorry	0	0.00023	kg
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5e477f64-c9	transport, freight, lorry 7.5-16 metric ton, EURO6 transport, freight, lorry 7.5-16 metric ton, EURO6 APOS, U	tyre wear emissions, lorry	0	0.00023	kg
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8bddb73a-d	transport, freight, lorry with refrigeration machine, 3.5-7.5 ton, EURO3, R134a refrigerant, freezing transport, freight, lorry with refrigeration machine, 3.5-7.5 ton, EURO3, R134a refrigerant, freezing	tyre wear emissions, lorry	0	0.00041	kg
ee533d89-c9	transport, freight, lorry with refrigeration machine, 3.5-7.5 ton, EURO4, carbon dioxide, liquid refrigerant, cooling transport, freight, lorry with refrigeration machine, 3.5-7.5 ton, EURO4, carbon dioxide, liquid refrigerant, cooling	tyre wear emissions, lorry	0	0.00041	kg
bdafaa5e-91	transport, freight, lorry with refrigeration machine, 3.5-7.5 ton, EURO4, carbon dioxide, liquid refrigerant, cooling transport, freight, lorry with refrigeration machine, 3.5-7.5 ton, EURO4, carbon dioxide, liquid refrigerant, cooling	tyre wear emissions, lorry	0	0.00041	kg
a39db7d2-52	transport, freight, lorry with refrigeration machine, 3.5-7.5 ton, EURO4, R134a refrigerant, cooling transport, freight, lorry with refrigeration machine, 3.5-7.5 ton, EURO4, R134a refrigerant, cooling	tyre wear emissions, lorry	0	0.00041	kg
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426e8a9f-ce	transport, freight, lorry with refrigeration machine, 3.5-7.5 ton, EURO5, carbon dioxide, liquid refrigerant, cooling transport, freight, lorry with refrigeration machine, 3.5-7.5 ton, EURO5, carbon dioxide, liquid refrigerant, cooling	tyre wear emissions, lorry	0	0.00041	kg
44bcb9d-40	transport, freight, lorry with refrigeration machine, 3.5-7.5 ton, EURO5, carbon dioxide, liquid refrigerant, cooling transport, freight, lorry with refrigeration machine, 3.5-7.5 ton, EURO5, carbon dioxide, liquid refrigerant, cooling	tyre wear emissions, lorry	0	0.00041	kg

PREF	PNAME
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d57266c2-1a	transport, freight, light commercial vehicle transport, freight, light commercial vehicle APOS, U
10138d21-da	transport, freight, light commercial vehicle transport, freight, light commercial vehicle APOS, U
ccc7ed67-e5	transport, freight, lorry 28 metric ton, vegetable oil methyl ester 100% transport, freight, lorry 28 metric ton, vegetable oil methyl ester 100% APOS, U
584fc575-b1c	transport, freight, lorry 28 metric ton, vegetable oil methyl ester 100% transport, freight, lorry 28 metric ton, vegetable oil methyl ester 100% APOS, U
4335ccbb-b1	transport, passenger coach transport, passenger coach APOS, U
ff5ef059-858	transport, passenger coach transport, passenger coach APOS, U
b7c613d6-f1	transport, passenger, bicycle transport, passenger, bicycle APOS, U
6faf8b3e-33c	transport, passenger, bicycle transport, passenger, bicycle APOS, U
ed88c010-f0	transport, passenger, electric bicycle transport, passenger, electric bicycle APOS, U
b8711445-b5	transport, passenger, electric bicycle transport, passenger, electric bicycle APOS, U
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806c93a2-a9	transport, regular bus transport, regular bus APOS, U
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90154a05-58	transport, trolleybus transport, trolleybus APOS, U
690b545e-4e	transport, trolleybus transport, trolleybus APOS, U

Where is data quality measured and documented?

4 LC calculation result, system process



The background image shows a mountain range with green slopes and a valley filled with dense evergreen forests. The sky is overcast with grey clouds. A purple semi-transparent banner is overlaid across the middle of the image, containing white text. The foreground shows a rocky, light-colored slope on the left and some green vegetation on the right.

How data quality is addressed in openLCA

Addressing data quality in openLCA

- So far:
 - Show data quality assessment done by data provider to user
 - Enable users to define and set up own data quality systems
 - Link data quality with uncertainty where needed
 - Allow calculation of data quality over the life cycle
 - Show in calculation result
 - Find best suited processes (somehow)

Show data quality assessment done by data provider to user

P Inputs/Outputs: hard coal, import from AU | hard coal | APOS, U - RLA

▼ Inputs + × 1.23

Flow	Category	Amount	Unit	Costs/Revenues	Uncertainty	Avoided waste	Provider	Data quality e...	Location	Description
Fe hard coal	051:Mining of hard coal/0510:...	1.00200	kg		lognormal: g...		P market for...	(3; 5; 5; 5; 2)		Compensatio...
Fe transport, freight train	491:Transport via railways/4912:...	0.20000	t*km		lognormal: g...		P market for...	(1; 2; 3; 1; 1)		The weighted ...
Fe transport, freight, sea, bulk c...	501:Sea and coastal water trans...	15.00000	t*km		lognormal: g...		P market for...	(3; 3; 3; 1; 1)		Rough estima...

▼ Outputs + × 1.23

Flow	Category	Amount	Unit	Costs/Revenues	Uncertainty	Avoided prod...	Provider	Data quality e...	Location	Description
Fe hard coal	051:Mining of hard coal/0510:...	1.00000	kg	0.03600 EUR	none					
Fe Particulates, > 10 um	Emission to air/unspecified	0.00200	kg		lognormal: g...			(2; 5; 5; 5; 2)		For a lack of ...

Show data quality assessment done by data provider to user, editable

Welcome | market for jatropa seed | jatropa seed | APOS, U | Analysis result of market for jatropa seed | jatropa seed | APOS, U | P hard coal, import from AU | hard coal | APOS, U -

Pedigree matrix

Click on the matrix cells to select entries

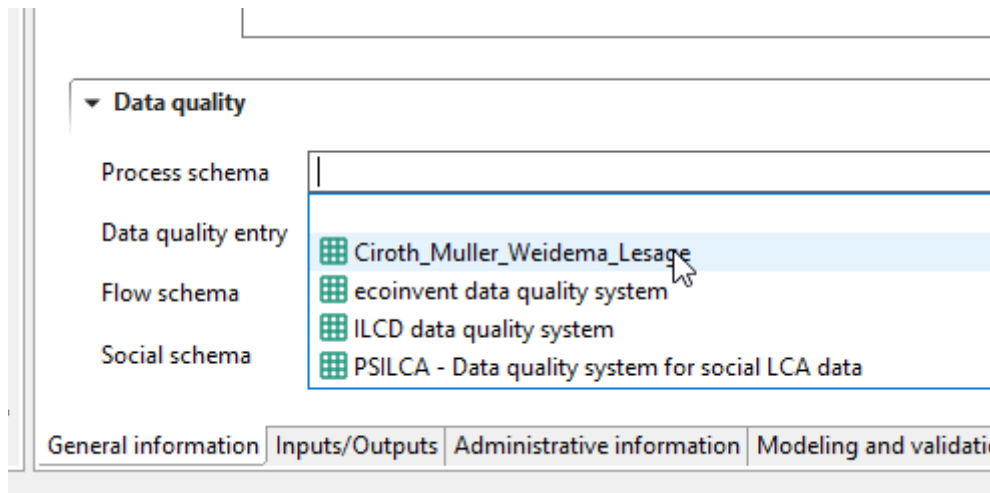
	1	2	3	4	5
Reliability	Verified data based on measurements	Verified data partly based on assumptions or non-verified data based on measurements	Non-verified data partly based on qualified estimates	Qualified estimate (e.g. by industrial expert)	Non-qualified estimates
Completeness	Representative data from all sites relevant for the market considered, over an adequate period to even out normal fluctuations	Representative data from > 50% of the sites relevant for the market considered, over an adequate period to even out normal fluctuations	Representative data from only some sites (< 50%) relevant for the market considered or > 50% of sites but from shorter periods	Representative data from only one site relevant for the market considered or some sites but from shorter periods	Representativeness unknown or data from a small number of sites and from shorter periods
Temporal correlation	Less than 3 years of difference to the time period of the data set	Less than 6 years of difference to the time period of the data set	Less than 10 years of difference to the time period of the data set	Less than 15 years of difference to the time period of the data set	Age of data unknown or more than 15 years of difference to the time period of the data set
Geographical correlation	Data from area under study	Average data from larger area in which the area under study is included	Data from area with similar production conditions	Data from area with slightly similar production conditions	Data from unknown or distinctly different area (North America instead of Middle East, OECD-Europe instead of Russia)
Further technological correlation	Data from enterprises, processes and materials under study	Data from processes and materials under study (i.e. identical technology) but from different enterprises	Data from processes and materials under study but from different technology	Data on related processes or materials	Data on related processes on laboratory scale or from different technology

Base uncertainty: or:

d waste	Provider	Data quality e...	L
	P market for...	(3; 5; 5; 5; 2)	
	P market for...	(1; 2; 3; 1; 1)	Edit
	P market for...	(3; 3; 3; 1; 1)	

d prod...	Provider	Data quality e...	L
		(2; 5; 5; 5; 2)	

Show data quality assessment done by data provider to user, editable



Show data quality assessment done by data provider to user, editable

Infrastructure process Add a tag

Create product

Time

Start date: 01.01.2015

End date: 31.12.2020

Description: The trade volumes represented

Geography

Location: Latin America and the Caribbean

Geographic data: [open in map](#)

Description: This datasets models the

Technology

Description: The coal is transported from the Railway Association (BITRE, 2019). Reference(s): Bureau of Infrastructure, Transport and Regional Development (BITRE, 2019)

Data quality

Process schema: ecoinvent data quality

Data quality entry: (not specified)

Flow schema: ecoinvent data quality

Social schema:

Pedigree matrix X

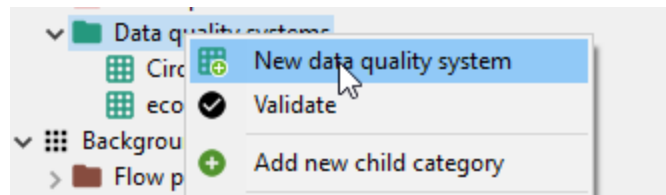
Click on the matrix cells to select entries

	1	2	3	4	5
Reliability	Verified data based on measurements	Verified data partly based on assumptions or non-verified data based on measurements	Non-verified data partly based on qualified estimates	Qualified estimate (e.g. by industrial expert)	Non-qualified estimates
Completeness	Representative data from all sites relevant for the market considered, over and adequate period to even out normal fluctuations	Representative data from > 50% of the sites relevant for the market considered, over an adequate period to even out normal fluctuations	Representative data from only some sites (< < 50%) relevant for the market considered or > 50% of sites but from shorter periods	Representative data from only one site relevant for the market considered or some sites but from shorter periods	Representativeness unknown or data from a small number of sites and from shorter periods
Temporal correlation	Less than 3 years of difference to the time period of the data set	Less than 6 years of difference to the time period of the data set	Less than 10 years of difference to the time period of the data set	Less than 15 years of difference to the time period of the data set	Age of data unknown or more than 15 years of difference to the time period of the data set
Geographical correlation	Data from area under study	Average data from larger area in which the area under study is included	Data from area with similar production conditions	Data from area with slightly similar production conditions	Data from unknown or distinctly different area (North America instead of Middle East, OECD-Europe instead of Russia)
Further technological correlation	Data from enterprises, processes and materials under study	Data from processes and materials under study (i.e. identical technology) but from different enterprises	Data from processes and materials under study but from different technology	Data on related processes or materials	Data on related processes on laboratory scale or from different technology

OK Cancel

General information | Inputs/Outputs | Administrative information | Modeling and validation | Parameters | Allocation | Social aspects | Impact analysis

Enable users to define and set up own data quality systems



market for jatropha seed | jatropha seed | APOS, U

Analysis result of market for jatropha seed | jatropha ...

hard coal, import from AU | hard coal | APOS, U - RLA

Ciroth_Muller_Weidema_Lesage

Version 00.00.003

UUID 64925569-1840-4067-9448-43e02f125934

Last change 2017-04-06T10:58:06+0200

Tags Add a tag

Source

Indicators & Scores

	1	2	3	4	5	Add score
Reliability	Verified data based on measurements	Verified data partly based on assumptions or non-verified data based on measurements	Non-verified data partly based on qualified estimates	Qualified estimate (e.g. by industrial expert)	Non-qualified estimates	Remove indicator
Completeness	Representative data from all sites relevant for the market considered, over an adequate period to even out normal fluctuations	Representative data from > 50% of the sites relevant for the market considered, over an adequate period to even out normal fluctuations	Representative data from only some sites (< < 50%) relevant for the market considered or > 50% of sites but from shorter periods	Representative data from only one site relevant for the market considered or some sites but from shorter periods	Representativeness unknown or data from a small number of sites and from shorter periods	Remove indicator
Temporal correlation	Less than 3 years of difference to the time period of the data set	Less than 6 years of difference to the time period of the data set	Less than 10 years of difference to the time period of the data set	Less than 15 years of difference to the time period of the data set	Age of data unknown or more than 15 years of difference to the time period of the data set	Remove indicator
Geographical correlation	Data from area under study	Average data from larger area in which the area under study is included	Data from area with similar production conditions	Data from area with slightly similar production conditions	Data from unknown or distinctly different area (North America instead of Middle East, OECD-Europe instead of Russia)	Remove indicator
Further technological correlation	Data from enterprises, processes and materials under study	Data from processes and materials under study (i.e. identical technology) but from different enterprises	Data from processes and materials under study but from different technology	Data on related processes or materials	Data on related processes on laboratory scale or from different technology	Remove indicator
Add indicator	Remove score	Remove score	Remove score	Remove score	Remove score	

Uncertainties

	1	2	3	4	5
Reliability	<input type="text" value="1.0"/>	<input type="text" value="1.54"/>	<input type="text" value="1.61"/>	<input type="text" value="1.69"/>	<input type="text" value="25.0"/>
Completeness	<input type="text" value="1.0"/>	<input type="text" value="1.03"/>	<input type="text" value="1.04"/>	<input type="text" value="1.08"/>	<input type="text" value="25.0"/>
Temporal correlation	<input type="text" value="1.0"/>	<input type="text" value="1.03"/>	<input type="text" value="1.1"/>	<input type="text" value="1.19"/>	<input type="text" value="1.29"/>
Geographical correlation	<input type="text" value="1.0"/>	<input type="text" value="1.04"/>	<input type="text" value="1.08"/>	<input type="text" value="1.11"/>	<input type="text" value="25.0"/>
Further technological correlation	<input type="text" value="1.0"/>	<input type="text" value="1.18"/>	<input type="text" value="1.65"/>	<input type="text" value="2.08"/>	<input type="text" value="2.8"/>

Link data quality with uncertainty where needed

New data quality system
Creates a new data quality system

Name:

Description:

System defines uncertainties

Finish Cancel

▼ Uncertainties

	1	2	3	4	5
Reliability	<input type="text" value="1.0"/>	<input type="text" value="1.54"/>	<input type="text" value="1.61"/>	<input type="text" value="1.69"/>	<input type="text" value="25.0"/>
Completeness	<input type="text" value="1.0"/>	<input type="text" value="1.03"/>	<input type="text" value="1.04"/>	<input type="text" value="1.08"/>	<input type="text" value="25.0"/>
Temporal correlation	<input type="text" value="1.0"/>	<input type="text" value="1.03"/>	<input type="text" value="1.1"/>	<input type="text" value="1.19"/>	<input type="text" value="1.29"/>
Geographical correlation	<input type="text" value="1.0"/>	<input type="text" value="1.04"/>	<input type="text" value="1.08"/>	<input type="text" value="1.11"/>	<input type="text" value="25.0"/>
Further technological correlation	<input type="text" value="1.0"/>	<input type="text" value="1.18"/>	<input type="text" value="1.65"/>	<input type="text" value="2.08"/>	<input type="text" value="2.8"/>

(of course, whether this linkage makes sense is a separate discussion)

Allow calculation of data quality over the life cycle

LCa Calculation properties

Calculation properties

Please select the properties for the calculation

Allocation method: None

Impact assessment method: CML-IA baseline

Normalization and weighting set: EU25+3, 2000

Calculation type: Quick results Analysis Monte Carlo Simulation

Regionalized calculation

Include cost calculation

Assess data quality

< Back Next > Finish Cancel

LCa Calculation properties

Data quality properties

Please select the properties for the data quality assessment

Process schema: ecoinvent data quality system

Flow schema: ecoinvent data quality system

Aggregation type: Weighted average

Rounding mode: Half up

n.a. value handling:

< Back Next > Finish Cancel

Allow calculation of data quality over the life cycle, show in calculation result

market for jatropha seed | jatropha seed | APOS, U

Inputs

Name	Category	Sub-category	Amount	Unit	R	C	T	G	F
> Aluminium, in ground	Resource	in ground	0.00059	kg	2	2	3	1	1
> Anhydrite, in ground	Resource	in ground	1.41165E-8	kg					
> Antimony, in ground	Resource	in ground	2.40713E-9	kg	2	2	5	5	1
> Argon-40	Resource	in air	4.25638E-5	kg	1	1	5	1	1
> Arsenic, in ground	Resource	in ground	6.07274E-8	kg	1	2	1	1	1
> Barium, in ground	Resource	in ground	0.00040	kg	4	4	5	5	1
> Basalt, in ground	Resource	in ground	0.00015	kg	3	4	5	4	3
> Beryllium, in ground	Resource	in ground	9.92897E-10	kg	3	2	3	5	1
> Borax, in ground	Resource	in ground	6.59611E-7	kg	4	3	5	4	5
> Bromine, in water	Resource	in water	8.79379E-8	kg	4	5	3	4	1
> Cadmium, in ground	Resource	in ground	4.57994E-8	kg	1	3	3	1	1
> Calcite, in ground	Resource	in ground	0.01680	kg	3	3	4	4	3
> Calcium, in ground	Resource	in ground	5.22240E-5	kg	1	3	3	1	1
> Carbon dioxide, in air	Resource	in air	2.04857	kg	4	3	3	5	1
> Carbon, organic, in soil or biomass stock	Resource	in ground	9.84245E-5	kg	2	2	4	2	1
> Carnallite	Resource	in water	9.20673E-7	kg	5	4	5	4	4

Allow calculation of data quality over the life cycle, show in calculation result

Name	Category	Sub-category	Amount	Unit	R	C	T	G	F
Aluminium, in ground	Resource	in ground	0.00059	kg	2	2	3	1	1
P bauxite mine operation bauxite APOS, U - GL	072:Mining of no...	0729:Mining of other non...	0.00056	kg	2	2	3	1	1
P cobalt production nickel, class 1 APOS, U - G	072:Mining of no...	0729:Mining of other non...	1.10321E-5	kg	1	2	1	1	1
P cobalt production sulfuric acid APOS, U - GL	072:Mining of no...	0729:Mining of other non...	5.33297E-6	kg	1	2	1	1	1
P cobalt production copper concentrate, sulfide	072:Mining of no...	0729:Mining of other non...	2.86128E-6	kg	1	2	1	1	1
P cobalt production copper, anode APOS, U - C	072:Mining of no...	0729:Mining of other non...	2.59837E-6	kg	1	2	1	1	1
P cobalt production ferronickel APOS, U - GLO	072:Mining of no...	0729:Mining of other non...	1.46648E-6	kg	1	2	1	1	1
P zinc mine operation zinc concentrate APOS,	072:Mining of no...	0729:Mining of other non...	1.02078E-6	kg	1	3	3	1	1
P zeolite production, powder zeolite, powder A	202:Manufacture ...	2023:Manufacture of soap...	7.02606E-7	kg					
P cobalt production copper, cathode APOS, U	072:Mining of no...	0729:Mining of other non...	6.50234E-7	kg	1	2	1	1	1
P cobalt production electrolyte, copper-rich A	072:Mining of no...	0729:Mining of other non...	5.07718E-7	kg	1	2	1	1	1
P zeolite production, powder zeolite, powder A	202:Manufacture ...	2023:Manufacture of soap...	3.46913E-7	kg					
P zinc mine operation lead concentrate APOS,	072:Mining of no...	0729:Mining of other non...	2.02837E-7	kg	1	3	3	1	1
P cobalt production nickel concentrate, 16% Ni	072:Mining of no...	0729:Mining of other non...	1.47542E-7	kg	1	2	1	1	1
P zinc mine operation copper concentrate, sulfi	072:Mining of no...	0729:Mining of other non...	1.28613E-7	kg	1	3	3	1	1
P cobalt production cobalt APOS, U - GLO	072:Mining of no...	0729:Mining of other non...	1.26925E-7	kg	1	2	1	1	1

Allow calculation of data quality over the life cycle, show in calculation result

▼ Impact analysis: EF 3.0 Method (adapted)

Subgroup by processes Don't show < 1 %

Name	Category	Inventory result	Impact factor	Impact result	Unit	R	C	T	G	F
> Ionising radiation				0.04134	kBq U-235 eq	1	1	5	2	1
> Climate change				1.45100	kg CO2 eq	3	3	5	4	2
> Resource use, minerals and metals				1.29883E-5	kg Sb eq	3	1	2	2	1
> Human toxicity, cancer - inorganics				2.56851E-18	CTUh	2	3	1	4	3
> Photochemical ozone formation				0.00406	kg NMVOC ...	2	3	5	3	2
> Ecotoxicity, freshwater - inorganics				20.92396	CTUe	1	1	5	5	2
> Eutrophication, marine				0.00641	kg N eq	2	3	5	3	2
> Resource use, fossils				12.24467	MJ	2	2	5	3	2
> Human toxicity, non-cancer - inorganics				4.71327E-9	CTUh	2	2	5	4	2
> Eutrophication, freshwater				0.00069	kg P eq	1	1	3	1	1
> Human toxicity, cancer - metals				5.08230E-9	CTUh	4	5	5	5	5
> Climate change - Fossil				1.44824	kg CO2 eq	3	3	5	4	2
> Human toxicity, non-cancer - metals				1.97186E-7	CTUh	4	5	5	5	5
> Human toxicity, non-cancer				2.02688E-7	CTUh	4	5	5	5	5
> Acidification				0.04672	mol H+ eq	3	3	5	3	2
> Ecotoxicity, freshwater - organics				1.80870	CTUe	3	3	4	2	2
> Climate change - Biogenic				0.00126	kg CO2 eq	3	2	5	3	2
> Climate change - Land use and LU change				0.00151	kg CO2 eq	4	3	5	3	2
> Ozone depletion				8.37845E-8	kg CFC11 eq	2	3	5	5	3
> Human toxicity, non-cancer - organics				6.20786E-10	CTUh	3	2	5	4	3
> Ecotoxicity, freshwater - metals				121.00749	CTUe	2	3	5	5	4
> Human toxicity, cancer				5.61501E-9	CTUh	4	4	5	5	4
> Water use				3.10997	m3 depriv.	3	3	4	3	2
> Particulate matter				3.46113E-7	disease inc.	3	3	4	3	2
> Ecotoxicity, freshwater				143.57039	CTUe	2	3	5	5	4
> Human toxicity, cancer - organics				5.32712E-10	CTUh	1	1	5	1	1
> Land use				206.83832	Pt	1	1	3	1	1
> Eutrophication, terrestrial				0.19726	mol N eq	2	3	5	3	1

Allow calculation of data quality over the life cycle, show in calculation result

Impact analysis: EF 3.0 Method (adapted)

Subgroup by processes Don't show < 1 %

Name	Category	Inventory result	Impact factor	Impact result	Unit	R	C	T	G	F
> Ionising radiation				0.04134	nBq U-235 eq	1	1	5	2	1
> Climate change				1.45100	kg CO2 eq	3	3	5	4	2
Resource use, minerals and metals				1.29883E-5	kg Sb eq	3	1	2	2	1
> P copper mine operation and beneficiation, sulfide ore copper conce	072:Mining of non-ferrous metal ores / 0729:Mining of othe...			2.88545E-6	kg Sb eq	3	1	1	1	1
> P copper mine operation and beneficiation, sulfide ore copper conce	072:Mining of non-ferrous metal ores / 0729:Mining of othe...			1.38280E-6	kg Sb eq	3	1	1	1	1
F Tellurium, in ground	Resource / in ground	2.51991E-8 kg	40.70000 kg Sb eq/kg	1.02560E-6	kg Sb eq	3	1	1	1	1
F Copper, in ground	Resource / in ground	0.00011 kg	0.00137 kg Sb eq/kg	1.45828E-7	kg Sb eq	3	1	1	1	1
F Selenium, in ground	Resource / in ground	3.75005E-7 kg	0.19400 kg Sb eq/kg	7.27509E-8	kg Sb eq	3	1	1	1	1
F Gold, in ground	Resource / in ground	1.01386E-9 kg	52.00000 kg Sb eq/kg	5.27209E-8	kg Sb eq	3	1	1	1	1
F Silver, in ground	Resource / in ground	3.65436E-8 kg	1.18000 kg Sb eq/kg	4.31215E-8	kg Sb eq	3	1	1	1	1
F Molybdenum, in ground	Resource / in ground	2.38921E-6 kg	0.01780 kg Sb eq/kg	4.25279E-8	kg Sb eq	3	1	1	1	1
> P copper mine operation and beneficiation, sulfide ore copper conce	072:Mining of non-ferrous metal ores / 0729:Mining of othe...			1.01177E-6	kg Sb eq	3	1	1	1	1
> P gold mine operation and gold production, unrefined gold, unrefine	072:Mining of non-ferrous metal ores / 0729:Mining of othe...			7.38046E-7	kg Sb eq	2	1	3	5	1
F Gold, in ground	Resource / in ground	1.41932E-8 kg	52.00000 kg Sb eq/kg	7.38046E-7	kg Sb eq	2	1	3	5	1
> P zinc mine operation zinc concentrate APOS, U - GLO	072:Mining of non-ferrous metal ores / 0729:Mining of othe...			7.06708E-7	kg Sb eq	1	3	3	1	1
> P copper mine operation and beneficiation, sulfide ore copper conce	072:Mining of non-ferrous metal ores / 0729:Mining of othe...			7.02794E-7	kg Sb eq	3	1	1	1	1
> P copper mine operation and beneficiation, sulfide ore copper conce	072:Mining of non-ferrous metal ores / 0729:Mining of othe...			5.43365E-7	kg Sb eq	3	1	1	1	1
> P copper mine operation and beneficiation, sulfide ore copper conce	072:Mining of non-ferrous metal ores / 0729:Mining of othe...			5.19641E-7	kg Sb eq	3	1	1	1	1
> P copper mine operation and beneficiation, sulfide ore copper conce	072:Mining of non-ferrous metal ores / 0729:Mining of othe...			5.06873E-7	kg Sb eq	3	1	1	1	1
> P copper mine operation and beneficiation, sulfide ore copper conce	072:Mining of non-ferrous metal ores / 0729:Mining of othe...			4.32309E-7	kg Sb eq	3	1	1	1	1
> P copper mine operation and beneficiation, sulfide ore copper conce	072:Mining of non-ferrous metal ores / 0729:Mining of othe...			4.14739E-7	kg Sb eq	3	1	1	1	1
> P silver-gold mine operation with refinery gold APOS, U - RoW	072:Mining of non-ferrous metal ores / 0729:Mining of othe...			4.04860E-7	kg Sb eq	2	4	5	5	1
F Gold, in ground	Resource / in ground	4.20854E-9 kg	52.00000 kg Sb eq/kg	2.18844E-7	kg Sb eq	2	4	5	5	1
F Silver, in ground	Resource / in ground	1.57641E-7 kg	1.18000 kg Sb eq/kg	1.86016E-7	kg Sb eq	2	4	5	5	1
> P copper mine operation and beneficiation, sulfide ore copper conce	072:Mining of non-ferrous metal ores / 0729:Mining of othe...			3.51246E-7	kg Sb eq	3	1	1	1	1
> P copper production, cathode, solvent extraction and electrowinning p	242:Manufacture of basic precious and other non-ferrous m...			2.18783E-7	kg Sb eq	2	2	5	1	1
> P phosphate rock beneficiation phosphate rock, beneficiated APOS,	089:Mining and quarrying n.e.c. / 0891:Mining of chemical a...			1.76761E-7	kg Sb eq	1	2	5	3	1
> P silver mine operation with extraction lead concentrate APOS, U - P	072:Mining of non-ferrous metal ores / 0729:Mining of othe...			1.72006E-7	kg Sb eq	3	3	3	1	1
> P gold production gold APOS, U - AU	072:Mining of non-ferrous metal ores / 0729:Mining of othe...			1.50958E-7	kg Sb eq	3	3	5	1	1
> P gold-silver mine operation with refinery gold APOS, U - RoW	072:Mining of non-ferrous metal ores / 0729:Mining of othe...			1.48679E-7	kg Sb eq	3	4	5	5	1
> P molybdenite mine operation copper concentrate, sulfide ore APOS,	072:Mining of non-ferrous metal ores / 0729:Mining of othe...			1.44936E-7	kg Sb eq	2	2	5	1	1
> P zinc mine operation lead concentrate APOS, U - GLO	072:Mining of non-ferrous metal ores / 0729:Mining of othe...			1.40428E-7	kg Sb eq	1	3	3	1	1
> P chromite ore concentrate production chromite ore concentrate AF	072:Mining of non-ferrous metal ores / 0729:Mining of othe...			1.34081E-7	kg Sb eq	2	2	5	1	1
> Human toxicity, cancer - inorganics				2.56851E-18	CTUh	2	3	1	4	3
> Photochemical ozone formation				0.00406	kg NMVOC ...	2	3	5	3	2
> Ecotoxicity, freshwater - inorganics				20.92396	CTUe	1	1	5	5	2
> Eutrophication, marine				0.00641	kg N eq	2	3	5	3	2
> Resource use, fossils				12.24467	MJ	2	2	5	3	2
> Human toxicity, non-cancer - inorganics				4.71327E-9	CTUh	2	2	5	4	2
> Eutrophication, freshwater				0.00069	kg P eq	1	1	3	1	1
> Human toxicity, cancer - metals				5.08230E-9	CTUh	4	5	5	5	5

Allow calculation of data quality over the life cycle, show in calculation result

- (e.g., Agribalyse, manually calculated estimate of data quality for assumed most relevant parts of a life cycle, in excel → not necessary)

Find best
suited
processes
(somehow),
via GLAD
criteria in
openLCA
Nexus



A scenic mountain landscape with a purple overlay containing the word 'Outlook'. The background shows a valley with dense evergreen forests, rolling hills, and distant mountain peaks under a cloudy sky. In the foreground, there is a rocky, light-colored slope. A solid purple horizontal band is positioned across the middle of the image, with the word 'Outlook' written in white, sans-serif font.

Outlook

Outlook: data quality in openLCA

- We are doing not so bad, but
 - Capacity building
 - User defined fitness for purpose
 - Real uncertainty
 - A challenge: full system compliance (EF, etc) → cheat, “quality-washing”, ..)

GreenDelta

sustainability consulting + software

Thank you!

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