

# Uncertainty reduction in consequential LCA models



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For Life Cycle  
Inventories

Presentation for the LCA XI conference, Chicago, 2011.10.04-06.

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Bo Weidema

ecoinvent Centre



# Uncertainty reduction in consequential LCA models

- The sources of uncertainty
- Measurement or estimation in the ecoinvent database
- Uncertainty reduction



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# Sources of uncertainty in consequential LCA models

- Data
- Completeness
- Aggregation level
- Geography
- Modelling
- Forecasting



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# Data uncertainty



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- Basic data uncertainty is reported for each data point
- Defaults applied when measured data are insufficient
- Additional uncertainty related to data quality is estimated with the pedigree matrix approach - including uncertainty from extrapolating or interpolating

ecoEditor for ecoinvent version 3

File Edit View Extras Help

Activity Description

Add Remove Column Lay

Type

0 - Referenc... acrylic varnish, wi

4 - FromEnv... Water, unspecified

5 - FromTec... acrylic binder, with

5 - FromTec... ammonia

5 - FromTec... chemical

5 - FromTec... electricity

5 - FromTec... ethylene

5 - FromTec... titanium

5 - FromTec... transport

5 - FromTec... transport

Probab

Logn

Data

Comm

data fr

Edit Uncertainty Pedigree Matrix

Indicator Score	1	2	3	4	5
<b>Reliability</b>	<input type="radio"/> Verified data based on measurements	<input type="radio"/> Verified data partly based on assumptions OR nonverified data based on measurements	<input checked="" type="radio"/> Non-verified data partly based on qualified estimates	<input type="radio"/> Qualified estimate (e.g. by industrial expert)	<input type="radio"/> Non-qualified estimate
<b>Completeness</b>	<input type="radio"/> Representative data from all sites relevant for the market considered over an adequate period to even out normal fluctuations	<input type="radio"/> Representative data from >50% of the sites relevant	<input type="radio"/> Representative data from only some sites (<50%)	<input type="radio"/> Representative data from	<input type="radio"/> Representativeness
<b>Temporal Correlation</b>	<input type="radio"/> Less than 3 years of difference to the time period of the dataset				
<b>Geographical Correlation</b>	<input type="radio"/> Data from area under study				

Table 10.5 Uncertainty factors (variances of the underlying normal distributions) used to convert the data quality indicators of the pedigree matrix in Table 10.4 into additional uncertainty.

Indicator score	1	2	3	4	5
Reliability	0.000	0.0006	0.002	0.008	0.04
Completeness	0.000	0.0001	0.0006	0.002	0.008
Temporal correlation	0.000	0.0002	0.002	0.008	0.04
Geographical correlation	0.000	2.5e-5	0.0001	0.0006	0.002
Further technological correlation	0.000	0.0006	0.008	0.04	0.12

# Uncertainty related to completeness



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- Completeness of data behind a specific datapoint → DQI
- Missing data points → Replace by extrapolated data with a higher uncertainty
- Example: 5 kWh +/- [BU+DQI] purchased from Quebec ; missing data from Quebec
  - use data from CAN instead?
  - extrapolate (interpolate) Quebec data, e.g from CAN, adding higher pedigree scores
- Data and completeness uncertainties are thereby treated in the same way and can be handled via normal simulation with e.g. Latin hypercube sampling.

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# Uncertainty related to the model assumptions



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- Some related to specific data points (production volumes, market trends) → can be treated in line with the afore
- Some related to fixed model parameters:
  - market delimitations
  - capital replacement rate
  - technology levels
  - market constraints or elasticities

which can only be assessed by sensitivity analyses with manual modifications for each model run (although parametarisation may be used to facilitate this).

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**(PFL)**

**PSI**

**EMPA**

**ART**



# Uncertainty related to forecasting



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- The outlined approach can also be applied to forecasted data (data for years into the future)
  - increasing the temporal pedigree score for each data point
  - using a wider range of settings for the fixed model parameters in the sensitivity analyses

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# Uncertainty reduction

- Reducing the largest uncertainties first
- Differentiating between reducible and irreducible uncertainty



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