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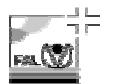
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Methodological Choices of ecoinvent

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[2] ecoinvent Centre, Swiss Centre for Life Cycle Inventories

Workshop on LCI Databases

InLCA / LCM 2003 Conference, Seattle, USA

September 24, 2003

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Goal of ecoinvent 2000

- Deliver background LCI data for LCAs

- Results (cradle-to-gate data) for attributional LCI, also with the option to include several LCIA methods

- Unit processes for attributional and consequential modeling

- Full matrix approach (complete consideration of recursions)

- Easy webbased access

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Co-product Allocation

- Based on allocation factors, which are stored separately in the database → flexible

- Choice of allocation factors based on expert knowledge, no fixed rules (but transparent to the user))

- System expansion not recommended (because too case specific for generic database)

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Recycling/Waste Allocation

- Cut-off approach is used for outputs with no economic value that are not sent to waste treatment

- No upstream burden is assigned to those outputs and no credit is given when they are used in another process

- If no specific information is available standard waste treatment processes are used:

  inert materials → landfill

  plastics, paper, etc → incineration

  metals → recycling

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Exclusion of Small Amounts (boundaries)

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- Goal: to be as complete as possible

- But: No fixed rules

- Based on expert knowledge

- Missing data that are expected to be of importance
  are estimated

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Exclusion of Spills and Losses

- Emissions from "regular" spills and losses are included (increased releases of radionuclides during NPP operation, "regular" oil platform and oil tanker spills)
- Emissions from accidents with high impact and low probability are excluded.

  -> risk assessment more appropriate

Age-appropriateness of Data

- Data valid for the year 2000 were used or data assumed to be valid for this year

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Surrogate and Estimated Data

- If important emission data etc. were not available, estimations by data collector (expert for this process or branch (eg metals) were used)

- Surrogate processes were used if not specific data was available and judged to be appropriate
  examples:
  - Ullmann's encyclopedia for technical chemistry used to model certain chemicals
  - one dataset for a chemical plant for organic chemicals

- Typical transport services and waste treatment applied in case of missing information

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Inventory for Impact Assessment

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- Higher differentiation of elementary flows than used today in impact assessment (e.g. SO2 into air, high population density or into air, low population density or into air, unspecified) → generic location

- Short term (< 100 years) and long term emissions (100 year to 60 000 year were used) → time frame

- Inclusion of land transformation (m^2) and land occupation (m^2a)

  → be prepared for LCIA methods in development or in the future

Matching the Goal to the Method

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- Not applicable, since ecoinvent is generic database for background data

Collecting Primary Data

- Mostly based on primary data such as environmental reports, national and international statistics, questionnaires

- In some cases LCA literature data (e.g., APME plastics, EAA aluminium data, KCL paper data), but - where possible - adapted to the ecoinvent methodology.

- Industry averages were used (not equivalent to BAT)

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Report Format

- Extensive documentation → Key

  Feature of ecoinvent

- Confidential implementation of LCI raw data possible

- Efficient implementation of LCI data in LCA software

  systems

- Based on SPOLD 97/99 data format

- Adapted to ISO Technical Specification 14048

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Structure of Data Format
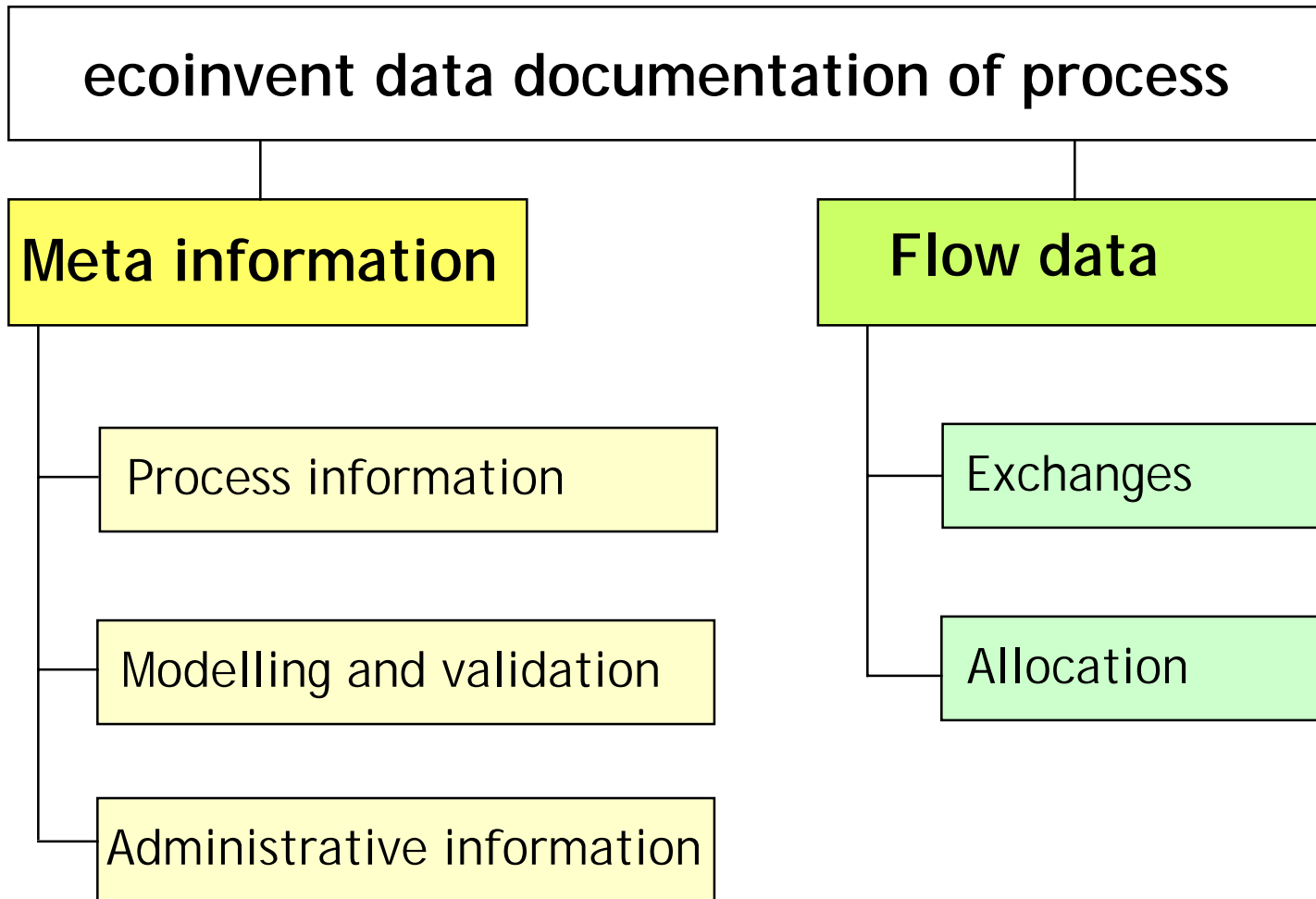
EcoSpold Fields: Data Requirements

Field	Unit proc.	Results	Elem. flows	Impact ass.
ReferenceFunction	Always	Always	Always	Always
Geography	Always	Always	Never	Never
Technology	Possible	Possible	Never	Never
TimePeriod	Always	Always	Never	Possible
DataSetInformation	Always	Always	Always	Always
Representativeness	Possible	Possible	Never	Never
Sources	Always	Always	Never	Always
Validations	Possible	Possible	Possible	Possible
DataEntryBy	Always	Always	Possible	Always
DataGeneratorAndPublication	Always	Always	Never	Always
Persons	Always	Always	Possible	Always
Exchanges	Always	Always	Never	Always
Allocations	Possible	Never	Never	Never

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Meta Information in Web-Interface

| Meta information	electricity, medium voltage, production UCTE, at grid, UCTE, [kWh]
Process information	electricity, medium voltage, production UCTE, at grid, UCTE, [kWh]
Reference function	electricity, medium voltage, production UCTE, at grid, UCTE, [kWh]
name	electricity, medium voltage, production UCTE, at grid
localName	Strom, Mittelspannung, Produktion UCTE, ab Netz
infrastructureProcess	no
unit	kWh
category	electricity
subCategory	supply mix
localCategory	Elektrizität
localSubCategory	Versorgungsmix
amount	1
includedProcesses	crade to busbar emissions, including construction, operation and dismantling of power plants
infrastructureIncluded	yes
datasetRelatesToProduct	yes
Geography	electricity, medium voltage, production UCTE, at grid, UCTE, [kWh]
location	UCTE
Technology	electricity, medium voltage, production UCTE, at grid, UCTE, [kWh]
text	average power plant technologies
Time period	electricity, medium voltage, production UCTE, at grid, UCTE, [kWh]
dataValidForEntirePeriod	yes
startYear	1990
endYear	1995

Internet

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Flow Information in Web-Interface
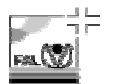
Flow data						steel, converter, low-alloyed, at plant, RER, [kg]	
Exchanges						steel, converter, low-alloyed, at plant, RER, [kg]	
From Nature						steel, converter, low-alloyed, at plant, RER, [kg]	

Number	Name	Location	Infra	Mean value	Unit	Uncertainty type	SD95%
resource/ in water							
3905	Water, unspecified natural origin		no	0.0027	m3	lognormal	1.11

From Technosphere						steel, converter, low-alloyed, at plant, RER, [kg]	

Number	Name	Location	Infra	Mean value	Unit	Uncertainty type	SD95%
chemicals/ inorganics							
301	oxygen, liquid, at plant	RER	no	0.0714	kg	lognormal	1.11
construction materials/ additives							
474	quicklime, in pieces, loose, at plant	CH	no	0.0425	kg	lognormal	1.11
construction materials/ others							
523	dolomite, at plant	RER	no	0.00275	kg	lognormal	1.11
electricity/ production mix							
664	electricity, medium voltage, production UCTE, at grid	UCTE	no	0.0219	kWh	lognormal	1.11
hard coal/ fuels							
832	hard coal coke, at plant	RER	no	0.00025	MJ	lognormal	1.11
metals/ extraction							
1065	blast oxygen furnace converter	RER	yes	1.33E-11	unit	lognormal	3.23
1095	ferrochromium, high-carbon, 68% Cr, at plant	GLO	no	0.0147	kg	lognormal	1.07
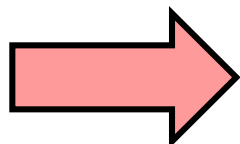
ecoinvent tool for conversion to MS Excel files available

Iterative Data Collection Procedure

- Review of data for unit processes by party not involved in data collection for these processes

- Analysis of cradle-to-gate results

- Monte Carlo simulation for entire data base

→ Analysis, discussion and refinement (as well as correction of errors) easily possible

Other

- Inclusion of infrastructure and capital goods (production means), separate

- Standard transport distances in production if no specific information is available (to avoid that specific data are "penalized")

- Distinction of fossil and renewable carbon for CO_2, CH_4, CO

- CO_2 as resource input for biomass

- Uncertainty: Standard procedure based on modified pedigree matrix of (Weidema and Wesnaes 1996) is applied if specific uncertainty is unknown

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Conclusions

- Conventions/decision rules important, but also flexibility has to be ensured

    → expert knowledge

    → flexibility of software database (to adapt)

- Documentation is a key factor

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Ecoinvent data Version 1.0 online

- Database accessible at:

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