



Swiss Centre for Life Cycle Inventories

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**agroscope**  
FAL RECKENHOLZ  
Research for AgriFood and Nature



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FAL FORSCHUNGSZENTRUM  
Forschung für Landwirtschaft und Natur

LCA forum 23, September 23, 2004  
ETH Zürich / Session „quality management and aspects“

# Data quality assurance in the ecoinvent Database

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slide 2

Presentation: Rolf Frischknecht



# Problem setting

- Large number of LCI datasets (more than 2'500)
- Considerable number of LCIA methods (more than 170)
- Up to 30 persons worked on ecoinvent LCI datasets
- Common rules on LCI data investigation and modelling

⇒ How to assure consistent modelling and data quality?

⇒ What can we learn from past and vast experiences?



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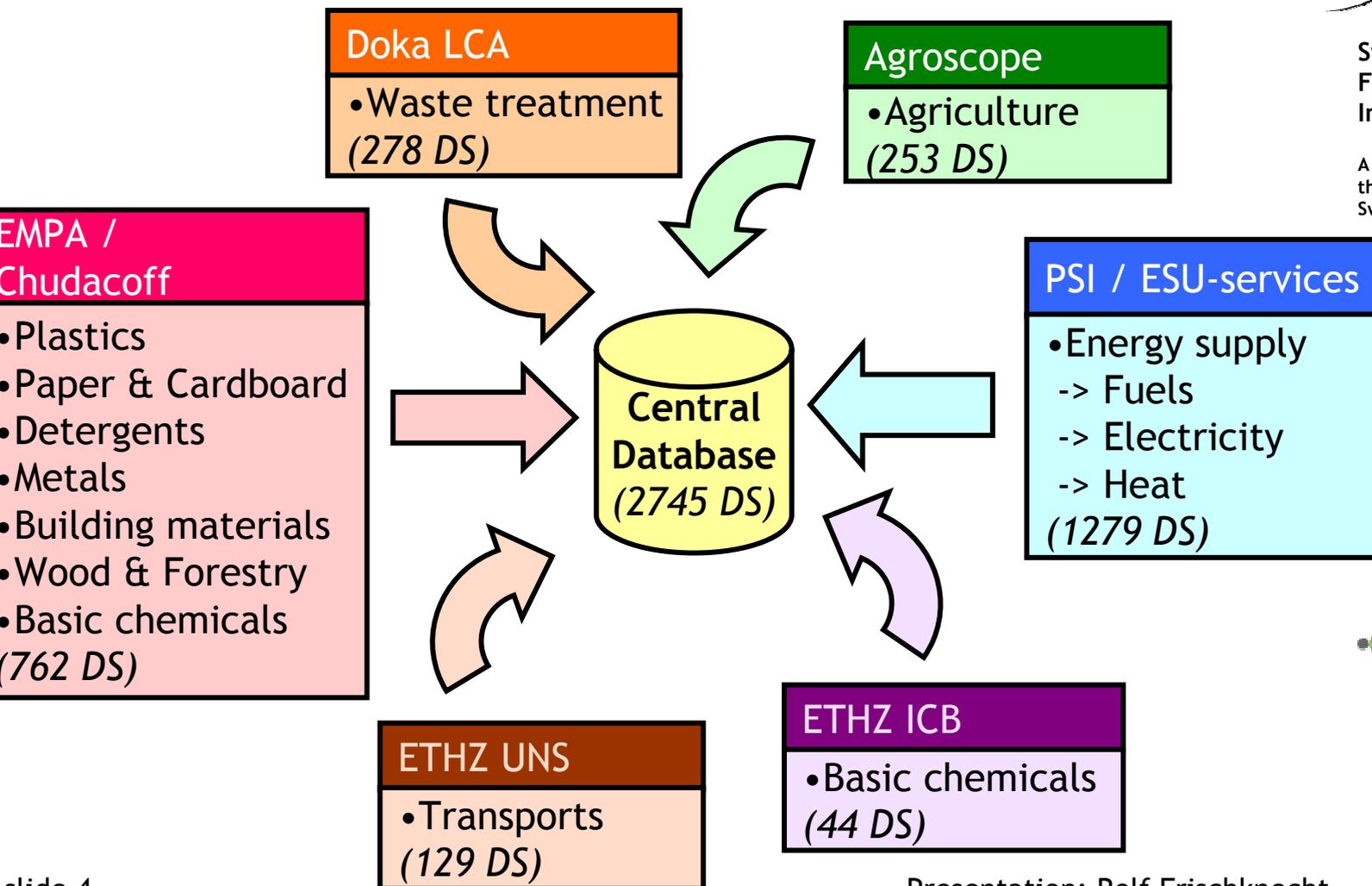
# Content: economic sectors covered

(DS = datasets)



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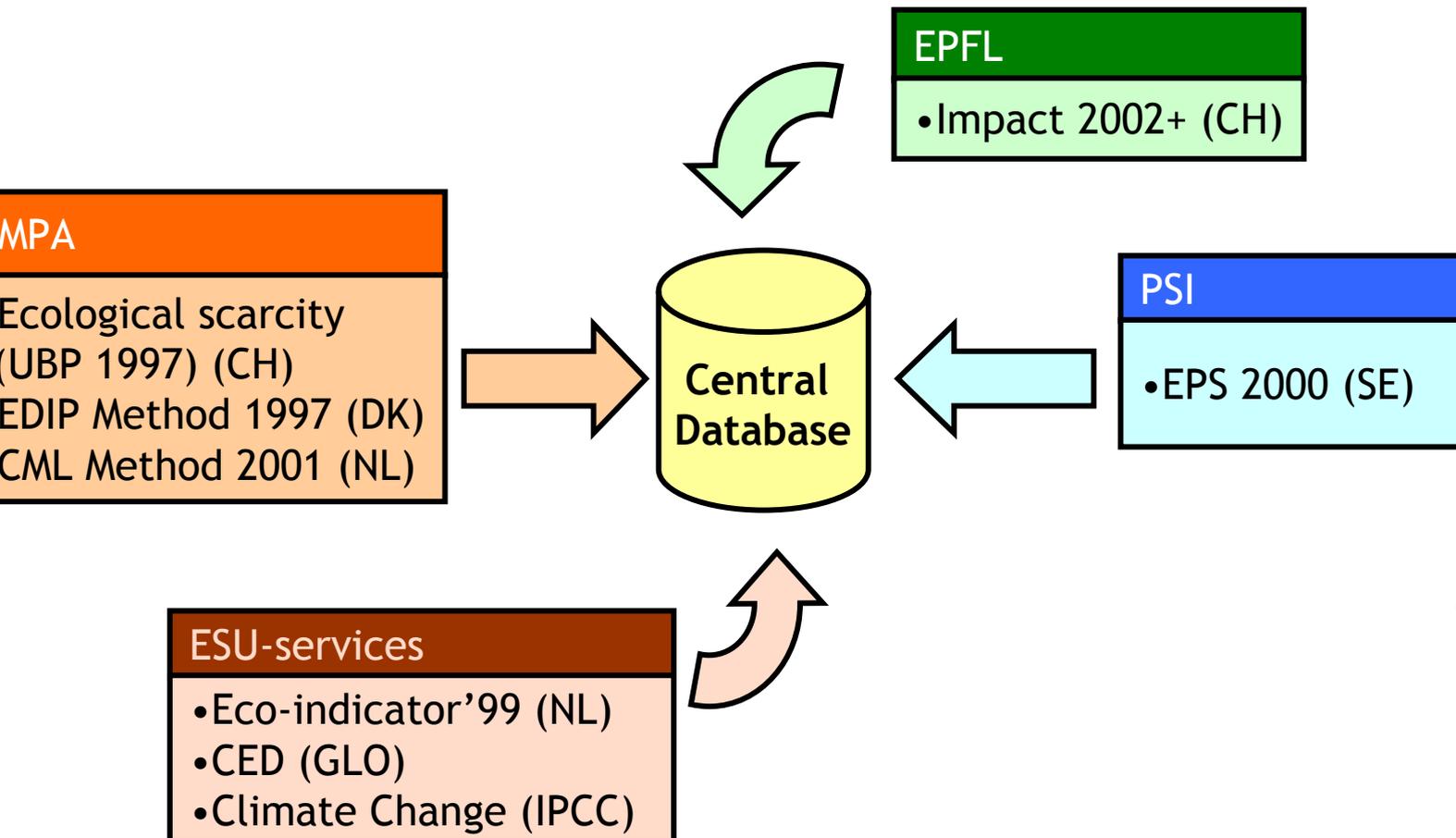
# Content: impact assessment methods

## Attribution of LCI data to method specific factors



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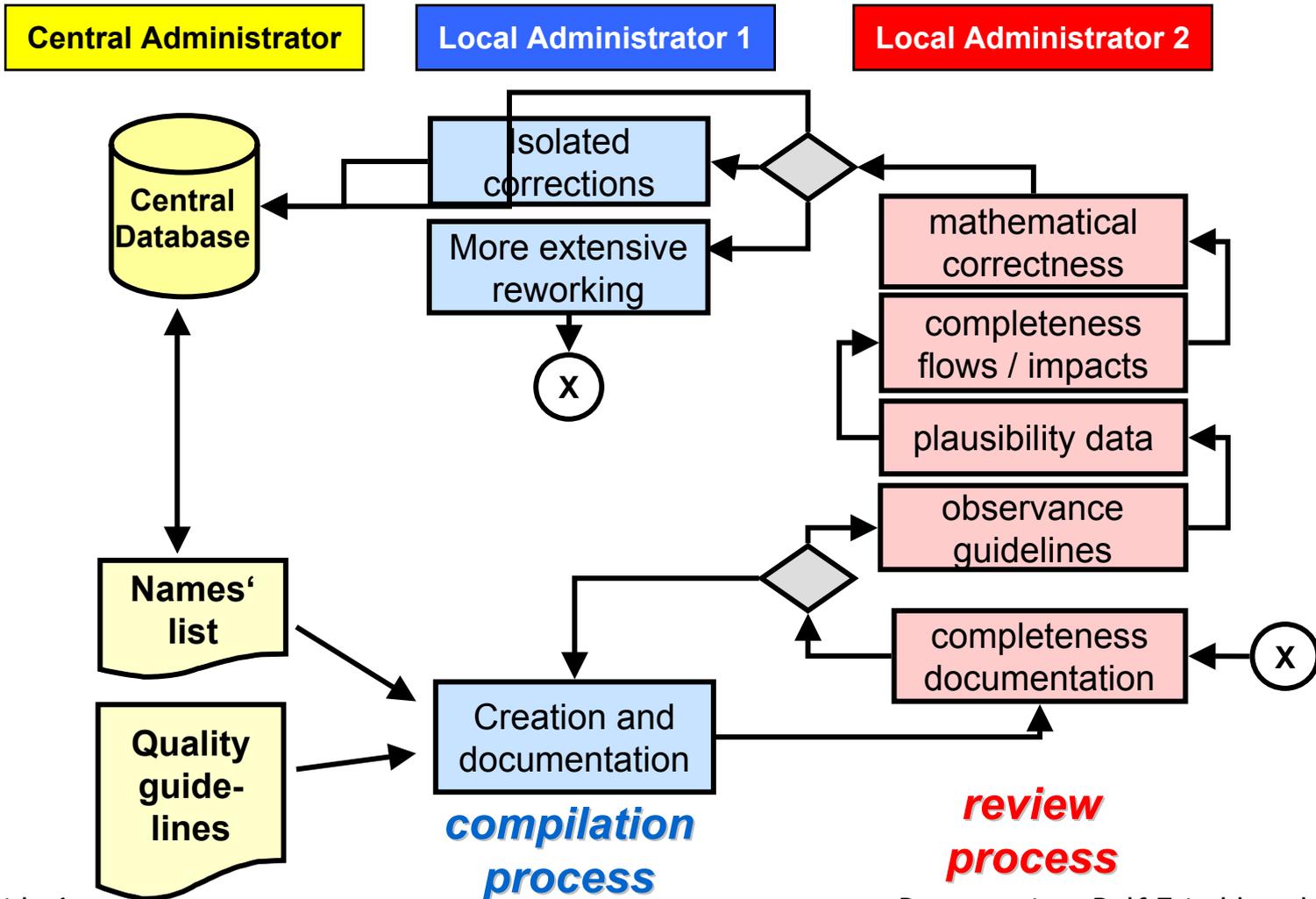


# Data compilation and quality assurance



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# Passive quality assurance



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Ecoinvent software system includes several control mechanisms:

- Names list
  - valid process names,
  - elementary flow names,
  - units,
  - regional (and national) codes,
  - persons and sources
- Sum control of allocation factors (sum shall equal 100%)
- Schema and semantic validation of dataset files
  - information available where required?
  - information in the expected format?



# Active quality assurance: Quality guidelines

## How to model

- electricity supply
- unknown transport services
- unknown waste treatment services
- chemicals in dilution
- means of production and infrastructure
- multioutput processes (no system expansion, i.e., no credits)
- recycling (cut-off)
- heavy metal emissions, particulates, water pollutants, carbon balance, sum parameters (NMVOC, BOD), etc.



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# Review:

## 1. Completeness and 2. Compliance



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Does the dataset information to be reviewed contain:

- XML data files, including meta information and flow data?
- chapter(s) of the corresponding final report, including all references, etc.?



Are the datasets modelled according to the quality guidelines?

- elementary flows
- transport services
- waste treatment services
- electricity models
- etc.



# Review:

## 3. Plausibility of data



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Are the data chosen to represent a process plausible?

- is the order of magnitude plausible?
- how does it compare to values derived from other studies?
- what is the relation of (direct) CO<sub>2</sub> emissions to (direct) emissions of other pollutants?
- What would be the overall total amount of resource extracted or pollutant emitted based on today's consumption?
- Assessment based on LCIA results helps identify major errors (errors of too high figures, but not the too low ones!)

The logo for ETH (Eidgenössische Technische Hochschule), consisting of the letters 'ETH' in a bold, italicized, black font.

The logo for EPFL (École Polytechnique Fédérale de Lausanne), consisting of the letters 'EPFL' in white on a red rectangular background.

The logo for PSI (Paul Scherrer Institut), consisting of the letters 'PSI' in white on a grey rectangular background.

The logo for EMPA (Empirech Materials Processing and Applied Chemistry), consisting of a red shield-like shape with a white dot inside, followed by the letters 'EMPA' in black.

The logo for EAWAG (Eidgenössische Anstalt für Wasserbau und Gewässerkunde), consisting of a blue circular graphic with a white 'C' shape inside, followed by the letters 'EAWAG' in black.

The logo for agroscope (FAL - Forschungsanstalt für Agrarökologie und Landbau), consisting of a green circular graphic with a white 'C' shape inside, followed by the text 'agroscope' in green and 'FAL RESEARCH FOR AGRICULTURE AND NATURE' in smaller black text below.



# Review:

## 4. Completeness of Inputs & Outputs



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Are the data complete?

- are all expected elementary flows quantified?
  - are the technosphere inputs complete?
  - judgement based on individual environmental and technical knowledge
- => this review item can neither be perfect nor fully consistent

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The logo for EMPA (Empa - Swiss Federal Laboratories for Materials Science and Technology), consisting of a red shield-like shape with a white 'E' and the letters 'EMPA' in white.

The logo for EAWAG (Eidgenössisches Anwaltsbüro für Wasser), consisting of a blue circular graphic with a white 'C' and the letters 'EAWAG' in blue.

The logo for agroscope (FAL - Federal Research Institute for Agriculture, Forests and Fisheries), consisting of a green circular graphic with a white 'A' and the text 'agroscope' in green, with 'FAL RESEARCH' and 'Research for Agriculture and Nature' in smaller text below.



# Review:

## 5. Mathematical correctness

Are the calculations performed correctly?

- conversion from “pounds per cubic foot” to  $\text{kg}/\text{m}^3$ , or “British thermal units per minute” to Watt kWh to MJ?
- transfer of original information (annual production volume and annual consumption and emissions) to emission factors or specific inputs



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The logo for EAWAG (Eidgenössisches Anstalt für Wasserbau und Gewässerschutz), consisting of the letters 'EAWAG' in a black font next to a blue circular graphic.

The logo for agroscope (FAL FORSCHUNGSANSTALT FÜR LÄNDLICHE WIRTSCHAFTEN), consisting of the word 'agroscope' in a green font next to a green circular graphic, with the full name in smaller text below.



# Review:

## 5. Mathematical correctness

Are the calculations performed correctly?

- conversion from
  - “pounds per cubic foot” to  $\text{kg}/\text{m}^3$ , **16.02**
  - “British thermal units per minute” to Watt **17.57**
  - kWh to MJ **3.6**
- transfer of original information (annual production volume and annual consumption and emissions) to emission factors or specific inputs



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# Experiences

Most (discovered and corrected) errors:

- transport demand
- infrastructure demand
- datasets with m<sup>3</sup> units
- wrong order of magnitude

software guided work flow was partly perceived as obstacle

software-based control versus freedom of the user

different workstyles -> different perceptions on the workflow



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# Assessment of the ecoinvent review step

- Formalised review helped to increase quality and consistency considerably
  - major challenges:
    - . number of datasets to be reviewed
    - . content-related review  
(limited individual environmental and technical knowledge)
    - . time consuming workflow
- ⇒ keep review step, but possibly simplify work flow
- ⇒ adequate measures to be discussed within the ecoinvent team



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