JRC ongoing activities for the improvement of Data Quality and Harmonization in LCI datasets and databases

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Who are we and what do we do?

The JRC is the European Commission’s in-house science service. It provides the science for policy decisions, with a view to ensuring that the EU achieves its Europe 2020 goals for a productive economy as well as a safe, secure and sustainable future.

The JRC plays a key role in the European Research Area and reinforces its multidisciplinarity by networking extensively with leading scientific organisations in the Member States, Associated Countries and worldwide.
“The mission of the IES is to provide scientific-technical support to the European Union's policies for the protection and sustainable development of the European and global environment”.
JRC – IES - Sustainability Assessment Unit (H08)  
**mission and goals**

**Foster sustainability principles in EU policies** through development/application of an **integrated sustainability assessment framework** for evidence-based decision support

- Facilitate systematic consideration of the social, economic, and environmental costs and benefits of EU policy measures based on **life cycle thinking**
- Support the development of new paths of growth focusing on a wider concept of **green economy**
- Boost the economic value of **ecosystem services** in a context of **integrated and efficient management of natural resources**
- Adopt a **spatially resolved approach** to sustainability assessment
- Increase the robustness and consistency of **integrated sustainability assessment**
Overview

- Introduction: The EU platform on LCA
- The Data Quality in different schemes
- Recent activities on LCI quality assessment/improvement
  - General Analysis on DQRs of different Databases
  - Background analysis of sector-specific Data
- Conclusions
EC Policy mandate (+10Yr)

- **Integrated Product Policy Communication** (IPP), 2003
  Commitments to provide Platform and Handbook, to improve coherence and quality, with associated increased data availability

- **Sustainable Consumption and Production / Sustainable Industrial Policy Action Plan**, 2008:
  “To implement this policy, consistent and reliable data and methods are required to assess the overall environmental performance of products

- Development and piloting of the **Product and Organization Environmental Footprint** (PEF/OEF) methods

- **Life Cycle Data** availability, quality and coherence are key issues
EPLCA – European Platform on LCA

Policy applications (sustainability), LCA data/studies development and sharing etc.

http://eplca.jrc.ec.europa.eu/
Data Quality in different schemes

- ILCD Handbook, including quality requirements for LCI datasets has been published in 2010.
- JRC has proposed in 2010 some less stringent quality requirements, called ILCD entry-level (ILCD EL), focusing mainly on quality of the dataset’s documentation and compliance with the ILCD Format and Nomenclature.
- Data quality requirements have been developed in 2012 (published in 2013) for the PEF and OEF scheme.
- ILCD EL and PEF data quality requirements have many common aspects, but they differ in the degree of strictness on the methodological and data quality requirements.
Data quality: two requirements schemes

**ILCD Entry-Level requirements (Dataset level)**
- Guarantees minimum LCI datasets quality level
- ILCD DN datasets registration pre-requisite
- Requires a 3rd party review
- Review report to be attached to dataset
- No data quality rating

**PEF data quality requirements (Study level)**
- Compliance at sectorial and study level
- Shall be met by PEF studies intended for external communication
- Semi-quantitative assessment of data quality
- Data quality rating formula enforced

\[DQR = \frac{TeR + GR + TiR + C + P + M}{6}\]
Data quality

Two requirements schemes

<table>
<thead>
<tr>
<th>ILCD Entry-Level</th>
<th>Documentation</th>
<th>Nomenclature</th>
<th>Data quality</th>
<th>Review</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>ILCD handbook requirements</td>
<td>The minimum documentation extent specified</td>
<td>Compliance with ILCD nomenclature document</td>
<td>ISO quality criteria</td>
<td>&quot;Qualified reviewer&quot; required (based on ISO 14025)</td>
<td>ISO 14040 and 14044</td>
</tr>
<tr>
<td>ILCD format to be used</td>
<td>ILCD reference elementary flows</td>
<td>EF Guide criteria (based on ISO)</td>
<td>Separate review report</td>
<td>EF Guides (Based on ISO)</td>
<td></td>
</tr>
</tbody>
</table>
Life Cycle Data Network

Officially launched the 6th of February 2014 by Director General of DG JRC (EC), and the Deputy Director General of DG Environment (EC)

Several European and non-European public and private organisations have already joined and many more have shown interest in joining
European reference Life Cycle Database (ELCD)

Content

- Data on key materials, energy carriers, transport, and waste management.

Support tools for Life Cycle Planning and Assessment in Business and Policy-making, not only oriented and driven by assured

ELCD datasets have been reviewed against LCDV Entry-level data quality requirements

Business Associations
Primary Providers

DQ evaluation on ELCD and others datasets/databases

- From 2011, JRC decided to test the data quality on a large number of datasets in the ELCD and other DBs:
  1. To ensure a good compliance (ISO and ILCD EL) for ELCD datasets
  2. To further improve the sector-specific knowledge of the review process
  3. To understand better the level of quality of ELCD datasets and its implications
  4. To point out the weakpoints and strenght of the ELCD, and draft strategies for DQ improvement.

- From 2012, the evaluations have been carried out also against the DQRs of the EF scheme.

THE REVIEWS ARE NOT AIMED TO COMPARE AND RANK THE OVERALL QUALITY OF ELCD AND OTHER DATABASES
Recent activities on LCI quality assessment/improvement: Analysis on DQR of some Key Commercial Databases

GOAL

• Analysing the extent to which life cycle datasets available in LCA databases meet ILCD EL and PEF data quality requirements
• Identifying key issues and the efforts required to solve them

SCOPE

• The analysis has been carried out on a sample of datasets of ECOINVENT v3.0, GaBi and EIME databases
• Findings at datasets level have then been extrapolated to the database level.
Criteria for the selection of Databases and Datasets

1. Presence of systematic compliance issues;
2. Significance in terms of environmental impacts and representativeness/relevance in the European/Global market;
3. Extensive use of the dataset as background processes in LCA studies;
4. Datasets with known challenging methodological problems and with significant environmental impacts;
5. Random choice (limited number of datasets).
Main Results

Format:
• GaBi allows to export in ILCD format.
• Ecoinvent uses Ecospold2, implementation of ILCD conv. In progress
• EIME does not have export capability

Nomenclature:
• GaBi: good matching with ILCD flowlist (18 flows to be corrected)
• Ecoinvent: few mismatch between EI elementary flows and ILCD
• EIME: uses the ILCD nomenclature rules

Documentation:
• GaBi: not 100% compliant. Documentation available, but often too generic. Detailed reports are usually lacking
• Ecoinvent : DQ guidelines are in line with the requirements, but not always applied. Detailed reports often available.
• EIME: Format of the documentation is compliant, while the content of the documentation is not always compliant.
Main Results

Data quality indicators (DQI) and Method ILCD EL:
• All the 3 DBs meets ISO requirements (so are compliant)

DQI PEF Requirements:
• GaBi: 6 DQI are considered, still some differences with PEF DQI
• Ecoinvent: follows the Pedigree Matrix according to 5 characteristics that act on a different level (Flow/datasets) than the PEF DQI. A transferring matrix is under development.
• EIME has implemented a DQI which uses the same indicators required by ILCD but with only 3 quality scores

Method, PEF Requirements:
• Multifunctionality and system boundaries are compliant in all the DBs
• End of Life formula is not implemented in any of the DBs
• Cut off: both GaBi and EIME are not compliant, while Ecoinvent datasets are variable, depending on the knowledge of data providers
• Impact categories: all three databases still have problems, for spatial resolution methods, LU-Soil Organic Matter model, and, in EIME, “Human toxicity”, “Resource depletion water” and “Ecotoxicity”
Conclusions and recommendation

Part 1

• All three databases are not fully compliant: a roadmap have been developed, identifying the efforts required to solve them.

• Different business models of the three databases suggest different solutions for the non-compliance issues.

• Format: it should be regarded as an exporting capability rather than a requirement for the database itself. A converter, how under development, is part of the solution.

• DQI/DQR: more procedural guidance on scoring the single quality indicators could be provided

• Methodology: some PEF requirements are not aligned with existing standards, in particular cut off and EoL. A database should be able to support studies with different purposes; for that reason, specific methodological requirements are preferable at study level rather than at dataset/database level.
Conclusions and recommendation

• The overarching goal of LCI databases is to provide robust, reliable and transparent life cycle information to inform the decision making process of policy makers and industrial actors.

• Data Quality Criteria are important to move towards the interoperability of databases (which goes beyond the use of a common format)

• Priority actions are necessary to favour a broader use of LCI data
  ➢ Exchange capability among the different databases
  ➢ Consistency within the same database (e.g. elementary flows) and between different databases
Recent activities on LCI quality assessment/improvement: 
**Background analysis of energy data to be used in ELCD**

**GOAL**

- Analysing the extent to which life cycle datasets available in LCA databases meet ILCD EL DQR (based on the score of ILCD handbook)
- Identifying the efforts required to enhance the DQR of ELCD database

**SCOPE**

- The analysis has been carried out on a sample of datasets of the ELCD, Ecoinvent, GEMIS and E3 Databases
- Findings at datasets level have then been extrapolated to the database level.
Criteria for the Databases and dataset selection:

1. Wide availability of EU-related data
2. Inclusion of wide datasets on energy
3. Broad consensus in the scientific community
4. Datasets representing 40 to 60% of the EU-27 electricity market, (per technology, in specific geographic origins);
5. At least four representative crude oil and one natural gas dataset + a renewable energy source.
## Main Results
(Exemplary Power dataset)

<table>
<thead>
<tr>
<th>Dataset</th>
<th>DB</th>
<th>DQI</th>
<th>Score</th>
<th>Short justification of DQI</th>
<th>DQR</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELCD</td>
<td>TeR</td>
<td>1</td>
<td>Modelled as the French technology mix</td>
<td>1.83</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GR</td>
<td>2</td>
<td>Some activities of milling and reprocessing refers to US data</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TiR</td>
<td>3</td>
<td>Some references are 20 years older than the ref. year (2009)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>1</td>
<td>100% of impact categories and 100% of reference flows covered</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>P</td>
<td>2</td>
<td>Relevant flows measured, other flows taken from literature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ecoinvent</td>
<td>TeR</td>
<td>3</td>
<td>Some data are 20 years older than the ref. year (2009)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>2</td>
<td>EoL of intermediate activities is missing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TiR</td>
<td>2</td>
<td>Ref. year 2002, relevant data are more updated than ELCD</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>1</td>
<td>EoL and allocation also for sub-processes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>nuclear power (France)</td>
<td>TeR</td>
<td>2</td>
<td>Referred to French representative plants but not as a mix</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>GR</td>
<td>4</td>
<td>Only the modeling of enrichment is correct</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TiR</td>
<td>2-3</td>
<td>(depending on plant) literature comes from 5-15 years before</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>2</td>
<td>75% of impact categories, 90% of flows covered</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>P</td>
<td>4</td>
<td>Literature data and auto-estimated data</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>4</td>
<td>EoL not modeled, not including infrastructures.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GEMIS</td>
<td>TeR</td>
<td>2</td>
<td>Referred to French representative plants but not as a mix</td>
<td>3.08</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GR</td>
<td>4</td>
<td>Only the modeling of enrichment is correct</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TiR</td>
<td>2</td>
<td>(depending on plant) literature comes from 5-15 years before</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>2</td>
<td>75% of impact categories, 90% of flows covered</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>P</td>
<td>4</td>
<td>Literature data and auto-estimated data</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>4</td>
<td>EoL not modeled, not including infrastructures.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E3</td>
<td>TeR</td>
<td>4</td>
<td>Considering a process scale instead of real plant</td>
<td>4.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GR</td>
<td>4</td>
<td>Only the modeling of enrichment is correct</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TiR</td>
<td>3</td>
<td>Reference year 2000, data from 1994-99</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>4</td>
<td>Less than 50% impact categories, 90% flows covered</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>P</td>
<td>4</td>
<td>Literature data and auto-estimated data</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>5</td>
<td>Cradle to gate system, EoL and infrastructure lacking</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Main Results

## (Exemplary Fuel dataset)

<table>
<thead>
<tr>
<th>Dataset</th>
<th>DB</th>
<th>DQI</th>
<th>Score</th>
<th>Short justification of DQI</th>
<th>DQR</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELCD</td>
<td>TeR</td>
<td>1</td>
<td></td>
<td>Relevant primary and secondary data referred to EU27</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GR</td>
<td>1</td>
<td></td>
<td>Very good modeling of EU27 share and market relevance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TiR</td>
<td>1</td>
<td></td>
<td>Ref year 2009, data from 2007 to 2009</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>1</td>
<td></td>
<td>100% of impact categories, 96% of flows covered</td>
<td>1.08</td>
</tr>
<tr>
<td>Ecoinvent</td>
<td>TeR</td>
<td>1</td>
<td></td>
<td>Relevant primary and secondary data referred to EU27</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GR</td>
<td>1</td>
<td></td>
<td>Very good modeling of EU27 share and market relevance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TiR</td>
<td>1</td>
<td></td>
<td>Ref year 2009, data from 2007 to 2009</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>1</td>
<td></td>
<td>100% of impact categories, 96% of flows covered</td>
<td>1.75</td>
</tr>
<tr>
<td>GEMIS</td>
<td>TeR</td>
<td>3</td>
<td></td>
<td>Modelled by a generic plant, default distance values</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GR</td>
<td>5</td>
<td></td>
<td>Not referred to any specific country</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TiR</td>
<td>4</td>
<td></td>
<td>Ref year 2000, data from 1985-95</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>2</td>
<td></td>
<td>75% of impact categories, 90% of flows covered</td>
<td>3.50</td>
</tr>
<tr>
<td></td>
<td>P</td>
<td>4</td>
<td></td>
<td>Estimated data from literature, assumptions not disclosed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>3</td>
<td></td>
<td>EoL not comprised, Allocation not specified</td>
<td></td>
</tr>
<tr>
<td>E3</td>
<td>TeR</td>
<td>2</td>
<td></td>
<td>Modeled from CONCAWE report assuming oil from middle east</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GR</td>
<td>3</td>
<td></td>
<td>Extraction only from mid. east, reps. of EU refinery undisclosed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TiR</td>
<td>2</td>
<td></td>
<td>Ref. year 2010, data coming from CONCAWE (1996-2007)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>4</td>
<td></td>
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<td>2.67</td>
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<td>P</td>
<td>2</td>
<td></td>
<td>No info about emission factors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>3</td>
<td></td>
<td>Cradle to gate system, EoL not included.</td>
<td></td>
</tr>
</tbody>
</table>
Conclusions and recommendation

- Model datasets by technology in each member state.
- Review the market share of energy periodically.
- Modeling the End of Life scenarios for energy systems (e.g. PV panels, nuclear residues, power plant dismantling etc.)
- Define criteria for scheduling the update of the datasets (e.g. depending on the obsolescence of the technologies).
- Include minor technologies that might be relevant for the future (e.g. Using PRIMES or TIMES models for projections)
Conclusions and recommendation

- Include the missing elementary flows (e.g. Halon 1211, Halon 1301, CFC-10 -11 and -12, cad-mium, indium, iridium, cyperme-thrin and decane) where lacking.

- ELCD database makes extensive use of the statistical information provided by the IEA, however, for the EU context it seems appropriate the use of data reported by each country to Eurostat.

- To improve precision, the use of additional data from of Business Associations and other Authoritative sources it’s recommended.
Thank you for your attention!

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D. Garrain – CIEMAT (Madrid – Spain)

European Platform on Life Cycle Assessment (EPLCA):
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