Methodology applied to the background analysis of energy data to be considered for the European Reference Life Cycle Database (ELCD)

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1. Introduction

In the Integrated Product Policy Communication of 2003 [1], the European Commission recognised Life Cycle Assessment (LCA) as "the best framework for assessing the potential environmental impacts of products". Since then, life cycle approaches were further strengthened in EU policies through the Sustainable Production and Consumption / Sustainable Industry Policy Action Plan Communications that encompasses various policies (e.g. Eco-design for Energy-related Products Directive, Footprint initiative, etc.). Within this context there is an urgent "need to improve data availability and quality worldwide by internationally cooperating on LCA data and methods". To address this situation, the European Reference Life-Cycle Database (ELCD) [2] has been developed by the European Commission's Joint Research Centre (DG JRC). The ELCD provides core Life Cycle Inventory (LCI) data from front-running EU-level business associations and, where not available, other sources. Within the ELCD, several energy-related data are provided, being energy a major input for almost all the environmental analyses of products or processes. The present paper will provide the description of the methodology that will be used for the analysis of the quality of energy data for European markets that are available in 3rd party life cycle databases and from authoritative sources that are, or could be, used in the context of the ELCD. The methodology have been developed by a joint project with the cooperation of the EC JRC and the Energy Systems Analysis (ASE) Unit of CIEMAT (Public Research Centre for Energy, Environment and Technology) (Madrid, Spain).

2. Selection and justification of energy datasets.

The definition of the methodology applied starts with the selection of the energy related datasets to be analysed within the project. The selection of the energy related datasets has been made taking into account the following aspects, basing on official statistics provided by Eurostat and European Commission:

- Datasets related to electricity: The selected samples must represent a significant share (such as 40 to 60%) of the EU-27 electricity market and associated technology mixes/geographic origins.
- Datasets related to fuels: The selection must include at least four representative crude oil datasets and one natural gas dataset.

Other aspects have also been considered that support the inclusion of some minority energy sources such as some renewable sources whose contribution to the European energy mix has prospects to be more important in the future [3]. In order to select the sample of datasets, the most updated data in terms of electricity and fuels in the EU-27 context have been deeply analysed.

3. Selection and justification of databases and other sources

The methodology was developed and tested on the most relevant energy datasets for the EU context, however it can be widely applied for the quality evaluation of energy data, even if provided by other sources. Basing on the above mentioned principles, some 3rd party life cycle databases (i.e. GaBi [4], Ecoinvent [5], E3 [6], Gemis [7]) have been selected, to be compared with ELCD database. It must be pointed out that some energy datasets provided in the ELCD have been originated from the GaBi database, thus GaBi datasets have been selected as basis for comparison as well as the ELCD data source for some of the considered energy pathways (i.e. electricity from nuclear, gas and coal sources, biofuels, etc.).

The main criteria for the database selection were based on the availability of EU-related data, the inclusion of wide datasets on energy products and services (specially focusing on those matching the chosen energy pathways), and the broad approval by the scientific community.

Apart from previous databases, other potential sources could be used as data providers in order to improve the ELCD database, i.e. EU projects considering energy datasets or papers where a complete energy LCI is presented (relevant literature reviews).

4. Data quality indicators

The proposed approach has been based on the quality indicators developed within the ILCD handbook [8-10] that have been further developed to facilitate their use in the analysis of energy systems. These are the following: Technological representativeness (TeR), Geographical representativeness (GR), Time-related representativeness (TiR), Completeness (C), Precision / uncertainty (P), Methodological appropriateness and consistency (M). The quality indicators have been refined in order to identify key aspects that are involved in both quality and methodological aspects for energy related LCI datasets. Considering, for example, the TeR, the specific technology used to generate electricity as well as the operational parameters strongly influences the environmental impacts of the process. This applies to both the inputs as well as the outputs that can differ considerably among technologies producing electricity from the same source. The number of aspects that can be decisive for the inventory is very extensive. A list of the most relevant ones have been identified and used for the analysis.

The overall Data Quality Rating (DQR) of the energy datasets (and databases) are calculated by summing up the achieved quality rating (ranging from 1 to 5), for each of the quality criteria indicator, divided by the total number of considered indicators.

5. Results presentation and interpretation

The quality of each dataset can be estimated for each indicator and then, compared across the different databases/source. Results will point out the findings and/or recommendations in order to improve the data quality as regards the established criteria. A template including quality parameters, rating, and suggestions for improving (e.g. sources or studies to be included) will be compiled for each analysed dataset.

Even though the final results will be discussed based on “qualitative” results for each indicator, the total DQR will be also calculated and internally disclosed (to JRC and/or data providers, and not to the public) as a tool for the internal analysis and further dataset improvements.

The proposed methodology can be applied for the energy-related data quality assessment, oriented towards the ELCD requirements, of all the datasets provided from 3rd parties (i.e. non just those selected for the present study).

6. References

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