Paris, 29.07.2015

Direction Economie Circulaire et Déchets
Service Produits et Efficacité Matières
Olivier Réthoré
Telephone : 01.47.65.24.44
E-mail : olivier.rethore@ademe.fr

BASE IMPACTS® DATA DOCUMENTATION

CATEGORY: ELECTRICITY

3 levels of documentation are available for the datasets in Base Impacts®:

- A **general documentation** explaining general information on the datasets and data general requirements
- A **sectorial documentation:** one document per sector describing the available datasets and their characteristics (technological representativeness, geographical representativeness), and providing the information on the datasets in a common layout. Information comes from the consultation specifications, the dataset commissioner technical proposal and the metadata
- The **datasets metadata** can be viewed directly in the datasets sheets. They include more detailed information (flow diagrams, Etc.)

This document is the category documentation for electricity.

CONTENTS

A. PRESENTATION OF THE DATASETS

1. List of available datasets

Electricity datasets are provided for low voltage (<1kV) electricity supplied to final consumers.

Electricity datasets are provided for 137 countries: the 34 countries of OECD and 103 countries outside OECD for which the International Energy Agency provides statistical data

The following datasets are available:

Technological representativity	**Geographical representa-tivity**	**Dataset type**
Electricity production from gas, oil, nuclear, lignite, coal, hydro	*All countries in Europe*	*Not publicly available in Base Impacts ®*
Electricity production from wind, solar PV, waste, biomass, tide	*World*	*Not publicly available in Base Impacts ®*
Power plant infrastructure	*World*	*Not publicly available in Base Impacts ®*
Electricity grid mix (built from the specific electricity production and power plant infrastructure datasets)	Provided for 137 countries	LCI Result
Electricity grid mix (maximizing dataset)	Global	LCI Result

Table 1 : Available datasets

2. Technical specifications

The datasets can be used for all LCA/CF studies where **low voltage electricity** is used directly from the grid (i.e. for electricity consumers without own electricity transformers, like SME and private households).

B. SCOPE OF THE DATASETS

1. Reference flow, functional unit

The processes are provided for 1 kWh of low-voltage electricity.

2. System boundaries

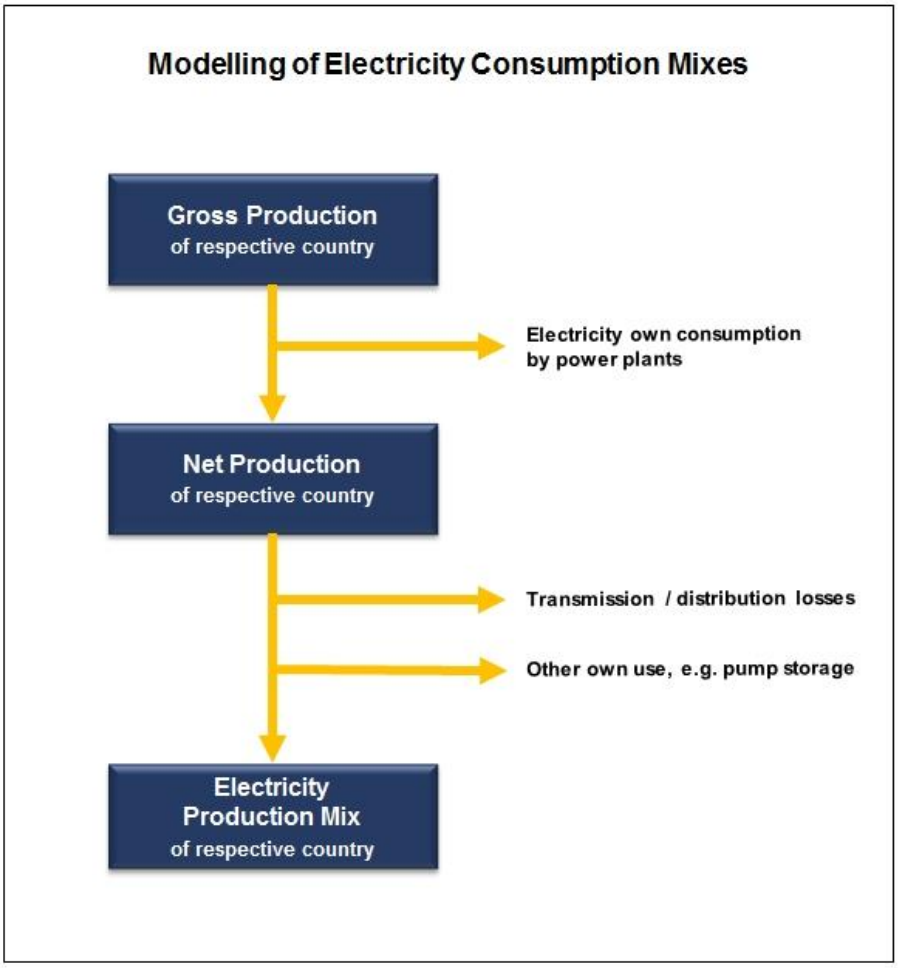
2.1. Foreground system boundaries

System boundaries

The electricity grid mix:

- includes transmission / distribution losses and the own use of electricity by energy producers (own consumption of power plants, and "other" own consumption e.g. due to pumped storage hydro power etc.).
- does not include Imports from neighboring countries.

The logic of modeling the electricity production mix is represented in the flow diagram[1] below:



[1] This diagram is provided in the metadata. WARNING: the title is wrong: the provided datasets are production mixes and not consumption mixes, as they do not include imports and exports of electricity.

Geographical perimeter

Datasets were provided for 137 countries

Geographical differences are taken into account at several steps of the modeling:

- **Specific electricity production mix** based on statistical data from International Energy Agency and described in a table provided in the metadata of each dataset.
- **Specific technology standards of the power plants**: The electricity is either produced in energy carrier specific power plants and/or combined heat and power plants (CHP). Also considered are the national and regional specific technology standards of the power plants in regard to efficiency, firing technology, flue-gas desulphurisation, NOx removal and de-dusting. The electricity provided by non-combustible renewable energy sources also considers the national or regional situation, such as solar radiation (photovoltaic), annual full load hours (wind power), and share of hydro power stations by type (run-of-river, storage and pumped storage).
- **Specific supply chain and propertied of the energy carrier**: The energy carrier supply considers the whole supply chain of the energy carrier from exploration, production, processing and transport of the fuels to the power plants. The supply chain is modeled in specific national / regional energy carrier consumption mixes (i.e. domestic production and imports), and considers national / regional average energy carrier properties (e.g. elemental composition and energy content).

Cut-off for each unit process:

- Coverage of at least 95% of mass and energy of the input and output flows, and 98% of their environmental relevance (according to expert judgment).
- The coverage of the exploration and well installation data (crude oil, natural gas, natural gas liquids) are only 90% of mass and energy and 95% of the environmental relevance (according to expert judgment).
- End-of-Life of the PV-modules is not included in the LCA-model.
- Waste is entering the Waste-to-Energy product system without any environmental burden (burdens are allocated to the primary life cycle of the product in which the waste is generated, e.g. burdens of packing material becoming waste are allocated to the product).

Infrastructures

Infrastructure of fossil power plants (coal, gas and oil), nuclear power stations and renewable power generation (wind, photovoltaic, hydro, biomass, geothermal) are considered.

2.2. Background system boundaries

Background system boundaries follow the rules defined by PE International.

C. DATA SOURCES AND QUALITY

1. Data quality requirements

Quality requirements for Base Impacts® datasets are detailed in the general Base Impacts® documentation.

No specific quality requirements were set for the electricity datasets.

2. Types and sources of data

The data sources for the complete product system are the following:

- The electricity grid mix data are based on national statistics.
- The key emissions e.g. sulphur dioxide, nitrogen oxide, etc., of the power plants / combined heat and power (CHP) plants are based on measured operating data taken from national statistics. All other emissions from the power plants / combined heat and power plants (CHP) are based on literature data and / or calculated via energy carrier composition in combination with (literature-based) combustion models.
- Detailed power plant models are used, which combine measured (e.g. NOx) with calculated emission values (e.g. heavy metals).
- The data on the energy carrier supply chain are based on statistics with country / region-specific transport distances and energy carrier composition, as well as industry and literature data on the inventory of exploration, production and processing. Infrastructure data are from literature.
- Refinery data are also based on statistical data and measurements of major refineries as well as literature data.
- For electricity from non-combustional renewable energy sources, like wind, hydro, solar (photovoltaic) and geothermal, also specific LCA models are used.

The datasets were created with the use of the following elements and references:

- 2006 IPCC Guidelines for National Greenhouse Gas Inventories
- 13. Verordnung zur Durchführung des Bundes-Immissionsschutzgesetzes
- Appendix H: Calorific Value, Price, and Emission Coefficients of Energy Kinds
- EMEP/EEA air pollutant emission inventory guidebook - 2009
- EMEP/CORINAIR Emission Inventory Guidebook - 2006
- Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009
- BVT - Festlegung in ausgewählten industriellen Bereichen als Beitrag zur Erfüllung der Klimasch...
- Brennstoffe und Verbrennungsrechnung, 2. Auflage
- GHG Inventories 2008 - Common Reporting Format (CRF)
- Erarbeitung der Grundlagen für das BVT - Merkblatt Großfeuerungsanlagen
- Integrated Pollution Prevention and Control (IPPC) - Ref. Doc. on the BAT for Large Combustion Plant
- The European Pollutant Release and Transfer Register
- Telefonische Recherche - Preis Kraftwerksnebenprodukte
- Electricity Information 2010
- Energy Statistics of Non-OECD Countries 2010
- Energy Balances of Non-OECD Countries 2010
- Bertin technologies 2000

3. Data quality

3.1. Technological representativeness

3.2. Time-related coverage

Reference year: 2011 (Data collection period 2007-2009)

Power plant efficiency data and shares on direct to combined heat and power generation (CHP) are related to 2008.

3.3. Geographical coverage

Datasets were provided for 137 countries

Geographical differences are taken into account at several steps of the modeling, as described in paragraph 2.1.

3.4. Precision

3.5. Completeness

All relevant flows quantified

3.6. Consistency

4. Multi-functionality and allocation procedure

4.1. Foreground system allocation procedure

For the combined heat and power (CHP) production allocation by exergetic content is applied. Electricity and power plant by-products, i.e. gypsum, boiler ash and fly ash are allocated by market value due to no common physical properties. Within the refinery allocation by mass (refinery expenditures) and net calorific value (feedstocks, e.g.crude oil) is used. For the combined crude oil, natural gas and natural gas liquids (NGL) production allocation by net calorific value is applied.

4.2. Background system allocation procedure

Background system allocation procedure follows the rules defined by PE International.

D. CRITICAL REVIEW

All Base Impacts® datasets follow the ILCD Entry Level requirements, which require a review either internal with public report or external.

The electricity datasets were reviewed by internal review:

- Raw data: Validation of data sources, Sample tests on calculations, Cross-check with other source, Expert judgement
- Unit process(es), single operation, black box: Energy balance, Element balance, Cross-check with other source, Cross-check with other data set, Expert judgement, Mass balance, Compliance with ISO 14040 to 14044
- LCI results or Partly terminated system: Energy balance, Element balance, Cross-check with other source, Cross-check with other data set, Expert judgement, Mass balance, Compliance with ISO 14040 to 14044
- LCIA results : Cross-check with other source, Cross-check with other data set, Expert judgement, Compliance with ISO 14040 to 14044
- Documentation: Expert judgement, Compliance with ISO 14040 to 14044, Documentation
- Life cycle inventory methods : Compliance with ISO 14040 to 14044
- LCIA results calculation : Expert judgement, Compliance with ISO 14040 to 14044
- Goal and scope definition: Expert judgement, Compliance with ISO 14040 to 14044

E. REPORTS FOR MORE INFORMATION

The following documents should be used for more information:

- Gabi Modelling Principles 2013
- General Base Impacts® documentation
- Review report, available in the metadata of each dataset

F. ADMINISTRATIVE INFORMATION

1. Commissioner

PE International.

2. Dataset modeler

PE International.

APPENDIX: DATA NEED AND DATA SELECTION

A Technical Committee on electricity datasets specifications was held on 25 March 2011 to identify the electricity datasets required for environmental labeling.

The conclusions of this Technical Committee were a synthesis of data need for electricity.

The datasets identified by the Technical Committee are provided in Base Impacts® as requested in the consultation specifications.