



# PRODUCT CATEGORY RULES (PCR)

For preparing an  
Environmental Product Declaration (EPD) for  
Electricity, Steam, and Hot and Cold Water  
Generation and Distribution

PCR CPC 17  
Version 1.1  
2007-10-31

CPC Groups  
171 – Electrical energy  
172 – Steam, and hot and cold water

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## Table of contents

<b>1</b>	<b>General Information</b>	<b>5</b>
1.1	PCR Document	5
1.2	Use of PCR document	5
<b>2</b>	<b>Product category description</b>	<b>6</b>
2.1	The product category	6
2.2	Description of the Life Cycle information modules	6
<b>3</b>	<b>Material content of the product to be declared</b>	<b>10</b>
<b>4</b>	<b>Declared unit</b>	<b>10</b>
<b>5</b>	<b>Units</b>	<b>10</b>
<b>6</b>	<b>Rules for the LCA</b>	<b>10</b>
<b>6.1</b>	<b>Core module</b>	<b>10</b>
6.1.1	System boundaries	10
6.1.1.1	Boundaries in time	10
6.1.1.2	Boundaries towards nature	11
6.1.1.3	Boundaries towards geography	11
6.1.1.4	Processes included in the core module	11
6.1.1.5	Boundaries towards other technical systems and technical boundaries	11
6.1.1.6	Boundaries towards risk assessment	11
6.1.2	Data collection and cut-off rules	11
6.1.3	Data quality, specific and generic data	11
6.1.4	Allocation	12
6.1.4.1	Introduction	12
6.1.4.2	Combined heat and power	12
6.1.4.3	Electricity, steam or hot water from a waste incineration plant	12
6.1.4.4	Fuel-related waste treatment	12
6.1.5	Calculation procedures	13
<b>6.2</b>	<b>Core module's infrastructure upstream and downstream modules</b>	<b>13</b>
6.2.1	System boundaries	13
6.2.1.1	Introduction	13
6.2.1.2	Boundary in time	13
6.2.1.3	Boundaries towards nature	13
6.2.1.4	Boundaries towards geography	13
6.2.1.5	Equipment and processes included	13
6.2.1.6	Boundaries towards other technical systems and technical boundaries	14
6.2.1.7	Boundaries towards risk assessment	14
6.2.2	Data collection and cut-off rules	14
6.2.3	Data quality, specific and generic data	14
6.2.4	Allocation	15
6.2.4.1	Introduction	15
6.2.4.2	Allocation of infrastructure in CHP plants	15

6.2.4.3	Allocation in generic data .....	15
6.2.5	Calculation procedures.....	15
6.2.6	Substitution data.....	15
<b>6.3</b>	<b>Upstream processes .....</b>	<b>16</b>
6.3.1	System boundaries .....	16
6.3.1.1	Boundaries in time .....	16
6.3.1.2	Boundaries towards nature.....	16
6.3.1.3	Boundaries towards geography.....	17
6.3.1.4	Processes included .....	17
6.3.1.5	Boundaries towards other technical systems and technical boundaries .....	17
6.3.1.6	Boundaries towards risk assessment.....	17
6.3.2	Data collection and cut-off rules.....	17
6.3.3	Data quality, specific and generic data .....	17
6.3.4	Allocation.....	18
6.3.4.1	Introduction.....	18
6.3.4.2	Industrial waste steam/hot water used for energy conversion .....	18
6.3.4.3	Blast furnace gas used for energy conversion.....	19
6.3.4.4	Energy rich gases used for energy conversion.....	19
6.3.4.5	Bio fuel production and other fuels with biological origin.....	19
6.3.5	Calculation procedures.....	19
6.3.6	Substitution data.....	19
<b>6.4</b>	<b>Upstream processes' infrastructure upstream and downstream modules .....</b>	<b>19</b>
6.4.1	System boundaries .....	19
6.4.1.1	Introduction.....	19
6.4.1.2	Other system boundaries.....	20
6.4.2	Data quality, specific and generic data .....	20
6.4.3	Other rules, see section 6.2 .....	20
<b>6.5</b>	<b>Down-stream processes .....</b>	<b>20</b>
6.5.1	System boundaries .....	20
6.5.1.1	Boundaries in time .....	20
6.5.1.2	Boundaries towards nature.....	20
6.5.1.3	Boundaries towards geography.....	20
6.5.1.4	Items included.....	20
6.5.1.5	Boundaries towards other technical systems and technical boundaries .....	21
6.5.1.6	Boundaries towards risk assessment.....	21
6.5.2	Data quality, specific and generic data .....	21
6.5.3	Data collection and cut-off rules.....	21
6.5.4	Allocation.....	22
6.5.5	Calculation procedures.....	22
6.5.6	Substitution data.....	22
<b>6.6</b>	<b>Down-stream processes' infrastructure upstream and downstream modules....</b>	<b>22</b>
6.6.1	System boundaries .....	22
6.6.1.1	Introduction.....	22
6.6.1.2	Items included.....	22
6.6.1.3	Other system boundaries.....	22
6.6.2	Data collection and cut-off rules.....	22

6.6.3	Data quality, specific and generic data .....	22
6.6.4	Calculation procedures.....	23
6.6.5	Other rules, see section 6.2 .....	23
<b>7</b>	<b><i>Instructions on the content and format of the Type III environmental declaration.....</i></b>	<b>23</b>
<b>7.1</b>	<b>Programme related information .....</b>	<b>23</b>
<b>7.2</b>	<b>Product related information.....</b>	<b>23</b>
7.2.1	Producer description .....	23
7.2.2	Product system description .....	23
7.2.2.1	Energy conversion system .....	23
7.2.2.2	Distribution system .....	23
7.2.2.3	Products.....	24
7.2.3	Declared unit.....	24
<b>7.3</b>	<b>Comparisons of EPDs within this product category .....</b>	<b>24</b>
<b>7.4</b>	<b>Validity of the EPD.....</b>	<b>24</b>
<b>7.5</b>	<b>Environmental information.....</b>	<b>24</b>
7.5.1	Environmental performance declaration - Minimum set of parameters from the LCA study, reported per declared unit .....	24
<b>7.6</b>	<b>Dominance analysis and conclusions .....</b>	<b>27</b>
<b>7.7</b>	<b>Differences versus previous versions of the EPD.....</b>	<b>27</b>
<b>8</b>	<b><i>Additional Environmental information.....</i></b>	<b>27</b>
<b>8.1</b>	<b>Additional environmental information based on LCA .....</b>	<b>27</b>
<b>8.2</b>	<b>Additional environmental information not based on LCA.....</b>	<b>27</b>
<b>9</b>	<b><i>Mandatory statements .....</i></b>	<b>29</b>
<b>10</b>	<b><i>References .....</i></b>	<b>29</b>
	Annex 1 Energywares.....	30
	Annex 3 The Alternative Generation Method.....	33

# 1 General Information

## 1.1 PCR Document

This is a document of Product Category Rules (PCR) for the assessment of the environmental performance of Electricity and/or Steam or Hot Water Generation and Distribution and the declaration of this performance by an EPD. It is approved by the EPD<sup>®</sup> system, held by the International EPD Consortium (IEC) and following the General Programme Instructions for environmental product declarations, EPD, which is based on ISO 14025.

This PCR document was developed in an international bottom up process and went through the following stages of discussion:

- A working group, lead by PCR moderator Caroline Setterwall, Vattenfall, prepared a draft based on the former version of the PCR, PSR 2004:2.

Participating organizations in the working group
Elforsk, Sweden
Five winds, Germany
Östfoldforskning, Norway
Fortum, Finland
esu-services, Switzerland
Göteborg Energi, Sweden
Cycleplan, Estonia
British Energy, United Kingdom
Ecobilancio, Italy
EdF France
Vattenfall, Sweden

- The draft was discussed at three telephone meetings from October 2006 till February 2007 and subsequently revised according to decisions made.
- Open consultation meeting in Brussels March 8<sup>th</sup>, 2007, where the PCR was accepted with some changes
- Published at the PCR forum at [www.environdec.com](http://www.environdec.com) during March 2007 to receive further comments
- Reviewed and approved by *The Swedish Environmental Management Council*, October 31<sup>st</sup> 2007, and by the *International EPD Consortium (IEC)* 29<sup>th</sup> February 2008.

The PCR document is a living document. If relevant changes in LCA methodology or in electricity, steam or hot water production technology occur, the document will be revised and any changes published on the GEDNet Internet website:

[www.environdec.com](http://www.environdec.com).

## 1.2 Use of PCR document

This PCR document provides basic rules for performing the LCA and what kind of additional environmental information to address in preparation of an EPD for electricity and/ or steam or hot or cold water, generated in separate plants or in combined heat and power plants and distributed to the consumer. The PCR also

defines the predetermined parameters from the LCA and additional environmental information to be declared in the EPD.

This PCR document facilitates comparison of electricity and heat (hot water or steam) and cold water, generated in different systems. It also may be used to develop data for an information module for electricity, steam or hot water input when assessing the environmental performance of materials or other products.

## 2 Product category description

See General Programme Requirements, section 2 Development of Product Category rules, paragraph 2.2.

### 2.1 The product category

The product category “Electricity, Steam, Hot and Cold Water Generation and Distribution”, UN CPC 17 (United Nation Central Product Classification, division 17) includes the generation and distribution of electricity, steam, hot and cold water.

Examples are:

- Electricity from an individual production facility, e.g. a hydropower plant,
- Typical electricity from a type of facility, e.g. an average wind power plant
- A typical electricity mix
- Heat from a district heating systems with several heat sources

Generation includes the processes from cradle to power plant transformer inclusive or to the heating/cooling plant delivery point to the distribution system. Distribution includes the processes after the power plant transforming process to the customer or from the heating/cooling plant delivery point to the distribution system to the customer central unit.

This PCR document does not cover the use stage of electricity, steam, and hot/cold water. The use of electricity, steam and hot/cold water fulfils various functions in different contexts. Mechanical work, etc in other technical systems is outside the scope of this PCR.

### 2.2 Description of the Life Cycle information modules

The lifecycle comprises several information modules according to the following list and Fig 1. All information modules include waste handling according to the Polluter Pays principle (PP, see Appendix 1, General Programme Instructions, 1.7.1 Handling of wastes, treatment of worn-out products and output flows that are reused or recycled):

- The **core module** comprises gate-to-gate environmental information on the operation stage and on the handling of fuel residues from the energy conversion plant or system of energy conversion plants.
  - The **infrastructure up-stream module** associated with the **core module** comprises the construction of the energy conversion plant (system) and fuel preparation equipment and storages including reinvestments.

- The **infrastructure down-stream module** associated with the **core module** comprises dismantling of the (system) and fuel preparation equipment and storages
- The **up-stream processes** comprise cradle-to-gate environmental information on production of fuel, auxiliary material and chemicals
  - The **infrastructure up-stream module** associated with the **up-stream processes** comprise construction of and reinvestments in fuel preparation equipment at the site of the energy conversion plant (dryer, mill etc.) and suppliers' facilities.
  - The **infrastructure down-stream module** associated with the **up-stream processes** comprise dismantling of fuel preparation equipment at the site of the energy conversion plant (dryer, mill etc.) and suppliers' facilities.
- The **down-stream processes** comprise distribution, use stage, and end-of life scenarios of which only distribution is required for this product category.
  - The **infrastructure up-stream module** associated with the **down-stream processes** comprises construction of the distribution system including reinvestments.
  - The **infrastructure down-stream module** associated with the **down-stream processes** comprises dismantling of the distribution system.

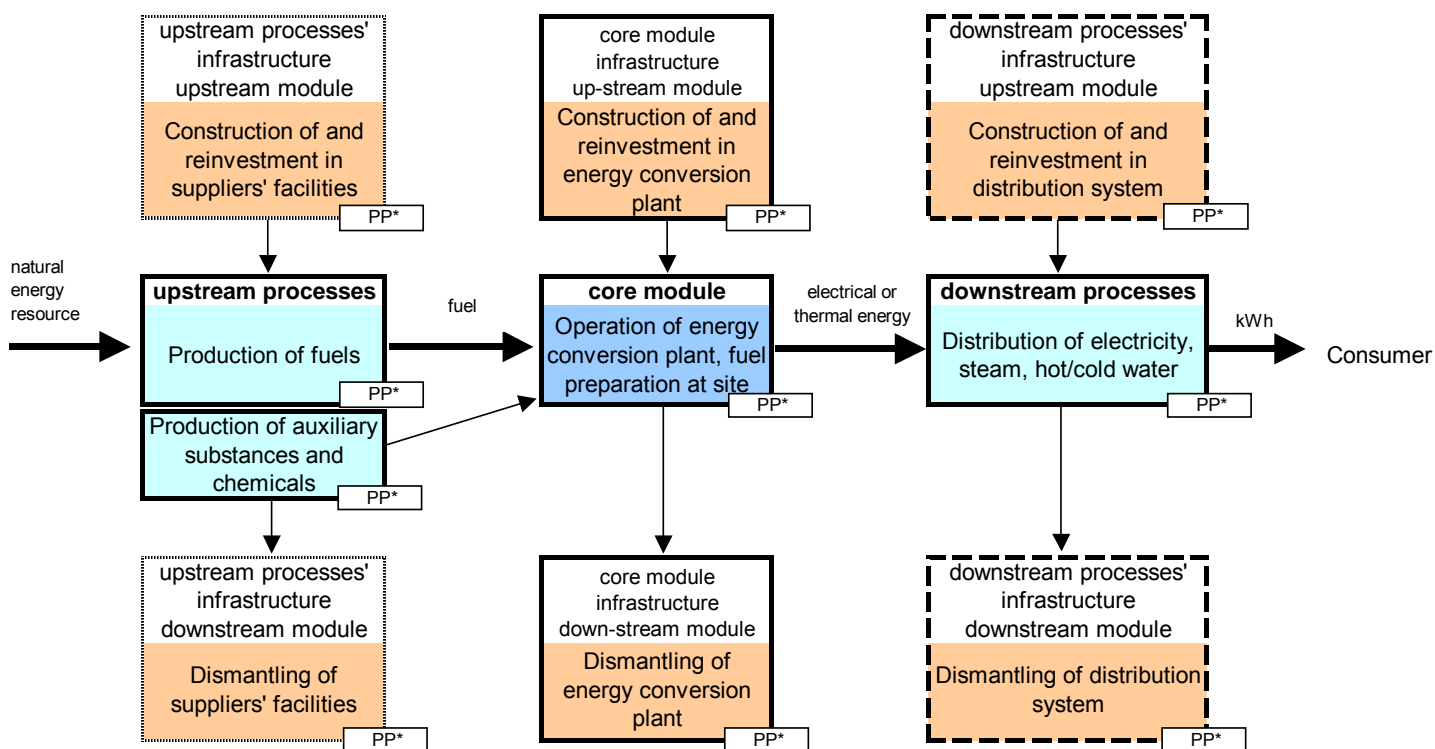


Figure 1 Illustration of the life cycle structure and rough system boundaries. Squares with unbroken edge line indicate processes that shall be included, dashed edge line indicate processes that should be included, dotted edge line indicate processes that may be included.\* Polluter Pays principle, see Appendix 1, General Programme Instructions, 1.7.1 Handling of wastes, treatment of worn-out products and output flows that are reused or recycled. The PP principle implies that the waste generator must take responsibility for his waste)

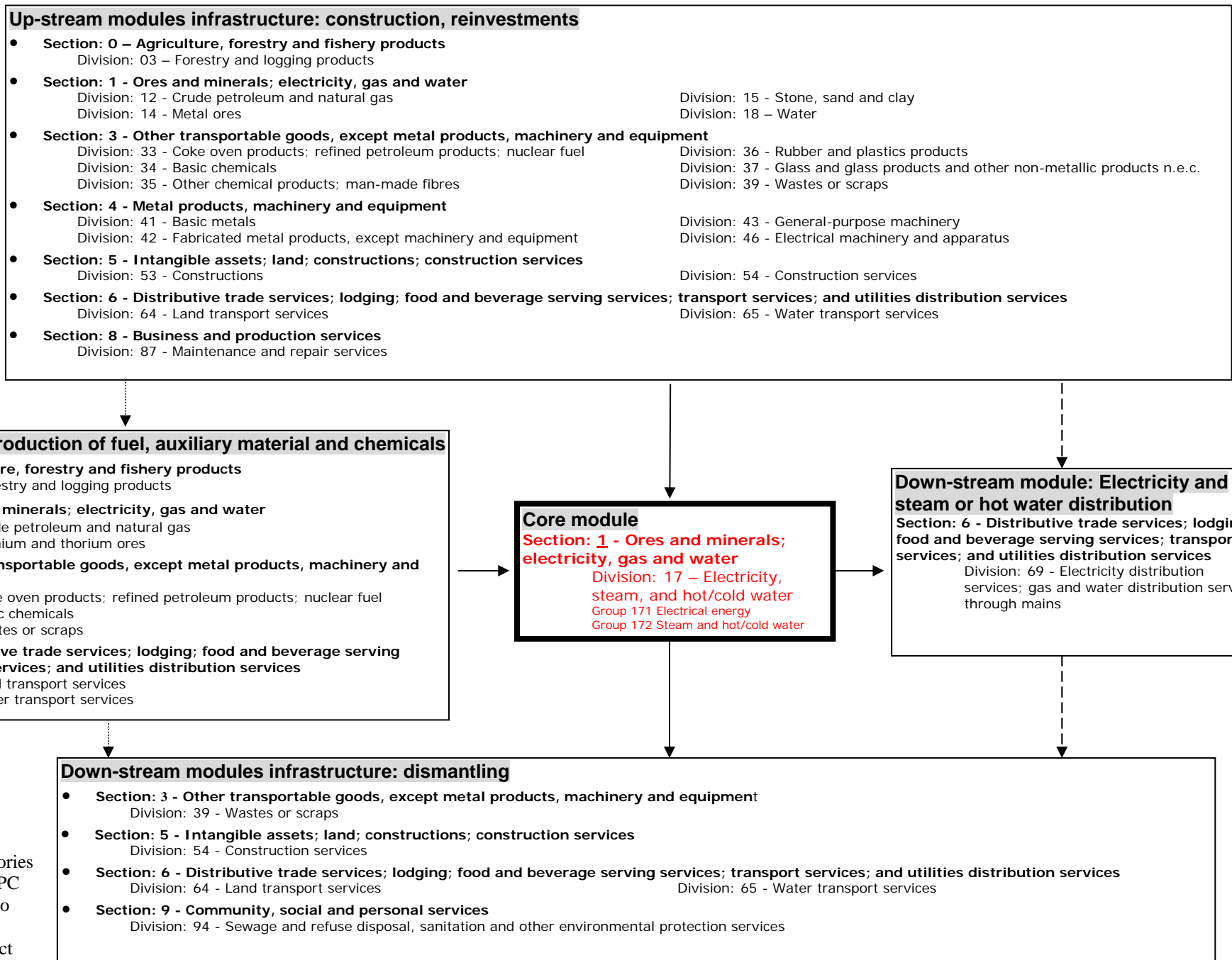


Figure 2 Product categories according to the UN CPC coding system related to up- and down-stream processes of this product category

Fig 2 shows an overview of up- and down-stream processes and services required for producing the product electricity, steam, and/or hot/cold water. Most often these up- and down-stream processes are outside the direct influence of the organisation generating the electricity, steam etc. Nevertheless these processes are part of the product system of this product category and data from these processes should be collected according to the specific PCR documents for the product categories where these processes belong when available.

If PCRs and EPDs do not exist for up-and down-stream processes required for an EPD for UN CPC 17, generic datasets from public databases can be used to fill these gaps. The datasets should be consistent with the specific data used in the EPD, a requirement met best by fulfilling the general data quality requirements in Appendix 1, section 1.6.1.

### **3 Material content of the product to be declared**

Not relevant for product category UN CPC 17.

### **4 Declared unit**

See Appendix 1, General Programme Instructions, section 1.3, regarding general rules.

The declared unit is defined as 1 kWh net <sup>1</sup> of electricity generated and thereafter distributed and/or 1 kWh of steam or hot/cold water generated and thereafter distributed to the consumer.

### **5 Units**

SI units and

- kWh for electricity, steam , and hot/cold water
- kW for power
- mSv for dose

### **6 Rules for the LCA**

See Appendix 1, General Programme Instructions, section 1.4 - 1.7 for general rules

#### **6.1 Core module**

##### **6.1.1 System boundaries**

###### **6.1.1.1 *Boundaries in time***

Input and output data of the core module shall reflect one reference year or an annual average of a defined reference period.

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<sup>1</sup> 1 kWh net means that electricity used within the power plant is subtracted from the amount of kWh generated in that plant.

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#### **6.1.1.2 Boundaries towards nature**

All emissions to nature from the included process shall be within the system boundaries. Any inputs directly from nature shall be included.

#### **6.1.1.3 Boundaries towards geography**

Data shall be site specific.

#### **6.1.1.4 Processes included in the core module**

- Energy conversion process of plant(s)
- Fuel preparation performed by the producer of electricity, steam, hot or cold water (drying, grinding etc.)
- Maintenance (for example lubrication but not reinvestment of components)
- Test operations of reserve power and reserve heat
- Transportation of waste
- Handling/treatment/storage of fuel related waste
- Handling/treatment/storage of other waste

#### **6.1.1.5 Boundaries towards other technical systems and technical boundaries**

Inputs and outputs to and from the core module to other technical systems shall be included.

Data shall reflect the technology actually used.

#### **6.1.1.6 Boundaries towards risk assessment**

Environmental impacts due to accidents and undesired events are not part of the LCA but part of the environmental risk assessment to be reported under Additional environmental information.

Environmental burdens in conjunction with mishaps occurring more often than once in three years are considered to belong to normal operation and are part of the LCA (example: smaller frequent oil spills from hydropower stations to the river due to leaky packings). Events with environmental impact that happen less frequent than once in three years belong to the environmental risk assessment (example: the rupture of a Kaplan turbine hub leading to a sudden larger oil emission).

#### **6.1.2 Data collection and cut-off rules**

Data regarding the operation of the energy conversion plant or system of energy conversion plants can be gathered from reports to authorities and from the environmental management system or other similar documents as well as from expert estimates (e.g. on future nuclear waste handling or reinvestment rates). Deviation from the 1 % cut-off rule described in General Programme Instructions, shall be justified.

#### **6.1.3 Data quality, specific and generic data**

Specific data shall be used for amounts of inputs and outputs in following activities

- operation of energy conversion plant (system of energy conversion plants)
- fuel preparation processes at energy conversion site e.g. drying and grinding
- maintenance activities e.g. lubrication
- operation (also test operation) of reserve power and reserve heat

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- distances for the transportation of fuel related waste and type of vehicles
- handling/treatment/storage of fuel related waste
- amounts and type of treatment of other waste

#### 6.1.4 Allocation

##### **6.1.4.1 Introduction**

Allocation always implies valuation and the main goals for the allocation choices made for this product category is to keep the allocation methodology rather simple but transparent and maintain comparability between EPDs.

Results calculated with other allocation methods than the mandatory ones listed below may be reported and discussed under *Additional environmental information*.

In case there are several products from an energy conversion plant (system), like for example electricity and steam or a waste treatment service and district heat, the LCA results of all products and services provided by this plant, to which impacts have been allocated, shall be reported in the Ecoprofile of the EPD.

##### **6.1.4.2 Combined heat and power**

Allocation of benefit and environmental burdens for combined heat and power generation shall be made with the Alternative Generation Method, see Annex 2. The environmental burdens of combined heat and power generation are distributed between the two products – electricity and steam/hot water– in proportion to the fuel needed for separate electricity and heat generation, i.e. according to the best efficiency of each of the two processes with the same fuel. For calculation of the allocation factors see Annex 2.

The electricity used, internally, in the CHP shall also be split between the products according to the Alternative Generation Method, which means that the net electricity generation is calculated as the gross electricity generation minus the – to electricity allocated - portion of the internally used electricity.

##### **6.1.4.3 Electricity, steam or hot water from a waste incineration plant**

This multi-output process delivers waste treatment services, steam, hot water and/or electricity. The allocation between service and products follows the General Programme Instructions regarding waste treatment, see Appendix 1. The burdens of collecting and transporting the waste to the incineration plant as well as the incineration process that destructs the waste shall be allocated to the waste treatment service (according to the Polluter Pays allocation method) whereas equipment and processes needed to make use of the produced heat as e.g. district heat or process steam shall be allocated to these products.

##### **6.1.4.4 Fuel-related waste treatment**

The allocation of treatment/handling of fuel-related waste follows the Polluter Pays allocation method described in the General Programme Instructions in section 1.7.2 in Appendix 1.

Nuclear fuel reprocessing is a waste treatment service stabilizing spent nuclear fuel and shall be allocated to the nuclear power plant operator. The plutonium and MOX fuel are additional assets leaving the reprocessing plant without any burdens.

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Because most of the depleted uranium is currently stocked, all requirements and emissions of the enrichment step are attributed to the enriched uranium. Because only a small amount of the total depleted uranium produced will ever be used, depleted uranium shall be considered as a waste and listed as such in the inventory.

If the ash from combustion plants is deposited, the deposition process shall be allocated to the ash generator. If the ash is reused as for instance road filling any processes necessary to stabilize the ash shall be allocated to the ash generator and the collection and transportation to the site of use is allocated to the next user. If ash from bio fuels is spread in the forest all processes needed to spread the ash shall be allocated to the ash generator.

#### 6.1.5 Calculation procedures

The reference flow shall be calculated as the kWh generated during the defined reference period.

## 6.2 Core module's infrastructure upstream and downstream modules

### 6.2.1 System boundaries

#### 6.2.1.1 *Introduction*

For some of the product systems in the product category the construction of the power plant is the environmentally important part, (e.g. wind-, and photovoltaic) and hence construction shall be included as part of the input required for this product category.

#### 6.2.1.2 *Boundary in time*

The technical service life of the energy conversion plant shall be defined and justified.

Data for construction materials and services should not be older than 10 years.

The LCA shall be valid for the reference year or reference period.

#### 6.2.1.3 *Boundaries towards nature*

All resources from nature and emissions to nature should be included in the calculations.

#### 6.2.1.4 *Boundaries towards geography*

Data should reflect the geographic location or geographical region of the production site of inputs (e.g. materials or electricity).

#### 6.2.1.5 *Equipment and processes included*

Infrastructure of energy conversion plant (system of energy conversion plants), construction, reinvestments and dismantling (end of life) shall be included in the LCA

- Energy conversion plant building and other infrastructure including, digging, foundations, roads etc within the site, and respective construction processes

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- Machinery, cables and other equipment for the conversion process and reserve power
- Fuel preparation equipment (e.g. mill, dryer) and fuel storage facilities at energy conversion plant site
- Power plant transformer
- Connection to the grid
- Transportation of inputs and outputs
- Facilities for handling of fuel-related waste
- Reinvestments of material and components during the estimated technical service life
- Emissions due to inundation of land (hydropower)

If dismantling is not probable (for example large-scale hydropower) the end of life may be excluded. In such case the estimated technical service life is the time after which 100% of upgrading and reinvestment has taken place, i.e. 100 % of the machinery and 100 % of concrete in waterways and dams. The need for refurbishing groundwork, digging, and transportation of filling material etc. during the technical service life shall be estimated and included.

#### **6.2.1.6 *Boundaries towards other technical systems and technical boundaries***

Modern technology for production of construction materials should be assumed. For input materials and components the technology used in the geographic region where the material or component is purchased should be the basis for calculations.

Inputs and outputs to and from the Life Cycle from and to other technical systems shall be described.

#### **6.2.1.7 *Boundaries towards risk assessment***

Environmental impacts due to accidents and undesired events are not part of the LCA but part of the environmental risk assessment to be reported under Additional environmental information.

Environmental burdens in conjunction with mishaps occurring more often than once in three years are considered to belong to normal operation and are part of the LCA.

#### **6.2.2 Data collection and cut-off rules**

The material composition can be gathered e.g. from the documentation from the construction process, such as plans, invoices, project reports, environmental impact assessments, etc.

The need for reinvestments during the technical service life shall be assessed and documented.

Compliance with the 1%-rule should be aimed for.

#### **6.2.3 Data quality, specific and generic data**

Specific data should be used for

- material composition of energy conversion plant

- material composition of fuel preparation equipment /e.g. mill, dryer) and storages
- material composition of facilities for handling of fuel-related waste
- reinvestment rates

Generic data may be used for

- manufacture of construction materials and chemicals
- transportation distances
- transportation services (fuel use and emissions in conjunction with transportation)
- construction services
- dismantling services
- waste treatment processes
- national or regional mixes for electricity generation
- resource use and emissions in conjunction with electricity used during the construction/reinvestment/dismantling processes

#### 6.2.4 Allocation

##### **6.2.4.1 Introduction**

Allocation always implies valuation and the main goals for the allocation choices made for this product category is to keep the allocation methodology rather simple but transparent and maintain comparability between EPDs.

Results calculated with other allocation methods than the mandatory ones listed below may be reported and discussed under *Additional environmental information*.

##### **6.2.4.2 Allocation of infrastructure in CHP plants**

Parts or components of infrastructure exclusively used for the generation of one of the products is allocated to that product to 100 %, e.g. the generator is allocated to electricity and district heat exchanger is allocated to district heat. Infrastructure, necessary for the generation of all products is allocated to the different products according to the Alternative Generation Method, see section 6.1.4.2.

##### **6.2.4.3 Allocation in generic data**

Up-stream data from databases using data calculated with a consequential approach using system expansion and credits are not permitted in LCA for EPDs. If no other data are available for a certain input all negative parameter values shall be set to zero.

Allocation methods used in up-stream data from databases should be documented.

#### 6.2.5 Calculation procedures

The technical service life of the infrastructure shall be defined. The reference flow for infrastructure shall be calculated as the reference flow calculated for the core module multiplied by the technical service life, see section 6.1.5.

#### 6.2.6 Substitution data

If specific data cannot be retrieved the following databases should be used for Europe:

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MATERIAL	DATABASE
Steel	IISI (International Iron and Steel Institute)
Primary copper Copper products	ICA (International Copper Association) European Copper Institut (Deutsches Kupferinstitut – Life Cycle Center)
Electricity	ecoinvent Data for different power technologies combined with IEA (International Energy Agency) statistics on electricity generation mixes for nations, regions etc.
Fuels	ecoinvent
Aluminium	EAA (European Aluminium Association)
Plastics	PE Plastics Europe (former APME Association of Plastics Manufacturers in Europe)
Chemicals	PE Plastics Europe (former APME Association of Plastics Manufacturers in Europe), ecoinvent
Electronic components	EIME (Environmental Information and Management Explorer) EcoBilan
Transports	NTM or regional alternatives <sup>2</sup>
Waste management,	ecoinvent
Other construction material	ecoinvent

In other parts of the world other databases may be more appropriate.  
Note that recycling at end of life or credits for incineration shall not be included in data used from databases.

### 6.3 Upstream processes

#### 6.3.1 System boundaries

##### 6.3.1.1 *Boundaries in time*

Data for production of fuel used in the energy conversion plant shall be valid for the reference period defined for the core module. Deviations shall be justified.

Data for production of auxiliary material and chemicals should be valid for the reference period defined for the core module.

Generic data used should not be older than 10 years

##### 6.3.1.2 *Boundaries towards nature*

All resources from nature and emissions to nature should be included in the calculations.

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<sup>2</sup> Network for Transportation and Environment, a non-profit association working for consensus regarding environmental issues in combination with transportation (<http://www.ntm.a.se/eng-index.asp>).

### **6.3.1.3 Boundaries towards geography**

Generic data used should reflect the geographical region where the fuels, electricity, auxiliary material, and chemicals are purchased.

### **6.3.1.4 Processes included**

**Fuel production** (fuel to be used in the energy conversion plant)

- Extraction of natural energy resources
- Processing of fuel
- Preparation of fuel
- Fuel storage operation
- Transports: extraction/farming-> refinery->conversion plant
- 

**Production of auxiliary inputs** to the energy conversion plant(s) shall be presented from cradle to the conversion plant gate:

- Extraction of natural resources for auxiliary inputs (fuels and electricity used by suppliers, materials, chemicals)
- Production of fuels and electricity used by suppliers and auxiliary materials and chemicals
- Storage of auxiliary materials and chemicals at energy conversion site
- Transports: extraction -> processing -> conversion plant

### **6.3.1.5 Boundaries towards other technical systems and technical boundaries**

For fuel used by the energy conversion plant the technology actually used should be the basis for calculation.

For fuels and electricity used by suppliers and production of input auxiliary materials and chemicals the production technology used in the geographic region where the electricity, fuel, material or chemical is purchased should be the basis for calculations.

### **6.3.1.6 Boundaries towards risk assessment**

Environmental impacts due to accidents and undesired events are not part of the LCA but part of the environmental risk assessment to be reported under “additional environmental information”.

Environmental burdens in conjunction with mishaps occurring more often than once in three years are considered to belong to normal operation and are part of the LCA.

### **6.3.2 Data collection and cut-off rules**

Information should be collected from the main fuel subcontractors and data should be valid for the reference period defined for the core module.

Compliance with the 1%-rule should be aimed for.

### **6.3.3 Data quality, specific and generic data**

#### **Production of fuel for the energy conversion plant**

Specific data should be used for amounts of inputs and outputs in following activities

- production of main fuels

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- distances for the transportation within the fuel production chain and to the energy conversion plant and type of vehicles

Generic data may be used for

- production of fuels bought on the spot market
- transportation services (fuel use and emissions in conjunction with transportation)
- resource use and emissions in conjunction with electricity used in suppliers' processes
- national or regional mixes for electricity generation
- resource use and emissions in conjunction with production of auxiliary materials and chemicals used in suppliers' processes
- resource use and emissions in conjunction with treatment of operational waste from suppliers' processes

### **Production of electricity and fuels used by suppliers and production of input auxiliary material and chemicals for the energy conversion plant**

Specific data should be used for large input flows to the core module. Deviations shall be justified. Generic data may be used for production and transportation of input chemicals and auxiliaries as well as for transportation of operational waste from the energy conversion plant and the following waste treatment, destruction, or deposition services.

#### 6.3.4 Allocation

##### **6.3.4.1 Introduction**

Allocation always implies valuation and the main goals for the allocation choices made for this product category is to keep the allocation methodology rather simple but transparent and maintain comparability between EPDs.

Results calculated with other allocation methods than the mandatory ones listed below may be reported and discussed under *Additional environmental information*.

In the case that it is difficult to decide if a fuel used in the energy conversion plant is a waste or a by-product from another party and the case is not described in this PCR the verifier should be very careful in checking the selected allocation method according to the general principles in the General Programme Instructions of the EPD<sup>®</sup> system and to the examples mentioned in this PCR.

##### **6.3.4.2 Industrial waste steam/hot water used for energy conversion**

Industrial waste steam/hot water that would have been emitted to a recipient (if it were not used in an energy conversion process) is considered to be free of environmental burden i.e. only transportation from the industry shall be allocated to the energy conversion system using the steam/hot water. The environmental performance of the industry is in this case not affected whether the energy in the wastewater is used or not. This is in accordance with the General Programme Instructions regarding waste treatment, see section 1.7.2 in Appendix 1.

Sometimes the industry changes its process in order to make the waste steam/hot water usable for energy conversion. In that case a portion of the industries

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environmental burden shall be allocated to the energy conversion system based on an energy analysis of the industry's processes.

#### **6.3.4.3 *Blast furnace gas used for energy conversion***

Blast furnace gas has a quite low calorific value and consists mainly of carbon monoxide and it must be flared if not sold. It accounts for a minor part of the industry's revenues and the industry's process is not affected whether it is used for energy conversion or not and hence it should be considered a waste. Accordingly the user gets the gas without environmental burdens and the emissions from combustion are allocated to the gas destruction service

#### **6.3.4.4 *Energy rich gases used for energy conversion***

Energy rich gas from industries is considered as a product of these industries and a portion of the industries' environmental burdens shall be allocated to this gas based on an energy analysis of the industry's processes.

#### **6.3.4.5 *Bio fuel production and other fuels with biological origin***

Bio fuel cultivation aimed at electricity/steam/hot/cold water production is included as a whole e.g. short rotation forestry.

If bio fuel is acquired from forestry, allocation by volume (solid m<sup>3</sup>) shall be used between the forest products (e.g. timber, pulp wood, fire wood, forest residues etc). If bio fuel is acquired from saw mills or other wood processing industries allocation by volume shall be used (solid m<sup>3</sup>) between the wood products of that industry. If the sawdust stems from an industry producing highly processed products, like e.g. furniture, the sawdust constitutes a minor part of the industry's overall revenues and should be considered a by-product.

If bio fuel is acquired from agriculture residues or from food industry it is considered as spillage i.e. only the burdens from its collection and transportation will be allocated to the fuel production process.

Other fuels with biological origin e.g. municipal sludge or demolition wood are considered as spillage i.e. only the burdens from its collection and transportation will be allocated to the fuel production process.

#### **6.3.5 Calculation procedures**

The reference flow calculated for the core module shall be used, see section 6.1.5.

#### **6.3.6 Substitution data**

See section 6.2.6.

### **6.4 Upstream processes' infrastructure upstream and downstream modules**

#### **6.4.1 System boundaries**

##### **6.4.1.1 *Introduction***

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Infrastructure of upstream processes, e.g. construction and dismantling of suppliers' factories, vehicles and roads may be included.

#### **6.4.1.2 Other system boundaries**

See section 6.2.1 for remaining system boundaries.

#### **6.4.2 Data quality, specific and generic data**

Generic data may be used for

- material composition
- reinvestment rates
- manufacture of construction materials and chemicals
- transportation distances
- transportation services (fuel use and emissions in conjunction with transportation)
- construction services
- dismantling services
- waste treatment processes
- national or regional mixes for electricity generation
- resource use and emissions in conjunction with electricity used during the construction/reinvestment/dismantling processes

#### **6.4.3 Other rules, see section 6.2**

For rules regarding Data collection and cut-off, see section 6.2.3

For rules regarding allocation, see section 6.2.4

For rules regarding calculation procedures, see section 6.2.5

For rules regarding substitution data, see section 6.2.6

### **6.5 Down-stream processes**

#### **6.5.1 System boundaries**

##### **6.5.1.1 *Boundaries in time***

The losses in the distribution system included in the calculations shall be valid for the reference period defined for the core module.

##### **6.5.1.2 *Boundaries towards nature***

All resources from nature and emissions to nature shall be included in the calculations.

##### **6.5.1.3 *Boundaries towards geography***

For distribution of heat and steam data shall reflect the distribution system actually used. For electricity data should reflect the region where most of the electricity is sold.

##### **6.5.1.4 *Items included***

Distribution (of generated electricity, steam, and hot/cold water)

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The following items shall be included in the LCA calculations

- Average transmission/distribution losses associated with the transmission and distribution of electricity to a consumer, defined with respect to connection voltage.
- For heat, steam, hot and cold water, average distribution losses in the distribution system used.

The following items should be included in the LCA calculations

- Operation and maintenance of the distribution systems including transportation and specific emissions of e.g. oil, Zn, Cd, SF<sub>6</sub>.

#### **6.5.1.5 Boundaries towards other technical systems and technical boundaries**

Inputs and outputs to and from the distribution system operation and maintenance activities from and to other technical systems should be described.

For fuels, input auxiliary materials and chemicals the technology used in the geographic region where the fuel/material/chemical is purchased should be the basis for calculations.

#### **6.5.1.6 Boundaries towards risk assessment**

Environmental impacts due to accidents and undesired events are not part of the LCA but part of the environmental risk assessment to be reported under Additional environmental information.

Environmental burdens in conjunction with mishaps occurring more often than once in three years are considered to belong to normal operation and are part of the LCA.

#### **6.5.2 Data quality, specific and generic data**

Specific data shall be used for

- distribution losses in steam and hot/cold water distribution systems

Specific data should be used for

- **typical** transmission and distribution losses in the power networks used for delivery of electricity to different customers, defined with respect to connection voltages.

Generic data may be used for

- **average** national transmission and distribution losses in the power networks representative for the delivery of electricity to a customer, defined with respect to connection voltage
- operation and maintenance of the distribution systems
- transports

#### **6.5.3 Data collection and cut-off rules**

Numbers on distribution losses should be based on measurements.

Compliance with the 1%-rule should be aimed for.

#### 6.5.4 Allocation

There are no special allocation cases.

#### 6.5.5 Calculation procedures

The reference flow calculated for the core module shall be used, see section 6.1.5.

#### 6.5.6 Substitution data

If specific data cannot be retrieved national or regional averages may be used.

### **6.6 Down-stream processes' infrastructure upstream and downstream modules**

#### 6.6.1 System boundaries

##### **6.6.1.1 Introduction**

For some product systems the construction of the distribution system makes up a substantial part of the overall environmental impact and hence construction, reinvestment and dismantling of the distribution system should be included as part of the input required for this product category.

##### **6.6.1.2 Items included**

Infrastructure of the distribution system, construction, reinvestments and dismantling (end of life) should be included in the LCA.

- Power line and power poles
- Cables
- Switch yards and transformer stations
- Ground work

##### **6.6.1.3 Other system boundaries**

See section 6.2.1 for remaining system boundaries.

#### 6.6.2 Data collection and cut-off rules

Data may be collected from databases or other sources.

The need for reinvestments during the technical service life should be estimated and included in the LCA.

Compliance with the 1%-rule should be aimed for.

#### 6.6.3 Data quality, specific and generic data

Generic data may be used for

- material composition of distribution system
- reinvestment rates normally applied
- manufacture of construction materials and chemicals
- transportation distances
- transportation services (fuel use and emissions in conjunction with transportation)

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- construction services
- dismantling services
- waste treatment processes
- national or regional mixes for electricity generation
- resource use and emissions in conjunction with electricity used during the construction/reinvestment/dismantling processes

#### 6.6.4 Calculation procedures

The technical service life of the infrastructure shall be defined. The reference flow for infrastructure shall be calculated, as the technical service lifetime multiplied by the amount of kWh distributed in the system during an annual average of a reference period.

#### 6.6.5 Other rules, see section 6.2

For rules regarding allocation, see section 6.2.4.

For rules regarding substitution data, see section 6.2.6.

## **7 Instructions on the content and format of the Type III environmental declaration**

### **7.1 Programme related information**

See General Programme Instructions, section 3, Declaration requirement and format, paragraph 3.1

### **7.2 Product related information**

#### 7.2.1 Producer description

The producer and the location of the energy conversion plant(s) shall be described and reference may be given to environmental management systems.

#### 7.2.2 Product system description

See General Programme Instructions, section 1.3.2. in Appendix 1 for general rules.

##### **7.2.2.1 *Energy conversion system***

The technology used for energy conversion shall be presented briefly, including a technical characterisation with reference to base load, peak load, reserve heat etc. Installation year shall be reported as well as a technical specification including, installed capacity, input fuel (where relevant), annual generation during defined reference period, conversion efficiency, full load hours (or other information so that full load hours can be calculated), and technical service life. The basis for the estimation of the technical service life shall be given.

##### **7.2.2.2 *Distribution system***

The design of the transmission and distribution systems shall be described shortly. Technical service life shall be given along with an explanation for this estimation.

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Furthermore transmission and distribution losses for electricity at different voltages (high, medium, low voltage) and in different regions (urban, rural) should be given. If data at different voltages and in different regions cannot be obtained average data on losses shall be given.

Distribution losses for heat, steam, hot and cold water shall be given based on measurements in the distributions systems used.

### **7.2.2.3 Products**

The products are described:

- For electricity generation voltage and feed voltage shall be reported
- For steam, and hot and cold water, feed temperature and return temperature shall be presented

### **7.2.3 Declared unit**

The declared unit shall be given along with the reference flow.

## **7.3 Comparisons of EPDs within this product category**

Energy can be supplied through different energy carriers like heat/steam or electricity, but the amount of kWh needed will differ with different energy carriers due to different energy quality and conversion/distribution efficiencies. The user of the EPD information shall be made aware of these differences to be able to compare EPDs within this product category.

## **7.4 Validity of the EPD**

The validity of the EPD shall be reported in the EPD.

## **7.5 Environmental information**

### **7.5.1 Environmental performance declaration - Minimum set of parameters from the LCA study, reported per declared unit**

The LCA results for upstream processes, core processes and downstream processes shall be reported separately.

In case there are several products from an energy conversion plant or system, like for example electricity and steam or a waste treatment service and district heat, the LCA results of all products and services, to which impacts has been allocated, shall be reported in the Ecoprofile of the EPD allowing the reader to calculate the total impact of the whole plant or system.

### **Resource use**

In this category the consumption of natural resources and resources shall be reported.

In addition input of recycled material from the technosphere should be reported.

Furthermore the electricity consumed in the energy conversion plant (system) shall be given as kWh electricity per declared unit and it shall be pointed out that environmental impact in conjunction with this electricity consumption is included in the Ecoprofile. It is the difference between gross and net generation in the case of electricity producing plants.

A complete report of resource consumption shall be provided in the LCA, while it is acceptable to present only selected, dominating resources in the EPD.

Resources shall be reported as inventory data, not aggregated, and shall be specified in grams, with the exception of hydropower, which shall be reported as kWh of potential energy, and wind power, geothermal power, and solar power, which are reported in kWh of electricity.

The sum of all input flows not followed from the cradle (i.e. from technosphere) shall be given.

Input parameters, extracted resources

- Non-renewable resources
- Renewable resources
- Water use

Input parameters, recycled resources

- Recycled resources as input

Input parameters from technosphere

- Aggregation of input flows not followed from the cradle

### Pollutant emissions

Output parameters: impact categories and inventory data

- Environmental impact categories given by the General Programme Instructions, section 3 Declaration requirement and format, paragraph 3.3
- LCI emission data supporting the environmental impact categories (main contributions)
- LCI emissions of radioactive isotopes in kBq, at a minimum C-14, Rn-222 and Kr-85
- LCI emissions of CO<sub>2</sub> with biological origin
- LCI emissions of particle matter (PM) preferably in separate categories of particle size (at a minimum a qualitative description of particle size)
- LCI emissions of toxic substances
- LCI emissions of oil to water and ground

## Waste and material subject to recycling

### **Core module**

Waste generated in the core processes shall be reported as inventory data in the categories below although these waste flows have been followed to the grave.

The quantity of fuel-related waste, which is generated by the energy conversion facility and directly related to the fuel used, shall be specified under separate sub-headings, such as ash and radioactive waste.

### **Fuel-related waste – non-radioactive** specified in weight units (g)

To landfill

- *Ash*
- *Gypsum*
- *Other*

To recycling or reuse

- *Ash*, it shall be clearly stated how the ash is recycled or reused, returned to the forest or used to build road embankments or other.
- *Gypsum*
- *Other*

**Hazardous fuel-related waste – radioactive** defined according to the relevant international, European and national legislation (EURATOM, IAEA, etc). The legal definition of the different categories of nuclear waste shall be given.

- From nuclear power plant
  - *Spent nuclear fuel* reported as total weight specified in weight units (g) of spent fuel assemblies unloaded from the reactor during the reference period
  - *Uranium in spent nuclear fuel* (expressed as initial uranium content in the fuel assemblies unloaded (g uranium atoms (U)))
- To final repository
  - *High-level radioactive waste* (spent fuel or parts of spent fuel, demolition waste, etc. including any containers, according to legislation and nuclear core components) specified in m<sup>3</sup>
  - *Medium and low-level radioactive waste* (conditioned operational waste, demolition waste, etc., including binding matrix (cement, bitumen or other) and containers, according to legislation) specified in m<sup>3</sup>

### **Hazardous waste - non-radioactive** specified in weight units (g)

- To landfill
- To incineration
- To reuse
- To recycling

### **Other waste** specified in weight units (g)

- To landfill
- To incineration
- To reuse
- To recycling

### ***Upstream and downstream processes***

Waste generated in the up- or downstream processes and where the treatment is not known shall be reported as inventory data in the categories below (reported separately for up- and downstream processes). When LCI-data from databases is used, the waste is followed to the grave in most cases and generated amounts are not recorded. When specific data has been retrieved from a subcontractor however it might be that no information has been given regarding treatment of its wastes.

### ***Hazardous waste – radioactive***

To final repository

- Volume of final repository necessary to deposit radioactive waste emanating from nuclear electricity used in up- and downstream processes
- Low-level radioactive waste without further treatment (such as mining/milling wastes)

### ***Hazardous waste – non-radioactive***

- Depleted uranium, UF<sub>6</sub> (in case of nuclear power)
- Other hazardous waste (treatment unknown)

### ***Other waste – fuel-related***

- Ash
- etc

### ***Other waste – non fuel-related***

- Inert waste (rock, sand etc)
- Other non-hazardous waste (treatment unknown)

## **7.6 Dominance analysis and conclusions**

A description of which activities in the lifecycle are dominant for different emission categories shall be given.

## **7.7 Differences versus previous versions of the EPD**

The main causes for changes in comparison to previous Ecoprofile versions shall be described shortly.

# **8 Additional Environmental information**

## **8.1 Additional environmental information based on LCA**

Under this heading LCA-based information may be provided for example results calculated with other allocation methods than required by the mandatory rules.

## **8.2 Additional environmental information not based on LCA**

Under this heading information that is not part of the LCA but identified as an important environmental aspect of the product or information asked for by customers and other stakeholders, shall be declared. Any literature reference or methodology used to acquire and describe additional environmental information shall be openly accessible and made available to the verifier.

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For the product category UN CPC 17 the following issues shall be addressed.

- **Radiology:** in the case of nuclear power, during normal operation in the reference year/period in the main life cycle stages fuel production, operation of energy conversion plant, and management of fuel residues expressed as dose in mSv.
- **Risk related issues**
  - Radiology and human toxicological risks
  - Environmental risks
    - Mishaps with environmental impact, that happen less frequent than once in three years should be identified and the impacts quantified
    - Potential undesired events with high or very high impact but low or minute probability (e.g. nuclear reactor meltdown, dam bursts, etc) shall be identified and described qualitatively.
- **Electro Magnetic Fields**
  - Description of the producer's measures to keep fields low and some information on limits and recommendations by different bodies.
- **Noise**
- **Land use**
  - Square meters used of specified land category according to Corine Land Cover Classes, level one at a minimum (5 classes) (<http://terrestrial.eionet.europa.eu/CLC2000/classes>)
  - Number of years that the areas are occupied
  - Description of activities on the occupied areas
- **Impacts on biodiversity**
  - Direct regional impacts concerning nature conservation issues like biodiversity and visual impact connected to land use

For the product category UN CPC 17 the following issues should be addressed

- **Radiology**
  - In case of power technologies other than nuclear power, radiology should be addressed qualitatively, at a minimum, where relevant (for example coal extraction).
- **Acidification due to use of forest residues**
  - Should be addressed qualitatively where relevant

For the product category UN CPC 17 the following issues may be addressed

- **Land use**
  - Qualitative description of potential impacts on indigenous people and their traditional activities as hunting, reindeer breeding, etc.
  - Esthetical issues
- **Radiology**

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- Proliferation precautions may be addressed.

## 9 Mandatory statements

The following text is quoted from the General Programme Instructions, section 3, Declaration requirement and format, paragraph 3.5.

The EPD shall include the following information as mandatory, if relevant for the EPD:

- Any omission of life cycle stages not making the EPD cover the full life cycle with a justification of the omission
- Means of obtaining explanatory materials (in the case of B2C communication)

The EPD shall include the following mandatory statements:

- *“EPDs from different programmes may not be comparable”*

The EPD shall also include information about the verification procedure practised inserted in the following box.

<p><b>PCR review, was conducted by:</b></p> <p>&lt; name and organization of the chair, and information on how to contact the chair through the programme operator &gt;</p>
<p><b>Independent verification of the declaration and data, according to ISO 14025:</b></p> <p><input type="checkbox"/> Internal                      <input type="checkbox"/> external</p>
<p><b>(Where appropriate) Third party verifier:</b></p> <p>&lt;name of the third party verifier&gt;</p>

## 10 References

General Programme Instructions for environmental product declarations, EPD, including Supporting annexes, held by The International EPD Consortium (IEC), [www.environdec.com](http://www.environdec.com)

GEDnet guide book, [www.environdec.com](http://www.environdec.com)

ISO 14025

ISO 14020 ff

ISO 14040, 44

ISO 13600 ff

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## Annex 1

### 1 Energywares

The following list of energyware (definition: tradable commodity used mainly to produce mechanical work or heat, or to operate chemical or physical processes) has been taken from Annex A of ISO 13600, Technical energy systems – Basic concepts (1997)

Solid fuels	Comments on the selected energyware
Energy coal	All coal extracted from the ground except metallurgical coal and filter carbon
Energy peat	Energy peat is distinguished from peat used for soil improvement or other purposes.
Commercial fire-wood	Wood chips and pulverised woods are sub-items of commercial firewood used as energywares.
Other biomass	Other biomass is harvested “energy forests”, straw, reeds, dried cow dung, bush and seed pods etc. grown and collected for the purpose of being marketed as fuel.
Fuel briquettes and pellets	Burnable substances of fossil or biological origin, in the form of powder, grains or chips, which are compacted into blocks to produce a fuel which is easy to handle.
Charcoal	Charcoal is the solid residue of the destructive distillation and pyrolysis of wood and is traded old in many countries. Filter charcoal is excluded.
Coke	Coke is a solid fuel obtained from coal by heating in the absence of air.

Table A1a: Solid fuels. Description of different energywares, according to ISO 13600

## Annex 1

Liquid fuels	Comments on the selected energyware
Crude oil	Crude oil, unextracted, is not an energyware. Once extracted it becomes an energyware.
Petroleum products Motor gasoline Aviation gasoline Aviation kerosene Other kerosene's Diesel fuel Heating gas oil Fuel oils 2-5 LPG (Liquefied Petroleum Gas)	Petroleum products can be classified as different types of energyware.  Any of several liquid mixtures of the volatile hydrocarbons butane and propane. LPGs are found in the gaseous state at atmospheric pressure and, and become liquefied at 15 °C under low pressures of 0.17 MPa to 0.75 MPa.
Semi-finished products	Semi- finished products (liquid hydrocarbons) are included in the list whether they are used for the manufacturing of fuels or as petrochemical feedstock.  Petroleum coke is not energyware, even if a substantial amount is used as fuel.
Motor alcohols	Motor alcohols are ethanol and methanol with additives and mixtures of compounds or groups of organic oxygenated compounds (ethers and alcohols) with petroleum fuels.
NGL (Natural Gas Liquids)	Natural gas liquids are those portions of natural gas, which are recovered as liquids in separators, field facilities or gas processing plants.
Fuels obtained from vegetable or animal oils	Vegetable and animal oils are oils extracted from various oleaginous plants and from animals.

Table A1b: Liquid fuels. Description of different energywares, according to ISO 13600

## Annex 1

	Comments on the selected energyware
<b>Gaseous fuels</b>	
Natural gas fuels	
Natural gas	Methane or higher C <sub>n</sub> gas mixtures.
LNG (Liquefied Natural Gas)	Natural gas stored, transported and handled in liquid form at low temperatures.
Converted gaseous fuels	
Coal-derived gas	Manufactured from metallurgical coal.
Furnace gas	
Gasified biomass	
Refinery gas	Separated from natural gas.
Town gas (city gas)	Gas manufactured for public supply.
Biogas (biomass)	Composed principally of a mixture of methane and carbon dioxide produced by anaerobic digestion of biomass; methane separated out of this mixture is called "biomethane". Manure and liquid manure gas, marsh gas, dump gas, etc. are produced and more or less regulated and exploited.
<b>Hydrogen gas</b>	In gaseous or liquid form from fossil or renewable sources.
<b>Fissile material</b>	Uranium, thorium and plutonium.
<b>Grid electricity</b>	Electrical energy is an energyware when it is produced in power plants and distributed over a public or similar network.
<b>Commercial heat, district heat</b>	Hot liquid or steam used in commercial heat distribution systems produced either from other energywares, reclaimable resources including waste heat, or from natural resources such as solar radiation and geothermal heat.

Table A1c: Gaseous Fuels. Description of different energywares, according to ISO 13600

## Annex 2

### 1 Allocation by the “Alternative Generation Method”

This Appendix provides a description of the allocation method for the distribution of the environmental impact associated with the generation of electricity and heat in a combined heat and power plant. The facility parameters to be used for this allocation are also specified.

#### 1.1 Description of the “Alternative Generation Method”

The Finnish District Heating Association originally developed this allocation method as a proposal for a new and uniform reporting method for European combined heat and power plant generation statistics. The method is still being discussed within Euroheat, Eurostat and Eurelectric. At present there is no uniform standard for the selection of facility parameters.

The method is available in different versions, with varying degrees of complexity of the calculation process. The simplest version is used in this application.

The allocation method is based on the fact that benefits gained from improved fuel utilisation as well as the environmental impacts connected to combined heat and power generation, are distributed between the two products – electricity and heat – in the same proportion as the fuel needed for separate electricity and heat generation processes. The relationship of distribution is expressed as percentage of the fuel needed for each alternative process with respect to the total quantity needed.

The principle behind the allocation method is illustrated below:

#### Example.

*Existing combined heat and power generation plant for which the allocation is to be made:*

*Electricity generation, net 30 units*

*Heat generation, net 60 units*

*Alternative generation facilities:*

*Heat generation  $\eta_h = 90\%$  (no flue gas condensation)*

*Electricity generation  $\eta_e = 40\%$*

*Fuel used by alternative electricity generation  $30/0.4 = 75$*

*Fuel used by alternative heat generation  $60/0.9 = 67$*

*Total fuel used by alternative generation 142*

*Allocate to electricity:  $75/142 \Rightarrow 53\%$*

*Allocate to heat:  $67/142 \Rightarrow 47\%$*

The choice of parameters for the alternative generation facilities has a direct impact on how the environmental impact is distributed. Various alternative approaches exist for the selection of facility data for alternative generation. The following principle shall apply to allocations upon which Environmental Product Declarations are to be based:

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## Annex 2

- Facility data for the best possible facility performance
- For the same type of technology and fuel as the facility studied.

In the case of co-combustion of several fuels in a facility, it is up to the author of the Life Cycle Assessment to select facility data and to provide justification for the allocation calculations.

### 1.2 Basis for Allocation – Facility Parameters for Alternative Facilities

The table below shows the facility parameters to be used in allocation for a number of different combined heat and power generation methods. The efficiency numbers are based on the lower heating value (net calorific value) of the fuels.

Combined heat and power		Alternative heat	Alternative electricity
Fuel type	Technology	Efficiency, heat $\eta_h$ (%)	Efficiency, electricity $\eta_e$ (%)
Biofuel	Steam cycle, heat and power	90 %	38 %
	Steam cycle, heat and power, flue gas condensation	110 %	38 %
Waste	Steam cycle, heat and power,	90 %	35 %
	Steam cycle, heat and power, flue gas condensation	100 %	35 %
Black coal	Steam cycle, heat and power	90 %	46 %
Natural gas	Steam cycle, heat and power	90 %	47 %
	Steam cycle, heat and power flue gas condensation	105 %	47 %
	Combined cycle, heat and power	90 %	58 %
Oil	Steam cycle, heat and power	90 %	46 %
Oil shale	Steam cycle, heat and power	86 %	38.9 %

Table A2: Facility parameters to be used in allocation for a number of different combined heat and power generation methods