

Product-Category Rules (PCR)  
for Preparing an Environmental Product  
Declaration (EPD) for  
Fluorescent Lamps for General Lighting Service  
PCR 2015:1.0

CHINA ELECTRIC CO., LTD.

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This document complies with the relevant requirements of the International EPD® SYSTEM, as well as the management requirements of the Environment and Development Foundation ([www.edf.org.tw](http://www.edf.org.tw))

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## 1. General Information

This document is to be used as the product category rules (PCR) for the manufacturing of fluorescent lamps for general lighting service (“product”) globally. This PCR covers products with the following Harmonized System (HS) Code: *8539.31 (fluorescent, hot cathode discharge lamps, other than ultraviolet lamps)*. The requirements specified in this PCR are intended to be used for EPDs certified in accordance with the ISO 14025 standard. This document shall be valid until November 30, 2017.

This PCR was first drafted by the CHINA ELECTRIC CO., LTD. Representatives from major Taiwanese manufacturers of similar products and stakeholders were invited by the Taiwan Lighting Fixture Export Association to the open consultation meeting held on August 20, 2015, to participate in the discussion and review of this PCR. The Environment and Development Foundation (EDF) subsequently reviewed and approved this PCR.

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## 2. Company and product description

The EPD shall include information about the manufacturing company/organization. The information may include manufacturing process related information, and environmental related information, such as the environmental management system information. The information may also include special issues which the company/organization would like to emphasize, such as the products meeting certain environmental criteria, or environmental safety and health related information.

This PCR covers the whole life stages of the product, and is applicable to both Business-to-Business (B2B) and Business-to-Consumer/Customer (B2C) communications. During the inventory of product related environmental impacts, the scope of inventory shall cover both the raw materials and packaging materials.

### 2.1 Product group function

The fluorescent lamp for general lighting service (“product”) is a low pressure mercury-vapor gas-discharge lamp. Most of the light produced by the lamp are visible light when electric current in the gas excites mercury vapor which produces short-wave ultraviolet light that causes one or multiple phosphor coatings on the inside of the lamp tube/bulb to glow. The products refer to in this PCR are used in lighting fixtures, such as fixed lighting fixtures, embedded/recessed lighting fixtures, luminaries and street lamps; but exclude special lighting equipment such as flashlights, or emergency lights.

### 2.2 Product components/compositions

The product’s main components/materials include but not limited to the:

- Glass tube
- Flare tube
- Exhaust tube
- Phosphor powder
- Lead wire
- Filament
- Lamp cap
- Lamp cap cement
- Mercury
- Inert gas
- Packaging materials: e.g., cardboard, paper sleeve, boxes, cartons, etc.

Auxiliary components/materials include, but not limited to:

- surfactant
- adhesive (e.g., Polyox)
- dispersant (e.g. acrylic polymer)

### **2.3 Product technical description**

The product technical description part of the EPD may include but not limited to the following information:

- Rated power (unit: W)
- Rated current (unit: mA)
- Rated voltage (unit: V)
- Luminaire luminous flux (unit: lm)
- Luminaire Efficacy (unit: lm/W)
- Light source color (e.g., Daylight, Daylight White, Cool White, White, Warm White)
- General color rendering index (unit: Ra)

### **3. List of materials and chemical substances**

The contents of the following materials and substances in the product shall be declared:

- All materials of the product (excluding packaging material) with weight ratio (material weight/product weight (excluding packaging))  $\geq 1\%$ ;
- All materials of the packaging with weight ratio (material weight/packaging weight)  $\geq 1\%$ ;
- All substances/materials in the product restricted/regulated by legal and customer requirements; for example, flame retardants, lead-free solders, and lead and flame retardant content in flux, or restricted substances regulated by EU RoHS Directive.

The declaration of halogen-free flame retardants, lead-free solders and no RoHS-regulated substances may only be made when appropriate evidences are available (for example, test reports from accredited laboratories/testing facilities). The following organizations may provide accreditation for testing facilities: Taiwan Accreditation Foundation (TAF), (Asia Pacific Laboratory

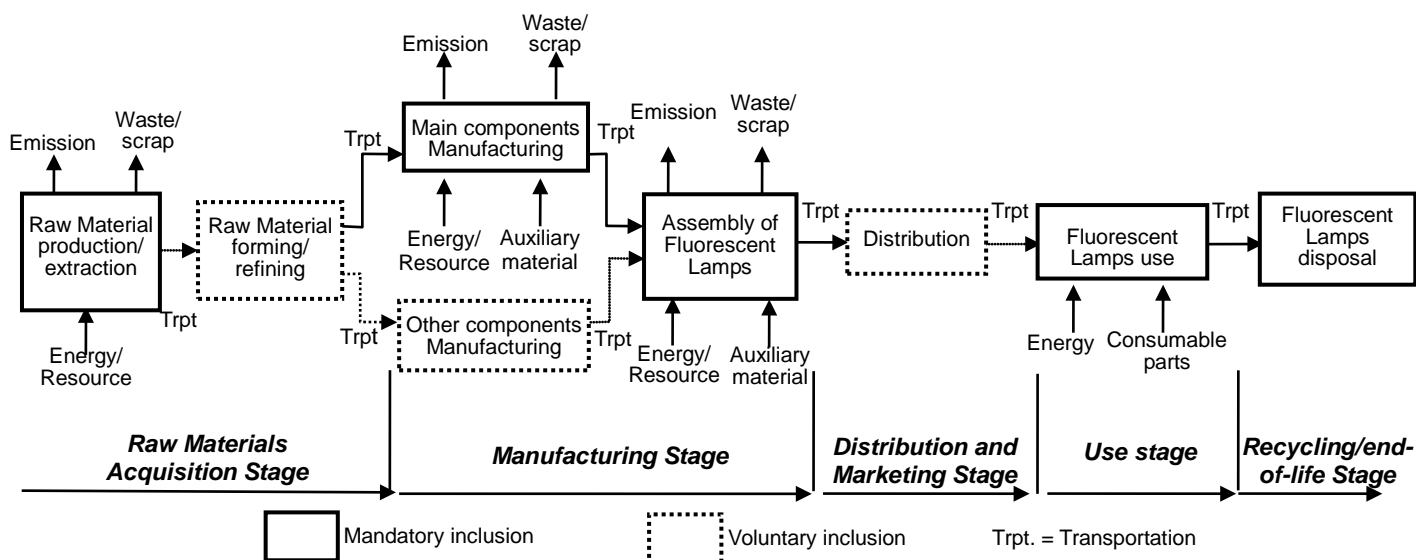
Accreditation Cooperation (APLAC), International Laboratory Accreditation Cooperation (ILAC) or ILAC Mutual Recognition Arrangement (ILAC MRA). For definitions of testing methodology and confirmations of regulated hazardous substances based on the accredited laboratories' product testing methods, please refer to IEC 62321 Standard.

#### 4. Declared unit

The declared unit is one (1) piece of fluorescent lamp for general lighting service, with the indication of rated power, light source color, color rendering index, and luminaire efficacy. The reason for adopting this unit is that the product is sold and marketed in this unit.

#### 5. System boundaries

The main system boundaries for the declared product system are presented as follows:



**Figure 1 System boundary of the product system**

As noted in Figure 1 above, the life cycle of a fluorescent lamp for general lighting service covers five life cycle stages: raw material acquisition, product manufacturing, distribution and marketing, product use and recycling/end-of-life. The system boundaries for the various life cycle stages are described as follows:

##### Raw Materials Acquisition Stage

The LCA shall include information for the following unit processes:

- Raw material extraction/production and manufacturing of main components and other components;
- Production/generation of energy used for raw material manufacturing.

The inclusion in the LCA the information on the forming and refining of raw materials and

transportation of raw materials are optional (voluntary).

### **Manufacturing Stage**

The LCA shall include information for the following unit processes:

- Manufacturing of main components and the generation of process waste;
- Assembly of product and generation of process waste;
- Transportation of main components/materials to the product assembly plant;
- Transportation of process waste from main component manufacturing and product assembly to the waste treatment facilities.

The inclusion in the LCA the information on the input/output of packaging material during main components manufacturing process and the manufacturing of minor/secondary components/parts is optional (voluntary).

The data quality requirements for the main components are described in Section 9 on calculation rules and data quality requirements. Data related to the minor/secondary components shall also be included in the EPD, but their data quality requirements are different from those of the main components.

### **Distribution and Marketing Stage**

The LCA shall include information for the following unit processes:

- Transportation of products to the distribution sites or customer designated locations.

Inventory and reporting of distributors' operations and transportation from sales/distribution sites to users is optional (voluntary).

### **Use Stage**

The electricity consumption of the product during the use stage can be calculated based on the lamp's power consumption (W) specified in the product specification and time used (hr), using the following equation:

$$\text{Total electricity consumption (kWh)} = \text{Power consumption as stated in the specification (W)} \times \text{product life (hr)} \div 1000$$

As the fluorescent lamp's specifications may report different times used, it is recommended for product manufacturers to declare the life of the product. However, power consumption calculation of this stage does not include power consumption of the accessories, such as the ballast's power consumption.

### **Recycling/end-of-life Stage**

- Reporting of recycling information (such as recycling and dis-assembly report or information on recycling channels) is mandatory in the EPD; the environmental impact shall be calculated

- based on the declared recycling rate;
- Inventory and reporting of transportation of end-of-life products to recycler or waste management sites is mandatory;
- If there are potential recycling benefits associated with the recycler's recycling technologies or recycling approach, information related to such benefits shall be provided in the EPD.

## **5.1 Specification of different boundary settings**

### **Boundary in time**

The validity period for the LCA results presented in the LCA report shall be defined.

### **Boundary towards nature**

If the manufacturing processes are located within Taiwan, the solid waste categories as defined in Taiwan's Waste Disposal Act shall be adopted. If the processes are located in other countries, equivalent legal requirements shall be considered.

The natural boundary of the system shall describe the boundary where the materials and energy resources flow from nature into the system, and where the water and air emissions and waste are released out of the system.

Only the quantity of the disposed waste needs to be considered; landfilling process does not need to be considered. If the waste is generated through wastewater treatment or incineration process, such waste should be included into the wastewater treatment or incineration process.

### **Boundaries in the life cycle**

The boundaries in the product life cycle are described in Figure 1. The construction of the site and infrastructure, as well as the production of manufacturing equipment and activities of site operators do not need to be included.

### **Boundaries towards other technical systems**

Boundaries towards other technical systems describe the inputs of material and other components towards other systems, as well as outputs of materials towards other systems. For the inputs of recycled materials and energy towards the product manufacturing stage, the transportation between the recycling process and use of recycled materials shall be included in the data set. For the production of recyclable products during the manufacturing stage, the transportation towards the recycling process shall be included.

*(Note: Further explanations are provided in Section 7 on open-loop recycling.)*

### **Boundaries regarding geographical coverage**

The manufacturing stage may cover manufacturing processes located on any sites around the world. For processes located in a specific region, the data used should be representative of the region. The data for the main constituents shall be the specific regional data for the region where the process takes place (see Section 9). For ease of comparison, no matter where the emissions are generated,

the same environmental impact parameters should be used for life cycle impact assessment (see Section 10).

## 6. Cut-off rules

For any impact category, if the sum of various impacts from a specific process/activity is less than 1% of the impact equivalent in that category, such a process/activity may be neglected during the inventory analysis. Nonetheless, the accumulated impact of neglected process/activity may not exceed 5%. That is, at least 95% of the potential life cycle emissions shall be evaluated.

Components and materials omitted from the LCA shall be documented.

(Note: This judgment for this “1% Rule” is based on the environment relevance assessment of material input to the system, and does not consider special and exceptional environmental impacts.)

## 7. Allocation rules

The main allocation rules shall be valid for the entire product system. For other secondary processes, other allocation rules may be defined; however, the use of these rules should be justified. Product-specific information should be preferentially collected in order to avoid the need for allocation. While selecting allocation rules, the following principles are recommended.

- **Multi-output:** The allocations are based on the changes in the resource consumption and pollutant emissions (for example, adopted quantity allocation for some main component, or surface allocation for some components), following the changes in the studied system’s output product or function or economical relationship.
- **Multi-input:** The allocation is based on actual relationship. For example, the manufacturing process’s emissions may be affected by the change in waste flow input.
- **Open loop recycling:** For the input of recycled materials or energy during the manufacturing stage of the product system, the transportation between the recycling process and the recycling to material use shall be included in the dataset. For the product which shall be recycled during the manufacturing stage, the transportation towards the recycling process shall be included.

*(Notes: - Allocation may be avoided through avoidance of dividing processes, for example as described in Section 6.3 of ISO/TR 14049; or through expansion of system boundary (for example as described in Section 6.4), so that the amended system shares the same product exchanges as the original system.)*

## 8. Units

The base units and derived units of the International System of Units (SI, *Système International d'unités*) shall be used preferentially.

Power & energy units:

- power unit: W



- energy unit: J

Specification units:

- length unit: m

- capacity unit: m<sup>3</sup>

- area unit: m<sup>2</sup>

- weight unit: kg

If necessary, prefixes may be used before the SI units:

10<sup>9</sup> = giga, symbol "G"

10<sup>6</sup> = mega, symbol "M"

10<sup>3</sup> = kilo, symbol "k"

10<sup>-2</sup> = centi, symbol "c"

10<sup>-3</sup> = milli, symbol "m"

10<sup>-6</sup> = micro, symbol "μ"

10<sup>-9</sup> = nano, symbol "n"

## 9. Calculation rules and data quality requirements

### Data quality requirements for the raw material acquisition

- Generic data may be used for the extraction, production, forming and refining of raw materials used for components of the products. Please refer to Appendix I for the common sources of generic data. The year of the data cannot be older than 1990.

### Data quality requirements for the manufacturing stage

- Site specific data (for example, specific data for manufacturing plant or transportation) shall be used for the manufacturing and assembly of major components and product. If other types of information are used, description of the information and rationale for using the information shall be provided. For site specific data of main component manufacturing plants, specific data from a plant representative of such a site may be used.
- Generic data may be used for the manufacturing of other components for the products, and based the calculation on actual consumption. Please refer to Appendix I for the common sources of generic data.
- When generic data are used, the equivalence between the chemical and/or physical process or

at least the same technical range of referred systems shall be considered. Moreover, it is also recommended to consider the date or geographic aspects of the data quality when feasible.

- Generic data may also be used when suppliers refuse to provide specific data, or when even if generic data are used in place of specific data, there is only minor impact to the results. The general rule is that if generic data are used in place of specific data, their combined contribution for all life cycle stages shall not be greater than 20% of total impacts for each impact category. However, there may be certain exception to specific products, and such exceptions shall be explained.
- The data shall be representative for the average of a specific year. If the average data for a specific year cannot be obtained, average data for a specific time period may be used. However, the selected specific time period should be representative, and the reason for using such data shall be provided.
- The electricity mix for the manufacturing stage should be site specific data. If site specific data cannot be obtained, the official electricity mix for the country where the site is located may be used as approximate value. The electricity mix should be documented.
- For the definition of hazardous waste, the definition as defined in Taiwan's Waste Disposal Act shall be used for sites located in Taiwan. For sites located outside Taiwan, legal requirements for the host country shall be observed.
- For the transportation of main components/materials to the manufacturing plant, the actual transportation modes used and distance traveled shall be considered.

#### **Data quality requirements for the distribution and marketing stage**

- For transportation of products to the downstream distributors, the actual mode of transportation and distance traveled shall be considered.

#### **Date quality requirements for the use stage**

- The energy consumption during the product use stage scenario shall be included.
- The energy consumption of the product shall be determined based on testing methodology stipulated in applicable international, national or industrial standards of the countries or regions the product is marketed.
- For the electricity mix for the use stage, the official electricity mix for the country where the product is exported may be used as approximate value or generic data. Please refer to Appendix I for the common sources of generic data. The year of the data cannot be older than 1990.

#### **Date quality requirements for the recycling/end-of-life stage**

- For transportation of end-of-life product as post-consumer waste for delivery to processors or recyclers, the data from national or industry sources or consumer behavior surveys can be used. When such data cannot be obtained, evaluation based on assumed scenario can be made, and the assumptions for such a scenario shall be reported in the EPD.
- Generic data may be used during the recycling/end-of-life stage, if for specific reason the site specific data for the recycling/waste disposal system cannot be obtained. Then generic data and recycling rate may be used to calculate environmental impact. Please refer to Appendix I for the common sources of generic data.

## 10. Parameters to be declared in the EPD

The following parameters shall be declared in the EPD:

### Resource use

- non-renewable resources
  - materials resources
  - energy resources (used for energy conversion purposes)
- renewable resources
  - material resources
  - energy resources (used for energy conversion purposes)
- secondary resources
  - material resources (pre-consumer or post-consumer recycling and reuse)
  - energy resources (used for energy conversion purposes)
- recovered energy flows (such as thermal energy) expressed in MJ
- water use divided into:
  - total amount of water (consider make-up water for in-plant recycling and reuse)
  - direct amount of water used by the core process

The following requirements on the resource declaration also apply:

- all parameters for resource consumption shall be expressed in mass, with the exception of renewable energy; resources used for the generation of hydroelectric, wind electricity and solar energy, which shall be expressed in MJ;
- all parameters shall not be aggregated but reported separately. Resources which contribute for less than 5% in each category shall be included in the resources list as “other”;
- nuclear power shall be reported among the non-renewable energy resources as kg of uranium calculated by converting the thermal energy (MJ) considering a reactor of III generation with an efficiency of 33%;
- the PCR can define other resources (for example rare materials originating from the LCI data) which may be listed and detailed in the EPD for each specific product category;
- the energy content into some products (such as paper or plastic based products) is useful information for the end of life management. For this reason, the “energy content of product” shall be declared in MJ: its estimation shall be made considering the gross calorific value of the product. Only the energy that is suitable for an eventual energy recovery at the end of life shall be considered (energy content of steel due to its carbon content for example shall not be considered since it is not practically recoverable);
- energy content of biomass used for feed or food purposes shall not be considered.

## **Impact equivalents expressed as potential environmental impacts**

The potential environmental impacts associated with the various types of use of resources and pollutant emissions shall be reported into the following impact categories:

- Emission of greenhouse gases (expressed as the sum of global warming potential, GWP, 100 years, in CO<sub>2</sub> equivalents).
- Emission of acidifying gases (expressed as the sum of acidifying potential in sulphur dioxide (SO<sub>2</sub>) equivalents).
- Emission of gases that contribute to the creation of ground-level ozone (expressed as the sum of ozone-creating potential, ethene-equivalents).
- Emission of substances to water contributing to oxygen depletion (expressed as phosphate (PO<sub>4</sub><sup>3-</sup>) equivalents).

## **Impact categories for optional declaration**

- Emission of ozone-depleting gases (expressed as the sum of ozone-depleting potential in mass of CFC 11-equivalents, 20 years).

## **Waste**

- hazardous waste (as defined in Taiwan's Waste Disposal Act, or follow host countries' laws for sites outside Taiwan).
- non-hazardous waste

Note: For characterization factors of each impact category, please refer to *General Programme Instructions For The International EPD System, Version 2.01 (2013-09-18)*.

## **11. Recycling information**

In order to ensure the completeness of the LCA, inclusion of recycling information for B2C product shall be mandatory. The recycling information shall include information such as dis-assembly instructions, which parts/components are suitable for recycling (such as metal cases) or not suitable for recycling. The information which the EU WEEE Directive requires the end product manufacturer to provide may also be included in the declaration information for products.

If practical, information for the parts which cannot be recycled and therefore should be disposed of properly during the end-of-life stage may also be included.

## **12. Other environmental information (Optional)**

The EPD may cover information including technology adopted, site of product manufacturing and assembly, as well as information on other working environment, health and risk-related aspects.

If this PCR is to be used for product carbon footprint declaration purpose, in the declaration, information regarding commitment on GHG reduction should be included and shall ensure that the commitment is measurable, reportable and verifiable. The organization may also list environmental

and energy management related information, such as awards, commendations and system certifications (e.g., ISO 14001, ISO 14064-1, IECQ HSPM) etc.



## 14. References

The EPD shall refer to the following documents:

- GENERAL PROGRAMME INSTRUCTIONS FOR THE INTERNATIONAL EPD® SYSTEM, Version 2.01 (2013-09-18), downloadable from:  
[http://www.environdec.com/Documents/GPI/General\\_programme\\_instructions\\_2\\_01\\_20130918.pdf](http://www.environdec.com/Documents/GPI/General_programme_instructions_2_01_20130918.pdf)
- Relevant PCR documents
- The underlying LCA report

When available, the following documents shall also be referenced:

- Other documents and recycling instructions that verify and complement the EPD.

## Appendix I – Generic Data Sources to Refer to

For processes located within Taiwan, Taiwan generic data or the data published by the commercial, industrial and energy competent authorities of the Republic of China (ROC) government, may be used. However, for other regions (such as EU), if there are more relevant generic data available, these data should be used instead. Most recent data from the following generic databases are recommended for use.

Material	Database	Published
Industrial processes	ecoinvent 3.1	2014
Packing materials, transport, Waste treatments	BUWAL 250, 2 <sup>nd</sup> edition	2004
Steel, Primary copper, Copper products, Electricity, Fuels, Aluminum, Chemicals, Transports, Waste management	ecoinvent 3.1	2014
	LCA Database for Taiwan : DoITPro	2008-2014
	PE-GaBi 14	2014
	ELCD version 3.2	1995-2014
	The Boustead Model 5.0	2013
	EIME (Environmental Information and Management Explorer) EcoBilan	1999-2014
Plastics	PE Plastics Europe (Association of Plastics Manufacturers in Europe)	1993-1998
	PE-GaBi 14	2014
	ELCD version 3.2	1995-2014
	ecoinvent 3.1	2014
	The Boustead Model 5.0	2013
	EIME (Environmental Information and Management Explorer) EcoBilan	1999-2014
Electronic components	LCA Database for Taiwan : DoITPro	2008-2014
	PE-GaBi 14	2014
	ELCD version 3.2	1995-2014
	ecoinvent 3.1	2014
	The Boustead Model 5.0	2013
	EIME (Environmental Information and Management Explorer) EcoBilan	1999-2014
LCA Database in Taiwan	Carbon factor database from EPA, ROC.	2013
	DoITPro	2014



## **Appendix II – Reporting Format for the EPD**

This appendix provides guidance information for the titles of sections, types of data and required information to be reported in the mandatory reporting part of the EPD. As a generic reporting template, the following titles and sub-titles are recommended:

*(Refer to the PCR manual for the section numbering, the information in Italics are the recommended data/information for inclusion)*

### **Introductory part**

Each EPD should have an introduction part on the top part of the EPD which includes the following information:

- *Company/organization name*
- *Product name*
- *EPD registration number*

### **Description of the company/organization and product/service**

#### ***Company/Organization***

- *Description of company/organization*
- *Description of overall working environment, existing quality system and environmental management system*

#### ***Product and services (see Section 2)***

- *Product's main applications*
- *Description of product specification, manufacturing process, manufacturing sites (if there are several sites)*
- *For product's environmental performance aspects, characteristics which may improve the usefulness of product*
- *Other types of relevant information, for example, special manufacturing processes with special advantages to the environment*

### **List of materials and chemical substances**

- *Content declaration (see Section 3)*

### **Presentation of the environmental performance**

- *Outline of the LCA methodology, for example, period of LCA, declared units, system boundaries (graphical presentation), cut-off and allocation rules, and data sources.*

#### ***Manufacturing stage (see Section 10)***

***Use stage*** (see Section 10)

- *Geographical region for product delivery*
- *Transportation data*
- *Product end-of-life information*

**Information about Company and Certification Organization**

***Recycling information*** (see Section 11)

***Other environmental information*** (see Section 12)

***Information regarding certification*** (see Section 13)

- *Names of certification and verification organizations*
- *Validity of certification certificates*
- *Compliance with legal and relevant requirements*

***References*** (see Section 14)

- *relevant PCR documents*
- *General Programme Instructions for the International EPD® System, Version 2.01 (2013-09-18)*
- *underlying LCA study*
- *other supporting documents for LCA information*
- *other relevant documents regarding company/organization's environmental activities*

### Appendix III Abbreviations

Acronym	Common Name
APLAC	Asia Laboratory Accreditation Cooperation
CFP	Carbon Footprint of Product
EPD	Environmental Product Declaration
ErP	Energy Related Product
ILAC	International Laboratory Accreditation Cooperation
ILAC MAR	International Laboratory Accreditation Cooperation Mutual Recognition Arrangement
ISO	International Organization for Standardization
LCA	Life Cycle Assessment
PCR	Product Category Rule
RoHS	The Restriction of the use of certain Hazardous Substances in electrical and electronic equipment
SPI	Society of the Plastics Industry
TAF	Taiwan Accreditation Foundation
TEC	Typical Energy Consumption
Trpt	Transportation
WEEE	The Waste Electrical and Electronic Equipment Directive