

Product-Category Rules (PCR)
for preparing an environmental product
declaration (EPD) for
e-Reader

PCR 2010:1.0

Quanta Computer Inc.

Version 1.0

2010-10-11

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1. General Information

This document is to be used as the product category rules (PCR) for e-reader produced globally. The requirements specified in this PCR are intended to be used for EPDs certified in accordance with ISO 14025 standard. This document shall be valid until October, 2012.

This PCR was prepared by the Quanta Computer Inc. Representatives from major Taiwanese manufacturers of similar products and stakeholders were invited to the open consultation meeting on July 27, 2010, to participate in the discussion and review of this PCR. EDF then reviewed and approved this PCR.

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2. Company and product description

The EPD/CFP 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 e-readers and their packaging. This PCR is only applicable to communications between businesses and customers (B2C).

2.1 Product function

The Electronic Reader (e-Reader), or called electronic book device, is a portable and quick start-up/shut-down electronic device, whose main function is to serve as a reading device for electronic books, documents, newspapers and magazines, as well as providing supplementary functions such as web-browsing, web-searching, and music player.

2.2 Product components

The basic components of the e-reader include:

- CPU
- System memory
- Motherboard
- Display device
- Chassis parts
- Battery
- Network module
- Input /Output Interface
- Packaging
- Other components: include stylus (touch screen pen), keyboard, cable & wire, external power supply, instruction/user manual, others

2.3 Product technical description

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

1. Product weight & dimensions;
2. Display device: Type (TFT-LCD, e-paper or other display technology), size of display, screen resolution;
3. Memory size;
4. Storage capacity;
5. I/O interface;
6. File formats supported;
7. Battery capacity;
8. Product design service life;
9. Others, such as external power supply (type & specification) & other information.

3. List of parts and banned substances

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

- List parts with accumulated weight ratio (part weight/product weight) $\geq 95\%$;
- All banned substances regulated by legal, customer and environmental requirements;
- The following materials in the main components: flame retardants, lead content in solder, lead and flame retardant content in solder masking agent, and substances regulated by RoHS Directive (the latest version).

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 defined as one unit of e-reader, as the e-readers are marketed and sold in such a unit.

5. System boundaries

The main system boundaries of the product system are presented as follows:

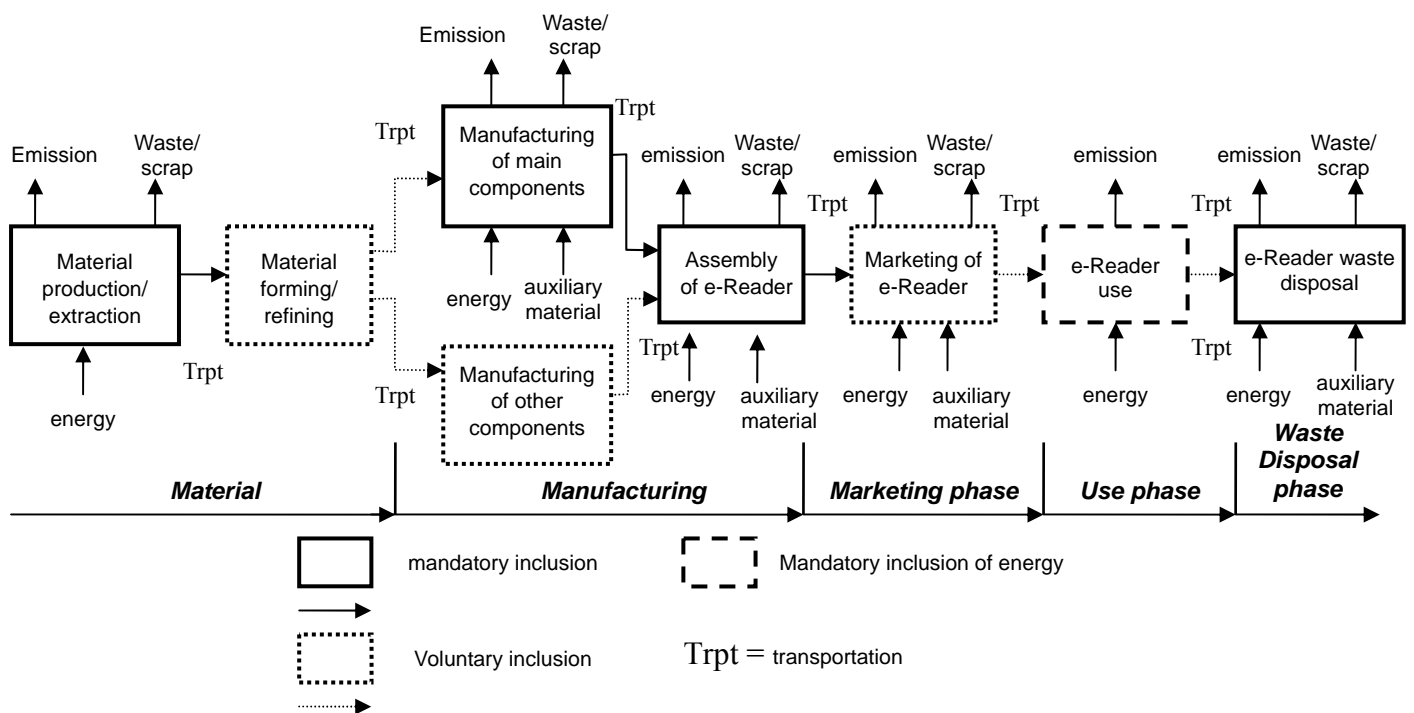


Figure 1 System boundary of the main product system

Note:

1. The classification of main components/assemblies and minor components:
 - a. Main components include: CPU, system memory, motherboard, display device,

chassis parts, battery, cable & wire. If the product is equipped with an external power supply, it should also be included.

b. Other smaller/minor components include: network module, input/output interface, packaging & others.

2. Distribution and marketing phase include:

a. Distribution transportation: The transportation from final assembly plant to customer designated venues, warehouses or retailers, shall be subject to mandatory inclusion.

b. Marketing transportation: The transportation from the ending point of distribution transportation to the site of end-user shall be subject to voluntary disclosure.

3. The declaration of system boundary for the CFP shall be made in accordance with principles as stated in ISO 14025.

The data quality requirements for the main components are described in Section 9 on calculation rules and data quality requirements. The EPD/CFP shall also include the other minor/smaller components of the e-readers, but their data quality requirements are different from those of the main components.

The lifecycle of the e-reader includes the raw material acquisition and the product manufacturing, marketing, use, recycling and waste disposal phases. Inclusion in the LCA the information on the material forming and refining, and manufacturing of smaller parts, product marketing, waste disposal and recycling, is of the voluntary reporting nature (see Section 11).

Raw materials acquisition and manufacturing phase

The LCA shall include information for the following unit processes:

- Material extraction and manufacturing of main components and other components;
- Manufacturing of main components;
- Product assembly;
- Transportation of main components to product assembly plant.

The inclusion in the LCA the information on the material forming and refining and

manufacturing of smaller parts is of the voluntary reporting nature. When voluntarily reported information is included, they shall be explained in the EPD/CFP.

Use Phase

If the products are used by end-users, the power consumption during On Mode and Off Mode shall be provided; if the product is equipped with a main switch, the power consumption during the switch-off mode shall meet relevant international requirements. If feasible, information on the energy consumption scenario, estimated standby time and number of page-turn shall be provided.

While evaluating and calculating product energy consumption, for e-reader with built-in battery, the following scenario may serve as the basis for calculation:

1. Assume the usage scenario and usable time after the product battery is fully charged. Since each product's segment, characteristics and user group may be different, the assumption and conditions for usage scenario shall be clearly disclosed. The following three product types and characteristics may be used in assuming usage scenario:
 - a Intermittent energy consumption type (e.g., display device using electro-phoretic display technology): Declare the total number of page-turn and document format after the battery is fully charged. Estimate the Day-of-Use (U) under the product's segment, characteristic and condition.
 - b Continuous energy consumption type (e.g., display device using TFT-LCD technology): Declare the total number of standby day after the battery is fully charged. Estimate the Day-of-Use (U) under the product's segment, characteristic and condition.
 - c Other type: Estimate the Day-of-Use (U) under the product's segment, characteristic and condition.
2. Estimate the annual number of battery charging (T) under the assumed usage scenario: $365 \text{ days} / (\text{Day-of-Use (U) under assumed scenario})$ (day/charging once)
3. Energy consumption during each battery charging cycle (Wh): The power required to charge a battery from fully discharged to fully charged.
4. Product's design service life (year).
5. Calculation of total energy consumption during the product use phase:

Total energy consumption during the product use phase (Wh) =
Energy consumption during each battery charging cycle (Wh) × number of
charging per year (T) × product design service life (years)

Note: For details of the calculation, please refer to Appendix IV Example of Product Energy Consumption.

Recycling/end of life

The reporting of recycling information (such as recycling and dis-assembly report and information on recycling channels) is mandatory in the EPD/CFP.

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 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 waste which is required to be disposed of needs to be considered; landfilling process does not need to be included. If the waste will be treated through water treatment or incineration, these processes need to be included.

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 the workers, 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 phase, 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 phase, 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 phase 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 components 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 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. Constituents 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 phase 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 phase, 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.

The following units shall be used:

Power & energy units:

- power unit: W
- energy unit: J

Specification units:

- length unit: m
- capacity unit: m³
- area unit: m²
- weight unit: kg

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

10⁹ = giga, symbol "G"

10⁶ = mega, symbol "M"

10³ = kilo, symbol "k"

10^{-2} = centi, symbol “c”

10^{-3} = milli, symbol “m”

10^{-6} = micro, symbol “ μ ”

10^{-9} = nano, symbol “n”

9. Calculation rules and data quality requirements

Date quality requirements for the raw material acquisition phase:

- Generic data may be used for the acquisition, production, forming and refining of raw materials used for the e-readers. Please refer to Appendix I for the common sources of generic data. The date of the generic data used can not be older than 1990.

Date quality requirements for the manufacturing phase:

- Site specific data (for example, specific factory data or transportation data for a specific manufacturing process) shall be used for the manufacturing of main components and assembly of e-readers. If other types of information are used, description of the information and rationale for using the information shall be provided.
- Generic data may be used in the manufacturing process for the minor (not main) components of the e-readers. . Please refer to Appendix I for the common sources of generic data.
- When suppliers refuse to provide specific data, the general rule is that if generic data are used in place of specific data, their combined contribution for all life cycle phases shall not be greater than 20% of total impacts for each impact category. However, for some specific products, there may be exception.
- The data shall be representative for the average of a specific year. If the average date for less than one full year cycle is used, description of the data and rationale for using such data shall be provided.
- The electricity mix for the manufacturing phase 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 should 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/assemblies to the assembly plant, the actual transportation modes and distances traveled shall be considered.

10. Parameters to be declared in the EPD

For the manufacturing phase, the following parameters shall be declared:

Energy Use MJ

Resource Use

Use of non-renewable resources:

- without energy content
- with energy content

Use of renewable resources:

- without energy content
- with energy content

Impact equivalents expressed as potential environmental impacts

-Global warming	kg CO ₂ equivalent
-Acidification	kg SO ₂ equivalent
-Ozone depletion	kg CFC-11 equivalent
-Photochemical oxidant formation	kg C ₂ H ₄ equivalent
-Eutrophication	kg PO ₄ ³⁻ equivalent

(Note: For characterization factors of each impact category, please refer to *EPD Supporting Annexes*, Version 1.0 (2008-02-29), The International EPD Cooperation, downloadable from <http://www.gednet.org/>)

Use Phase

If the products are used by end-users, the power consumption during On Mode and Off Mode shall be provided.

If the product is equipped with a main switch, the power consumption during switch-off mode shall meet relevant international requirements.

The following power and energy units shall be preferentially used: power units, kW or W; energy unit, kWh.

Additional information

Recyclable materials (optional)

Information on secondary materials (optional)

Waste (classification):

- Hazardous waste as defined in Taiwan's Waste Disposal Act. Follow host countries' laws for sites outside Taiwan.

- Other waste.

- Plastic parts marking

Where technologically possible, the plastic parts of the e-reader weighing \geq 25g shall be marked in accordance with the ISO 11469 and ISO 1043 Part 1/2/3/4, SPI or other international standard label to facilitate their identification and recovery at the end of life.

- Plastic packaging materials marking

The Plastic packaging materials must be labeled on the parts with SPI or other international standards for ease of sorting.

11. Recycling information

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. For example, the information requirements for the final product manufacturers contained in the WEEE Directive may also be included in the e-reader's EPD.

When practical, information for the parts which can not be recycled and therefore should be disposed of properly during the end-of-life phase may also be included.

In addition, the manufacturer may voluntarily evaluate and disclose the information regarding the environmental impacts and energy/resource consumption, during the product waste disposal phase and the material recycling and manufacturing phase.

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 shall be included,

and the commitment shall be ensured to be measurable, reportable and verifiable. In addition, the awards, commendations or certifications (such as QC08000 IECQ HSPM) in the environmental or energy conservation areas may also be reported.

13. Information about the certification

The information on PCR review, EPD verification and verification organization shall be included.

EPD Certification is valid until 2010-__-__

According to the Requirements for the international EPD system. General Programme Instructions, Version 1 (2008) – www.environdec.com

The PCR review for _____ (PCR 2010:) was administered by the Environment and Development Foundation and carried out by an LCA expert panel chaired by Dr. Ning Yu (ningyu@edf.org.tw)
Independent verification of the declaration, according to ISO 14025:2006

Internal External

Third party verifier : Environment and Development Foundation in Taiwan.

Accredited by :

Name:

Title:

Organization:

Signature:_____

Name:

Title:

Organization:

Signature:_____

Name:

Title:

Organization:

Signature:_____

Environmental declarations from different programmes may not be comparable.

14. References

The EPD shall make reference to the following documents:

- EPD General Program Instructions, Version 1.0 (2008-02-29), The International EPD Cooperation, downloadable from <http://www.gednet.org/>;
- Relevant PCR documents;
- The underlying LCA report.

When available, the following documents shall also be referenced:

- Other documents and recycling instructions which 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.

When data from the following generic databases are used, the most current and updated data should be used:

Material	Database	Published
Steel, Primary copper, Copper products, Electricity, Fuels, Aluminum, Chemicals, Transports, Waste management,	PE-GaBi	2006
	ELCD version 2.0	2009
	Ecoinvent 2 nd edition	2007
	The Boustead Model 5.0	2007
	EIME (Environmental Information and Management Explorer) EcoBilan	1998-2000
	DoitPro, Industrial Technology Research Institute (ITRI), Taiwan	1996
Plastics	PE Plastics Europe (Association of Plastics Manufacturers in Europe)	1993-1998
	PE-GaBi	2006
	ELCD	2009
	Ecoinvent 2 nd edition	2007
	The Boustead Model 5.0	2007
	EIME (Environmental Information and Management Explorer) EcoBilan	1998-2000
	DoITPro, Industrial Technology Research Institute (ITRI), Taiwan	1996

Material	Database	Published
Electronic components	PE-GaBi	2006
	ELCD	2009
	Ecoinvent 2 nd edition	2007
	The Boustead Model 5.0	2007
	EIME (Environmental Information and Management Explorer) EcoBilan	1998-2000
	DoITPro, Industrial Technology Research Institute (ITRI), Taiwan	1996

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, functional units, system boundaries (graphical presentation), cut-off and allocation rules, and data sources.*

Manufacturing phase (see Section 10)

Use phase (see Section 10)

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

Information about Company and Certification Organization

Recycling information (see Section 11)

Other environmental information (see Section 12)

Information regarding certification

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

References (see Section 13)

- *relevant PCR documents*
- *EPD Requirements, Version 1.0 (2008-02-29)*
- *Underlying LCA study*
- *other supporting documents for LCA information*
- *Other relevant documents regarding company/organization's environmental activities*

Appendix III Abbreviations

Acronyms	Common Name
APLAC	Asia Pacific Laboratory Accreditation Cooperation
CFP	Carbon Footprint of Product
CPU	Central Processing Unit
EPD	Environmental Product Declaration
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
TAF	Taiwan Accreditation Foundation
Trpt	Transportation
WEEE	The Waste Electrical and Electronic Equipment Directive

Appendix IV Example of Product Energy Consumption

1. If the product is of the intermittent energy consumption type (e.g., display device using electro-phoretic display technology)

Assume the product is only used for reading (single function) with the wireless networking and music player function turned off. The usage scenario and characteristics are assumed as:

- 2800 pages can be viewed after one charge.
- 200 pages viewed per day.

Calculation of energy consumption

- Day-of-use (U) = $2800 / 200 = 14$ (day/time)
- Number of battery charging per year (T): $365/14 \cong 27$ (time/year)
- Product design service life (year) = 4 (year)
- Energy consumption per charge (Wh)=40 (Wh)

Total energy consumption during use phase (Wh) = Energy consumption per battery charging (Wh) × Number of battery charging per year (T) × product design service life (year)

$$= 40 \text{ (Wh)} \times 27 \text{ (time/year)} \times 4 \text{ (year)} = 4320 \text{ (Wh)}$$

2. If the product is of the continuous energy consumption type (e.g., using the TFT-LCD display technology)

Assume the product is only used for reading (single function) with the wireless networking and music player function turned off. The usage scenario and characteristics are assumed as:

- 8 hours of standby and use time after each battery charge.
- 2 hours of use per day.

Calculation of energy consumption

- Day-of-use (U) = $8 / 2 = 4$ (day/time)
- Number of battery charging per year (T): $365/4 \cong 27$ (time/year)
- Product design service life (year) = 4 (year)

- Energy consumption per charge (Wh)=40 (Wh)

Total energy consumption during use phase (Wh) = Energy consumption per battery charging (Wh) × Number of battery charging per year (T) × product design service life (year)

= 40 (Wh) × 92 (time/year) × 4 (year) = 14720 (Wh)

Note: The manufacturer may assume actual usage or characteristics for each product based on the actual conditions, or refer to the examples in this appendix for direct calculation.

Appendix V Responses to Comments

Commenter	Comment/Recommendation	Response
Environment and Development Foundation (EDF) Dr. Ning Yu	1.§5 Duplicate description for distribution/marketing phase in system boundary. 2.§10 Recommend to retain ozone depletion as declared parameters in EPD.	1. Revised. 2. Revised.
Introduction of Green Energy & Environment Research Laboratories. Ray Reu Manager	1.§2.1 Product function should describe e-reader’s quick start-up/shut-down characteristic. 2.§5 In the system boundary, consider to list marketing transportation in the distribution/marketing phase as mandatory declaration item. 3.§5 Consider adding calculation example in the appendix section. 4.§11 Add ”manufacturer may voluntarily disclose environmental impacts during product and material recycling process.”	1. Revised. 2. Revised. Considering capability of evaluation and disclosure, still listed as voluntary item. 3. Revised. ° 4. Revised.
Introduction of Green Energy & Environment Research Laboratories. Zen_Wang Manager	1.§2.2 Include user manual and other components in the basic components part. 2.§3 Added “accumulated” to “weight \geq 95%.” 3.§5 Recommend adding battery replacement to consideration for energy consumption during use phase. 4. Add ITRI DoitPro database in Appendix I.	1. Revised. 2. Revised. 3. Battery life is affected by user habit and can be difficult to assess. Decided not to include battery replacement. 4. Revised.