Interim Report

PEFCR Pilot "IT Equipment - Storage" Scope and Representative Products Definitions

Prepared for and revised after the 4th Meeting of the Environmental Footprint Steering Committee, Monday-Tuesday, 30th June-1st July, 2014,
by the Technical Secretariat of the PEFCR Pilot "IT Equipment - Storage"

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Acronyms

BOM	Bill of materials
CD-ROM	Compact disk read only memory
CFP	Carbon Footprint of Products
DTR	Draft technical report
EoL	End-of-Life
EPD	Environmental Product Declaration
ETSI	European Telecommunications Standards Institute
FR	Failure rate
GHG	Greenhouse gas
ICT	Information and communication technology
IEC	International Electrochemical Commission
I/O	Input/output
IT	Information technology
ITU	International Telecommunication Union
SNIA	Storage Networking Industry Association
PCB	Printed circuit board
PCR	Product Category Rules
PEF	Product Environmental Footprint
PEFCR	Product Environmental Footprint Category Rules
RUaEP	Resource Use and Emissions Profile
TB	Terabyte
TR	Technical report
USB	Universal serial bus
TS	Technical secretariat

1. Glossary

To this document, technical terms in SNIA Emerald™ are applied.
In SNIA Emerald™ taxonomy, levels and categories are defined as the table below.

Table 1: Taxonomy overview

Category Level	**Online**	**Near Online**	**Removable Media Library**	**Virtual Media Library**	**Adjunct Product**	**Interconnect Element**
Consumer/ Component	Online 1	Near Online 1	Removable 1	Virtual 1	Not defined in this specification	Not defined in this specification
Low-end	Online 2	Near Online 2	Removable 2	Virtual 2		
Mid-range	Online 3	Near Online 3	Removable 3	Virtual 3		
	Online 4					
High-end	Online 5	Near Online 5	Removable 5	Virtual 5		
Mainframe	Online 6	Near Online 6	Removable 6	Virtual 6		

1.1 Categories of storage subsystems

1.1.1 Online

Subsystems in this profile may provide any combination of block, file or object interfaces and shall satisfy all the attributes below:

- Access Pattern: Random / Sequential, and
- MaxTTFD (t): t < 80 ms.

[Ref] SNIA Emerald™

1.1.2 Near Online

Subsystems in this profile employ MAID or FCAS architectures as well as any combination of block, file or object interfaces and shall satisfy all the attributes below:

- Access Pattern: Random / Sequential, and
- MaxTTFD (t): t > 80 ms.

[Ref] SNIA Emerald™

1.1.3 Removable Media Library

Subsystems in this profile rely on automated or manual media loaders, e.g. tape or optical libraries, and shall satisfy all the attributes below:

- Access Pattern: Sequential, and
- MaxTTFD (t): 80 ms < t < 5 min.

[Ref] SNIA Emerald™

1.1.4 Virtual Media Library

Subsystems in this profile rely on non-removable storage media and shall satisfy all the attributes below:

- Access Pattern: Sequential, and
- MaxTTFD (t): t < 80 ms.

[Ref] SNIA Emerald™

1.1.5 Adjunct Product

This operational profile defines the features and functionalities for products that support a storage area network and provide advanced management capabilities. Products in this category rely on a closed environment to typically support a single-purpose, dedicated storage-oriented service or application (e.g., virtualization, deduplication, NAS gateways). No end-user-accessible data is stored in the product across power cycles (though some data may be cached during a given operational period). Devices in this category are part of the data path from a host to a storage device, and are responding to IO requests in real time.
[Ref] SNIA Emerald™

1.1.6 Interconnect Element

This profile defines the features and functionalities for managed inter-connect elements within a storage area network, e.g. switches, extenders.
[Ref] SNIA Emerald™

1.2 Classifications in each category of storage subsystems

In SNIA Emerald™ taxonomy, each level corresponds to classification(s) in each category as shown in Table1. Difference of classifications depends on maximum supported drive count in Virtual Media Library and maximum supported configuration in other categories. See the tables below for more details.

Table 2: Classifications of Online category

Attribute	Classification					
	Online 1	Online 2	Online 3	Online 4	Online 5	Online 6
Access Pattern	Random/ Sequential	Random/ Sequential	Random/ Sequential	Random/ Sequential	Random/ Sequential	Random/ Sequential
MaxTTFD (t)	t < 80 ms	t < 80 ms	t < 80 ms	t < 80 ms	t < 80 ms	t < 80 ms
User-Accessible Data	Required	Required	Required	Required	Required	Required
Connectivity	Not specified	Connected to single or multiple hosts	Network-connected	Network-connected	Network-connected	Network-connected
Consumer/ Component	Yes	No	No	No	No	No
Integrated Storage Controller	Optional	Optional	Required	Required	Required	Required
Storage Protection	Optional	Optional	Required	Required	Required	Required
No SPOF	Optional	Optional	Optional	Required	Required	Required
Non-Disruptive Serviceability	Optional	Optional	Optional	Optional	Required	Required
FBA/CKD Support	Optional	Optional	Optional	Optional	Optional	Required
Maximum Supported Configuration	≥1	≥ 4	≥ 12	> 100	>400	>400

Table 3: Classifications of Near Online category

Attribute	Classification					
	Near Online 1	Near Online 2	Near Online 3	Near Online 4	Near Online 5	Near Online 6
Access Pattern	Random/ Sequential	Random/ Sequential	Random/ Sequential		Random/ Sequential	Random/ Sequential
MaxTTFD (t)	t > 80 ms	t > 80 ms	t > 80 ms		t > 80 ms	t > 80 ms
User-accessible Data	Required	Required	Required		Required	Required
Connectivity	Not specified	Network connected	Network connected		Network connected	Network connected
Consumer/ Component	Yes	No	No		No	No
Integrated Storage Controller	Optional	Optional	Required		Required	Required
Storage Protection	Optional	Optional	Required		Required	Required
No SPOF	Optional	Optional	Optional		Optional	Required
Non-Disruptive Serviceability	Optional	Optional	Optional		Optional	Required
FBA/CKD Support	Optional	Optional	Optional		Optional	Optional
Maximum Supported Configuration	≥ 1	≥ 4	≥ 12		> 100	> 1000

Table 4: Classifications of Removable Media Library category

Attribute	Classification					
	Removable 1	Removable 2	Removable 3	Removable 4	Removable 5	Removable 6
Access Pattern	Sequential	Sequential	Sequential		Sequential	Sequential
MaxTTFD (t)	80ms < t < 5m	80ms < t < 5m	80ms < t < 5m		80ms < t < 5m	80ms < t < 5m
User-Accessible Data	Required	Required	Required		Required	Required
Robotics	Prohibited	Required	Required		Required	Required
No SPOF	Optional	Optional	Optional		Optional	Required
Non-disruptive Serviceability	Optional	Optional	Optional		Optional	Required
Maximum Supported Drive Count	Not specified	4	≥ 5		≥ 25	≥ 25

Table 5: Classifications of Virtual Media Library category

Attribute	Classification					
	Virtual 1	Virtual 2	Virtual 3	Virtual 4	Virtual 5	Virtual 6
Access Pattern	Sequential	Sequential	Sequential		Sequential	Sequential
MaxTTFD (t)	t < 80 ms	t < 80 ms	t < 80 ms		t < 80 ms	t < 80 ms
User-accessible Data	Required	Required	Required		Required	Required
Storage Protection	Optional	Optional	Required		Required	Required
No SPOF	Optional	Optional	Optional		Optional	Required
Non-Disruptive Serviceability	Optional	Optional	Optional		Optional	Required
Maximum Supported Configuration	12	>12	> 48		> 96	> 96

1.3 Classifications in the PEFCR

In this document, storage subsystems are classified as:

- "Consumer use" i.e. Online 1 and Near Online 1,
- "Enterprise use", consist of;
  - "Online and Near Online" i.e. Online 2-6 and Near Online 2-6, and
  - "Backup equipment" i.e. Removable Media Library and Virtual Media Library, including Removable1 and Virtual 1 as data-center components.

SNIA Emerald™ mentions that entries in Consumer / Components level of taxonomy include both:

- Consumer products i.e. Online 1 and Near Online 1, and
- Data-center components (e.g. stand-alone tape drives) i.e. Removable 1 and Virtual 1.

See also *4 Representative products*.

1.4 Other technical terms

1.4.1 Host bus adapter

An I/O adapter that connects a host computer bus to an I/O interconnect.
[Ref] SNIA Dictionary 2014

1.4.2 Random I/O

Any I/O load whose consecutively issued read and/or write requests do not specify adjacently addressed data.
The term random I/O is commonly used to denote any I/O load that is not sequential, whether or not the distribution of data locations is indeed random. Random I/O is characteristic of I/O request-intensive applications.
[Ref] SNIA Dictionary 2014

1.4.3 Sequential I/O

An I/O load consisting of consecutively issued read or write requests to adjacently addressed data. Sequential I/O is characteristic of data transfer intensive applications.
[Ref] SNIA Dictionary 2014

1.4.4 Max TTFD

Shorthand for Maximum Time to First Data, the maximum time required to start receiving data from a storage system to satisfy a read request for arbitrary data.
[Ref] SNIA Dictionary 2014

1.4.5 MAID

Shorthand for Massive Array of Idle Disks, a storage system comprising an array of disk drives that are powered down individually or in groups when not required.
[Ref] SNIA Dictionary 2014

1.4.6 FCAS

Shorthand for Fixed Content Addressable Storage, a storage system optimized to manage content addressable data that is not expected to change during its lifetime.
[Ref] SNIA Dictionary 2014

2 General information about the pilot

2.1 Members of the Technical Secretariat

The following list presents the member organizations of the Technical Secretariat (TS) of this pilot.

Manufacturers:

- Fujitsu Limited
  - Yoshiko SHINOMURA
- Hitachi, Ltd.
  - Osamu NAMIKAWA: leader
- NEC Corporation
  - Noriyuki NAKAYAMA
- Toshiba Corporation
  - Norio TAKEYAMA

Industry/trade associations

- Japan Business Council in Europe (JBCE)
  - Akihito NAKAI
- Japan Electrical Manufacturers' Association (JEMA) of Japan's 4EE Industries
  - Kiyoshi SAITO: secretary

Program owner

- Japan Environmental Management Association for Industry (JEMAI)
  - Masayuki KANZAKI: technical advisory board

Research association

- National Institute of Advanced Industrial Science and Technology (AIST)
  - Kiyotaka TAHARA

Consultant

- Mizuho Information & Research Institute, Inc.
  - Masahiko SHIBATA
  - Yasushi FURUSHIMA

Contact of European Commission and Technical helpdesk

- DG Environment
  - Imola BEDO
- Ecofys
  - Caspar NOACH
  - Annemarie KERKHOF
  - Edgar van de BRUG

2.2 Activities

The table below shows the history of activities by the TS.

Date	Place	Activities
04/11/2013	-	1st wave of pilots started
13/11/2013	Tokyo	1st TS Regular Meeting
18/12/2013	Tokyo	2nd TS Regular Meeting
29/01/2014	Tokyo	3rd TS Regular Meeting
28/02/2014	-	Draft PEFCR Version 1.0 uploaded / Stakeholder comments collection started
06/03/2014	Brussels	1st Physical Consultation Meeting
28/03/2014	-	Stakeholder comments collection closed

Some TS members also had small meetings including web meetings as appropriately.
See *Annex A* for the Syllabus of the 1st Physical Consultation Meeting.

2.3 Overview of existing PCRs

The TS found several existing PCRs and sector guidelines include information applicable for PEFCR development:

- The CFP-PCR of "IT equipment" of the Carbon Footprint of Products Communication Program (Japan);
- The PCR Basic Modules of "CPC Division 45 - Office, accounting and computing machinery" of International EPD® System (Sweden);
- The PCR of "Personal computer" of the Carbon Footprint Label (Korea);
- ETSI/TS 103 199;
- ITU-T/L.1410;
- IEC/TR 62725;
- "ICT sector guidance" of the Product Life Cycle Accounting and Reporting Standard of the Greenhouse Gas protocol.

As none of them fully comply with the PEF Guide requirements, The TS understood necessity to develop a PEFCR, filling the gaps between existing PCRs and the PEF Guide, including:

- Data quality requirement,
- Requirements on generic data collection,
- Allocation rules,
- Downstream scenarios, and
- Selection of relevant impact categories.

The TS has to gather more information and utilize the findings from PEF screening in the next step to fill the gaps, and would like the stakeholders to help gathering information (such as scenarios in Europe) and conducting PEF screening if possible.
See *Annex B* for the overview of existing PCRs prepared for the 1st Physical Consultation Meeting.

2.4 Major comments received

Draft PEFCR Version 1.0 had been uploaded on the stakeholder workspace on 28th February 2014 and the 1st Physical Consultation Meeting was held on 6th March. 27 persons including 14 stakeholders were participated in the Meeting.
After the Meeting, the TS received a total of 16 comments from 3 stakeholders. The following are some of their typical comments.

Q1: The actual BOM doesn't take into consideration the solder paste. That paste can cause non negligible impacts, mainly on the abiotic depletion indicator, as it can contain silver.
A1: In this PEFCR, the TS will set a rule that collecting specific data at downstream parts level e.g. PCB is enough for calculation because the TS would like the PEFCR to be as feasible for practitioners as possible. Thinking along this idea, the TS expects that production process of solder paste, as same as some upper stream parts e.g. capacitor and resistor, will be considered as included within the boundaries of downstream parts' secondary data.

Q2: Why is "Maintenance" not included? This can contribute significantly to the "Use" stage.
A2: The TS will consider this issue through PEF screening.

See *Annex C* for all the stakeholder comments and answers.

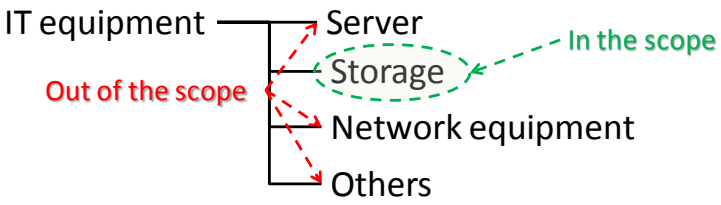
3 Scope of the PEFCR

The scope shall be storage subsystems in this document. Storage subsystems are defined in the 2014 SNIA Dictionary as an integrated collection of;

a) storage controllers and/or host bus adapters,
b) storage devices such as disk drives, CD-ROM drives, tape drives, and libraries, and
c) any required control software, that provides storage services to one or more computers.

3.1 General

- In this pilot, the TS will concentrate efforts on storage.
- Product in the scope: storage
- Products out of the scope: server, network equipment and other IT equipment



During this pilot phase, storage subsystems, categorized in SNIA Emerald™ as below, are covered:

- Online,
- Near Online,
- Removable Media Library, and
- Virtual Media Library.

Product classification in NACE/CPA code is;

- 26.20.2 Storage units and other storage devices

The scope in this document also includes:

- Online 1 (see NOTE1 below),
- Near Online 1 (see NOTE1 below), and
- Storage systems that provide interfaces other than block-mode access (see NOTE2 below).

The scope in this document excludes:

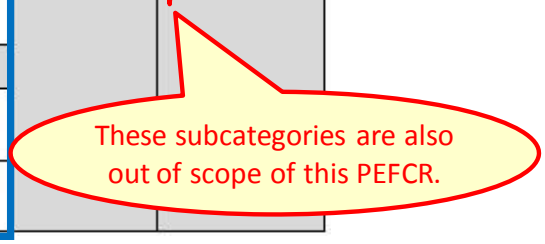
- Bare drives (see NOTE3 below), and
- Storage devices that rely on a USB connection for their power (see NOTE3 below).

NOTE1 Both Online 1 and Near Online 1 in taxonomy, not addressed beyond measurement methodology in SNIA Emerald™, are included in the scope of this PEFCR. See the figure below.

NOTE2 File-based and Object-oriented storage systems that provide interfaces other than block-mode access, which may be addressed in future revisions of SNIA Emerald™, are included in the scope of this PEFCR.

NOTE3 Devices without their own power sources e.g. bare drives and storage devices that rely on a USB connection for their power are excluded from the scope of this PEFCR, because there is no power measurement methodology for those devices.

Category Level	Online	Near Online	Removable Media Library	Virtual Media Library	Adjunct Product	Interconnect Element
Consumer/ Component[1]	Online 1	Near Online 1	Removable 1	Virtual 1	Not defined in this specification	Not defined in this specification
Low-end	Online 2	Near Online 2	Removable 2	Virtual 2		
Mid-range	Online 3	Near Online 3	Removable 3	Virtual 3		
	Online 4					
High-end	Online 5	Near Online 5	Removable 5	Virtual 5		
Mainframe	Online 6	Near Online 6	Removable 6	Virtual 6		



: Scope of this PEFCR : Not addressed beyond measurement methodology in SNIA Emerald™

3.2 Unit of analysis and reference flow

The unit of analysis shall be defined according to the following aspects:

- The function(s)/service(s) provided: "what",
- The extent of the function or service: "how much",
- The expected level of quality: "how well", and
- The duration/life time of the product: "how long".

"What"

Storage subsystems.
Storage subsystems are defined in the 2014 SNIA Dictionary as an integrated collection of;

a) storage controllers and/or host bus adapters,
b) storage devices such as disk drives, CD-ROM drives, tape drives, and libraries, and
c) any required control software, that provides storage services to one or more computers.

"How much"

(Tera) bytes of formatted capacity.
In SNIA Emerald™ Power Efficiency Measurement Specification, formatted capacity is defined as the total amount of bytes available to be written after a system or device has been formatted for use, e.g., by an object store, file system or block services manager.

"How well"

Ensuring capacity to be suited for needs of purchasing customer.
The primary FR data to ensure the capacity has to be taken into account when calculating the use phase. If these data are not available, average FR data has to be taken into account. Practitioners have to include environmental impacts of e.g. magnetic disk drive as service parts to PEF studies, according to the FR.

"How long"

Lifetime of each product.
The primary lifetime data to ensure capacity has to be taken into account when calculating the use phase. If these data are not available, 5 years as lifetime has to be taken into account.

NOTE1	In Japan, legal durable years for IT equipment are set as 5 years.
NOTE2	In the discussions at ENTR Lot 9, average economic lifetime is estimated as 5-7 years and average technical lifetime as 7-10 years.

Unit of analysis

In accordance with aspects of "what", "how much", "how well" and "how long", the unit of analysis is defined as "A storage subsystem providing one (tera) byte of formatted capacity to be suited for needs of purchasing customer for one year".

Reference flow

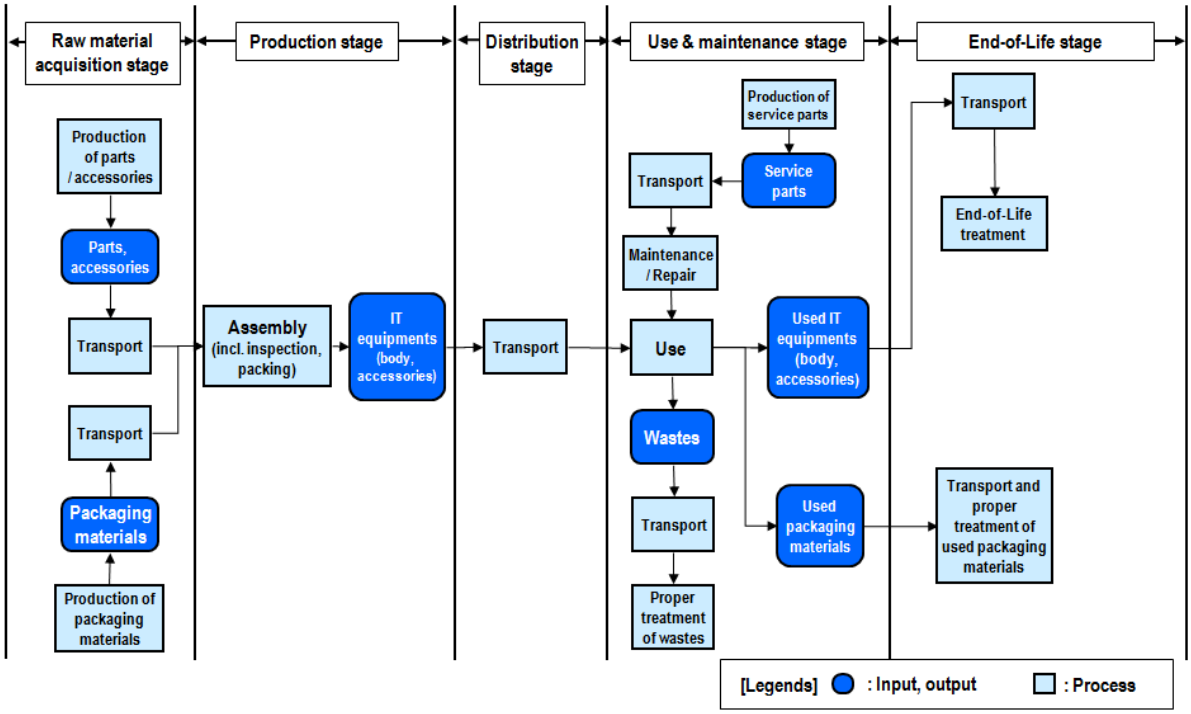
Based on the definition of the unit of analysis, reference flow is set as "(tera) byte·year". See the formula below.

$$\frac{RUaEP}{Capacity[TB] \cdot Lifetime[y]}$$

Inappropriate comparisons may occur when being evaluated per product. Practitioners can reflect contributions of long-life products on PEF studies when being evaluated per year and this enables fair comparisons in terms of durability. In many cases, long-life products will have larger environmental impacts than those of short-life products due to their length of use phase.
Practitioners can reflect contributions of long-life products on PEF studies when being evaluated per year. This enables fair comparisons in terms of durability.

3.3 System diagram

System diagram is considered as the figure below.



NOTE1 Development of control software is not included in the system boundary.
NOTE2 Handling of recycled material in a subsystem after use and recycled material input will be analyzed through PEF screening step.
NOTE3 After the screening a decision will be taken about which processes are irrelevant and will therefore be excluded from the boundaries of the system analysed.

4 Representative products

There are 2 types of classification for applications to define representative products:

i. "Online and Near Online" or "Backup equipment", and
ii. "Consumer use" or "Enterprise use".

These classifications will influence use phase scenarios.

"Online and Near Online"

Storage subsystems that are intended to service a mixture of Random and Sequential I/O requests.

"Backup equipment"

Storage subsystems that are intended to service primarily Sequential I/O requests, i.e. Removable Media Library and Virtual Media Library

"Consumer use"

Storage subsystems for domestic use, mainly used by consumers, i.e. Online 1 and Near Online 1.

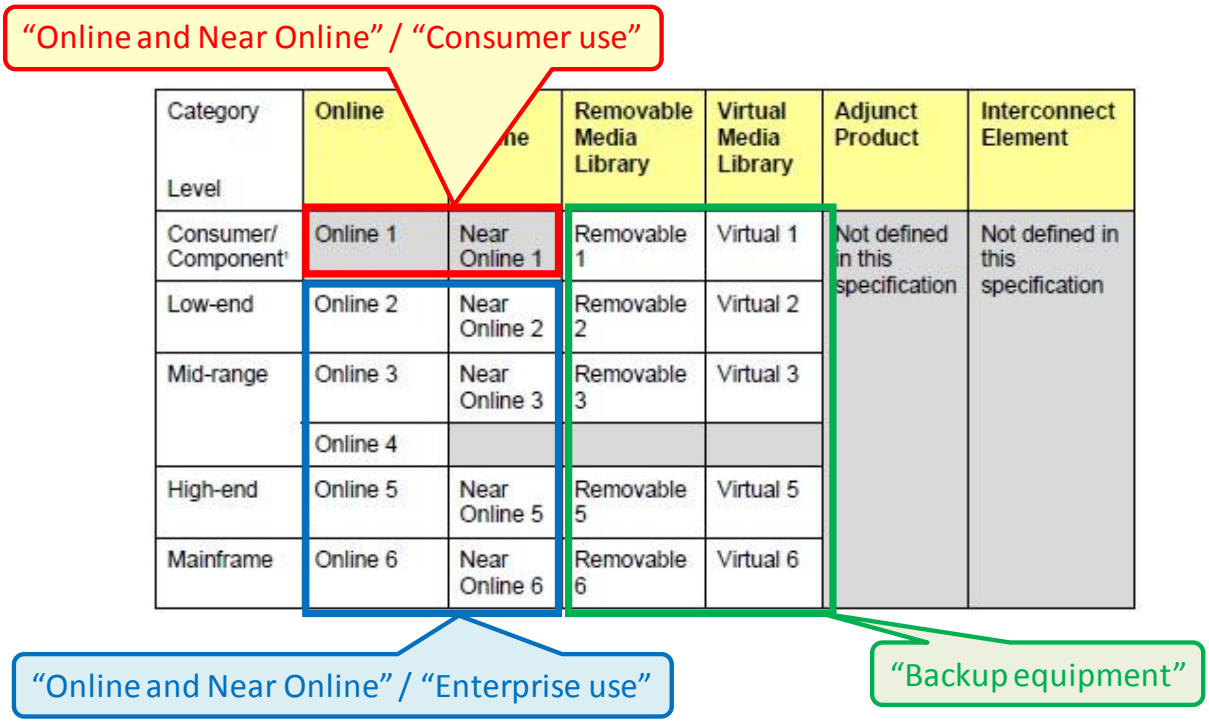
"Enterprise use"

Storage subsystems for business use, mainly used by enterprises.

Definitions of representative products

In accordance with classifications, representative products will be set on each of these 3 subcategories:

- "Online and Near Online" / "Consumer use",
- "Online and Near Online" / "Enterprise use", and
- "Backup equipment".



Category Level	Online	ne	Removable Media Library	Virtual Media Library	Adjunct Product	Interconnect Element
Consumer/ Component[1]	Online 1	Near Online 1	Removable 1	Virtual 1	Not defined in this specification	Not defined in this specification
Low-end	Online 2	Near Online 2	Removable 2	Virtual 2		
Mid-range	Online 3	Near Online 3	Removable 3	Virtual 3		
	Online 4					
High-end	Online 5	Near Online 5	Removable 5	Virtual 5		
Mainframe	Online 6	Near Online 6	Removable 6	Virtual 6		

The representative products will be virtual products with the average EU-sales weighted characteristics of existing technologies.

NOTE1 Although classified as Consumer/Component level, subsystems of "Removable 1" and "Virtual 1"are not intended for consumer use. Thus, all storage subsystems categorized in Removable Media Library and Virtual Media Library shall be defined as "Enterprise use" in this document.

NOTE2 "Online and Near Online" / "Enterprise use", the subcategory that has the largest sales volume, should be prioritized to set a representative product.

NOTE3 The TS will explore a possibility to integrate the 3 representative products into 1 through PEF screening.

5 BOM

The generic BOM for storage products is as the table below (tentative):

#	Category	Name	Quantity	Unit
1	Steel	Steel hot rolled coil		
2	Steel	Steel cold rolled coil		
3	Steel	Steel hot dip galvanized		
4	Steel	Steel sections		
5	Steel	Stainless steel		
6	Non-ferrous metal	Aluminum extrusion		
7	Non-ferrous metal	Aluminum sheet		
8	Non-ferrous metal	Copper sheet		
9	Non-ferrous metal	Copper tube		
10	Non-ferrous metal	Copper wire		
11	Non-ferrous metal	Brass		
12	Non-ferrous metal	Bronze		
13	Non-ferrous metal	Lead		
14	Non-ferrous metal	Zinc		
15	Non-ferrous metal	Gold		
16	Non-ferrous metal	Tin		
17	Non-ferrous metal	Nickel		
18	Plastics	HDPE		
19	Plastics	LDPE		
20	Plastics	LLDPE		
21	Plastics	PET		
22	Plastics	PP		
23	Plastics	GPPS		
24	Plastics	EPS		
25	Plastics	HIPS		
26	Plastics	PVC		
27	Plastics	PC		
28	Plastics	ABS		
29	Plastics	PC-ABS		
30	Plastics	Nylon 6		
31	Plastics	Nylon 6 glass filled		
32	Plastics	Nylon 66		
33	Plastics	Nylon 66 glass filled		
34	Plastics	POM		
35	Plastics	PMMA		
36	Plastics	Melamine resin		
37	Plastics	PBT		
38	Plastics	PAN		
39	Plastics	PB		
40	Rubber	Rubber		
41	Paper	Paper		
42	Paper	Cardboard		
43	Glass	Flat glass		
44	Glass	Optical lens		
45	Wood	Wood		
46	Electronic	Magnetic disk unit		
47	Electronic	Printed circuit board		
48	Electronic	Cable		
49	Electronic	Battery		
50	Electronic	Motor		
51	Electronic	tape cartridge		
52	Electronic	Power supply unit		
53	Electronic	Fan		
54	Electronic	Liquid crystal display module		
55	others	screw		

NOTE1 Generally steel and aluminum are shipped to sites of assembly via metal working processes e.g. pressing and cutting. These working processes and their associated environmental impacts will be included in PEF studies.

NOTE2 Plastics are shipped to sites of assembly in forms including but not limited to injection-moulded pieces. Processes e.g. injection moulding and their associated environmental impacts will be included in PEF studies.

6 Assumptions

6.1 Transportation scenarios

The primary transport data must be taken into account when calculating the transport (kilometres covered, types of transport). They must be justified and documented in the analysis.
If these data are not available, penalising average data must be taken into account:

- Worldwide transport (intercontinental): 19000 km by ship plus 1000 km by truck
- Intracontinental transport: 3500 km by truck
- Local transport: 1000 km by truck

([ref.] PCR of the PEP ecopassport PROGRAM)

6.2 Use phase scenarios

Operating time

The following operating time [h] shall be used for each subcategory (tentative):

A) "Online and Near Online" / "Consumer use"
- 8h/d, 200d/y

B) "Online and Near Online" / "Enterprise use"
- 24h/d, 365d/y

C) "Backup equipment"
- 2h/d for Active State, 10h/d for On Mode, 365d/y

Category / Level	Online	Near Online	Removable Media Library	Virtual Media Library
	A)			
Consumer/ Component	Online 1	Near Online 1	Removable 1	Virtual 1
Low-end	Online 2	Near Online 2	Removable 2	Virtual 2
Mid-range	Online 3	Near Online 3	Removable 3	Virtual 3
	Online 4			
High-end	Online 5	Near Online 5	Removable 5	Virtual 5
Mainframe	Online 6	Near Online 6	Removable 6	Virtual 6
	B)		C)	

Power consumption measurement

Power consumption measurement shall be conducted with the test method stipulated for use in Europe, e.g. (under survey):

- ENERGY STAR®
- SNIA Emerald™
- Act on the Rational Use of Energy (a law in Japan)

6.3 EoL scenarios

Parameters below are required to calculate RUaEP using the formula in PEF guide:

- Waste treatment methods,
- Recycling (or reuse) fraction of material, and
- Proportion of material in the product that is used for energy recovery.

Waste treatment methods will follow European regulations such as WEEE Directive (under survey).
Recycling (or reuse) fraction and proportion for energy recovery will be quoted from IEC/TR 62635.
IEC/TR 62635 provides the methodology for exchanging information between EEE manufacturers and recyclers, and for calculating the recyclability and recoverability rates. Annex D of the technical report includes some example data corresponding to identified scenarios.

7 References

7.1 Existing PCRs and sector guidelines

The CFP-PCR of "IT equipment" (PA-CI-04), Carbon Footprint of Products Communication Program (Japan)
http://pcr-library.edf.org.tw/data/japan/JEMAI201310_Electronics_IT%20Equipment.pdf

The PCR Basic Module of "UN CPC Division 45 - Office, accounting and computing machinery", Version 2.0, International EPD® System (Sweden)
http://environdec.com/en/PCR/Detail/?Pcr=7068

The PCR of "Personal computer" of Carbon Footprint Label (Korea)

ETSI TS 103 199 - V1.1.1 - Environmental Engineering (EE); Life Cycle Assessment (LCA) of ICT equipment, networks and services; General methodology and common requirements
http://www.etsi.org/deliver/etsi_ts/103100_103199/103199/01.01.01_60/ts_103199v010101p.pdf

ITU-T/L.1410 - Methodology for the assessment of the environmental impact of information and communication technology goods, networks and services
http://www.itu.int/rec/T-REC-L.1410-201203-I/en

IEC/TR 62725 - Analysis of quantification methodologies of greenhouse gas emissions for electrical and electronic products and systems
http://www.iec.ch/dyn/www/f?p=103:22:0::::FSP_ORG_ID,FSP_LANG_ID:1314,25
http://webstore.iec.ch/webstore/webstore.nsf/artnum/047668!opendocument

GHG Protocol Product Life Cycle Accounting and Reporting Standard ICT Sector Guidance - Chapter 6: Guide for assessing GHG emissions of Hardware (draft)
http://www.ghgprotocol.org/files/ghgp/GHGP-ICT-Hardware-v3-2-26JAN2013.pdf

Product Category Rules of the PEP ecopassport PROGRAM – Product Environmental Profile For Electrical, Electronic and HVAC-R equipments
http://www.pep-ecopassport.org/documents/PEP-PCR-ed%202.1-EN-2012%2012%2011.pdf

7.2 SNIA

SNIA Emerald™ Power Efficiency Measurement Specification, Version 2.0.2
http://snia.org/sites/default/files/EmeraldMeasurementV2_0_2.pdf

The 2014 SNIA Dictionary - A glossary of storage networking, data, and information management terminology
http://www.snia.org/sites/default/files/SNIADictionary2014-1-ENG.pdf

7.3 Other related documents

ENERGY STAR® Data Center Storage Specification Version 1.0
http://www.energystar.gov/products/specs/data_center_storage_specification_version_1_0_pd

DG ENTR Lot 9 preparatory study on Enterprise servers – Documents
http://www.ecodesign-servers.eu/documents

IEC/TR 62635 Guidelines for end-of-life information provided by manufacturers and recyclers and for recyclability rate calculation of electrical and electronic equipment
http://webstore.iec.ch/webstore/webstore.nsf/artnum/047037!opendocument

Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE)
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:197:0038:0071:en:PDF

Annex A Syllabus of the 1st Physical Consultation Meeting

EFP Pilot PEFCR-IT equipment

1st Physical Meeting
（Syllabus）

6th March, 2014
Avenue de Beaulieu 24, Brussels

1

Agenda (Draft) - 1st Physical Meeting, EFP Pilot PEFCR-IT equipment

Brussels, 6th March 2014, Avenue de Beaulieu 24 Brussels (DG Climate Action office)
Meeting time: 9:30 to 16:30 (lunch break from 12:00 to 13:30 and approx. 15-min coffee breaks)

1. Opening of the meeting
- *Welcome address and introduction*
- *Roll call of participants and Confirmation of Agenda*

2. Confirmation of Object for Pilot test
- *Product specification for IT equipment, Storage*
- *Purpose for development of PCR*
- *Background*
- *Schedule of pilot*
- ***TASK 1 : Registered stakeholders*** (*Verbal report, only*)

3. TASK 2 : Overview of existing PCRs
- *Possible core conflicts between existing PCRs and PEF guides*

4. TASK 3 : Scope of PEFCR (*Outline and point of view/Thought starter*)
- *Description of the scope*
- *Unit of analysis (functional unit)*

5. TASK 3 : Representative product & model (*Outline and point of view/Thought starter*)
- *Outline of Representative product & model*
- *BOM*
- *System boundary / System diagram*
- *Scenario of life cycle stages* (*Use, Transportation / Logistics, End of life, etc.*)

2

Technical Secretariat of EFP Pilot PEFCR-IT equipment

- Contact of Technical Secretariat

Organization	Representative	Role in the TS
Fujitsu Limited	Yoshiko SHINOMURA	
Hitachi, Ltd.	Osamu NAMIKAWA	Leader
Japan Business Council in Europe (JBCE)	Akihito NAKAI	
Japan Electrical Manufacturers' Association(JEMA) of Japan's 4EE Industries	Kiyoshi SAITO	Secretary
Japan Environmental Management Association for Industry (JEMAI)	Masayuki KANZAKI	Technical Advisory Board
Mizuho Information & Research Institute, Inc.	Masahiko SHIBATA	
National Institute of Advanced Industrial Science and Technology (AIST)	Kiyotaka TAHARA	
NEC Corporation	Noriyuki NAKAYAMA	
Toshiba Corporation	Norio TAKEYAMA	

- Contact of DG-ENV and Technical helpdesk

European Commission - DG ENV	Imora Bedo
Technical helpdesk - Ecofys	Caspar Noach

3

Confirmation of Object for Pilot test

4

Product specification for IT equipment, Storage

- IT equipment
  - Final Products
  - B to B / B to C
  - Representative of product category
    -- Server (Server computer)
    -- Storage
    -- Switching equipment
    -- Computers (exclude, server computer)
    -- etc.

- Storage
  - Representative manufacturers
    -- HP
    -- EMC
    -- IBM
    -- NetApp
    -- Dell
    -- Others

5

Purpose of development of PCR

- Purpose of PEFCRs (General guidance)

Definition:

- PEFCR - acronym of Product Environmental Footprint Category Rules
- "Product category specific, life-cycle-based rules that complement general methodological guidance for PEF studies by providing further specification at the level of a specific product category."

Purpose:

- To provide specific guidance for calculating and reporting products' life cycle environmental impacts
- To focus in the most important parameters in determining the environmental performance of a given product
- To allow the comparability between PEF calculations within the same product category

6

Background

- Methodology

  2013/179/EU COMMISSION RECOMMENDATION of 9 April 2013 on the use of common methods to measure and communicate the life cycle environmental performance of products and organisations
  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:124:FULL:EN:PDF

- Implementation Guidance
  - Guidance for the implementation of the EU Product Environmental Footprint (PEF) during the Environmental Footprint (EF) pilot phase : Ver 3.4 (latest)
    http://ec.europa.eu/environment/eussd/smgp/pdf/Guidance_products.pdf
  - Guidance for the implementation of the EU Organisation Environmental Footprint (OEF) during the Environmental Footprint (EF) Pilot Phase : Ver 3.1 (latest)
    http://ec.europa.eu/environment/eussd/smgp/pdf/Guidance_organisations.pdf

- Current progress (Discussion in 1st Physical Meeting)
  - TASK 1: CONFIRMATION OF THE TS & PARTICIPATION OF RELEVANT STAKEHOLDERS
  - TASK 2: EXISTING INFORMATION PCRs & SECTORIAL GUIDANCE DOCUMENTS
  - TASK 3: DEFINITION OF SCOPE & REPRESENTATIVE PRODUCT/ORGANISATION

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Schedule of Pilot

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		36	37
	2013(y)		2014(y)												2015(y)										…	2016(y)	
	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10		10	11
Steering Committee	1st 21th /Oct			6th																							
Technical advisory board																											
TS training			14th																								
Physical Meeting					6th																						
TASK 1: CONFIRMATION OF THE TS & PARTICIPATION OF RELEVANT STAKEHOLDERS																											
TASK 2 : EXISTING INFORMATION PCRs & SECTORIAL GUIDANCE DOCUMENTS																											
TASK 3 : DEFINITION OF SCOPE & REPRESENTATIVE PRODUCT/ORGANISATION																											
TASK 4 : PEF/OEF SCREENING																											
TASK 5 : DRAFT PEFCR/OEFSR																											
TASK 6 : PEFCR/OEFSR SUPPORTING STUDIES																											
TASK 7 : IDENTIFICATION OF BENCHMARK & CLASSES OF ENVIRONMENTAL PERFORMANCE																											
TASK 8 : PEFCR/OEFSR REVIEW																											

"Technical Helpdesk for the Testing of Environmental Footprint Rules", November 2013, Description of the Technical Helpdesk Support

- 1st Physical Meeting **PEFCR-IT equipment : 6th March@Brussels**

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Task 1 : Registered Stakeholders

Verbal report, only

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Task 2 : Overview of existing PCRs

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Possible core conflicts between existing PCRs and PEF guides

Purpose of study

- To search existing PCRs for the same product category (storage) to find basis for PEFCR development process.
- To identify the differences of discovered PCRs (in 1.) against criteria of "PEF Guide" to be filled during PEFCR development process.

Search of existing PCRs for the same product category

- PCRs following ISO 14025 or 14067
  - PCRs in in the narrow sense
    - -- GEDnet PCR library
    - -- PCRs not included in GEDnet PCR library
- Global/International sector specific guidelines
  - PCRs in the broad sense, such as GHG protocol's sector guidance, IEC's TR …
- Others

Identification of differences between screened PCRs and PEF guides

→ See, the result of study (Annex A)

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Summary of the study

1. We have found existing PCRs and sector guidelines which cover "storage" and include applicable information to a PEFCR, but,

[Existing PCRs]
Candidates for the basis of "storage" PEFCR
- "IT equipment" (Japan)
- "PCR Basic Module ver. 2.0" (Sweden) as quasi-basis
- "Personal computer" (Korea) as a quasi-basis

[Existing sector guidelines]
Troves of reference information to develop PEFCR
- ETSI/ TS 103 199
- ITU-T/L.1410
- IEC/TR 62725
- GHG Protocol ICT Sector Guidance (Draft)

2. As none of them comply fully with the PEF guide requirements, we have to develop "storage" PEFCR, filling with the gaps between existing PCRs and PEF guide, such as;
   - Data quality requirement ,
   - Requirements on generic data collection,
   - Allocation rules,
   - Downstream scenarios, and,
   - Selection of relevant impact categories.
3. We have to gather more information and utilize our findings from "PEF screening" in the next step to fill the gaps, and,
4. We would like our stakeholders to help gathering information (such as scenarios in EU) and conducting "PEF screening" (if possible).

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Task 3 : Scope of PEFCR

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Description of the scope (Thought starter)

- Outline
  - 2.1 Product category

    Name : IT equipment, Storage

    Description :

    Storage subsystems which are categorized in Online, Near Online, Removable Media Library and Virtual Media Library defined by "SNIA Emerald ™ Power Efficiency Measurement Specification Version 2.0.2, 12 August , 2013"

    Note 1 Storage subsystems integrated collection of (a.) storage controllers and/or host bus adapters, (b.) storage devices such as disk drives, CD-ROM drives, tape drives, and libraries, and (c.) any required control software, that provides storage services to one or more computers

    Note 2 Include the Level 1 of Online and Near Online, File based and Object-oriented storage systems

    Note 3 SNIA Emerald does not include the Bare drive and storage devices that rely on a USB connection for their power
  - 2.2 Product classification (NACE/CPA)

    NACE/CPA Code: 26.20.2 Storage units and other storage devices

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Unit of analysis (Thought starter)

- Definition of SNIA Emerald

: Scope of PEFCR : Not defined the method for Power Efficiency Measurement

Category / Level	Online	Near Online	Removable Media Library	Virtual Media Library	Adjunct Product	Interconnect Element
Consumer/ Component	Online1	Near Online1	Removable1	Virtual 1	Not defined in this specification	Not defined in this specification
Low-end	Online2	Near Online2	Removable2	Virtual 2		
Mid-range	Online3	Near Online3	Removable3	Virtual 3		
	Online4					
High-end	Online5	Near Online5	Removable5	Virtual 5		
Mainframe	Online6	Near Online6	Removable6	Virtual 6		

Source : SNIA Emerald ™ Power Efficiency Measurement Specification Version 2.0.2, 12 August , 2013"

- Unit of analysis (Functional unit)
  - ENV impact / Capacity ・y

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Task 3 : Representative product & model

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Outline of Representative product & model (Thought starter)

- Definition of “representative product”
  - Representative product existing in the EU market and belonging to the product category defined
  - May or may not be a real product that is sold on the market
    - when the market is made up of different technologies, the “representative product” may be a virtual (non-existing) product with the average EU-sales weighted characteristics of all technologies around
    - if the market and technical information is incomplete, a real product may be chosen

- PEFCR “IT-equipment” Storage

Plan 1 Plan 2 Plan 3

Category / Level	Online	Near Online	Removable Media Library	Virtual Media Library	Adjunct Product	Interconnect Element
Consumer/component	Online1	Near Online1	Removable1	Virtual 1	Not defined in this specification	Not defined in this specification
Low-end	Online2	Near Online2	Removable2	Virtual 2		
Mid-range	Online3	Near Online3	Removable3	Virtual 3		
	Online4					
High-end	Online5	Near Online5	Removable5	Virtual 5		
Mainframe	Online6	Near Online6	Removable6	Virtual 6		

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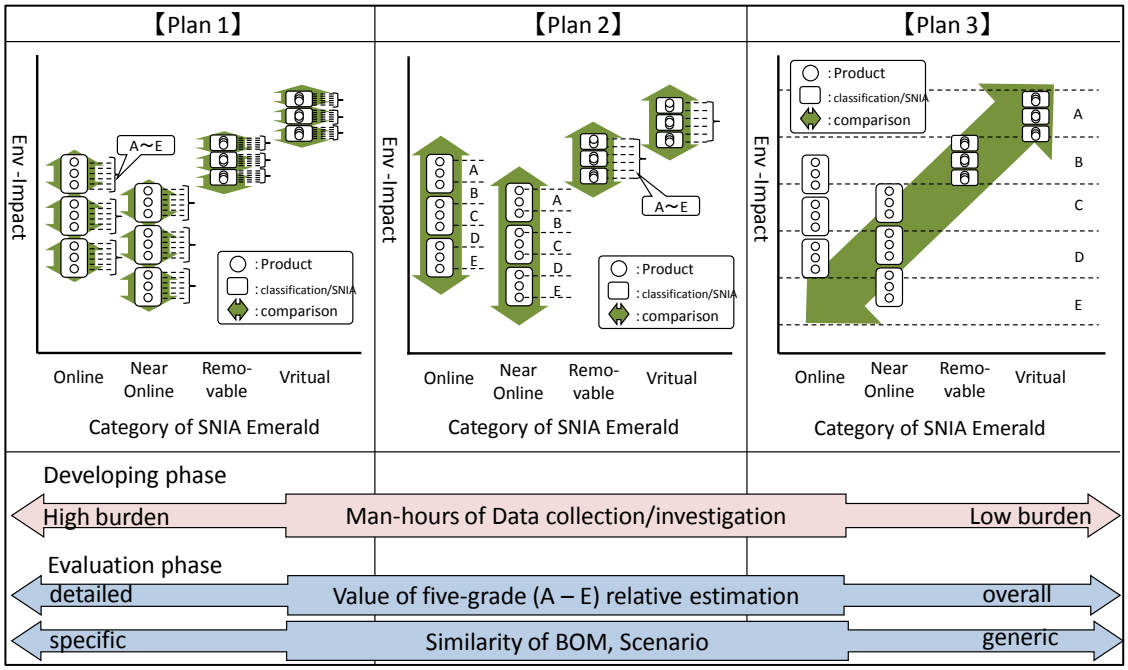
Outline of Representative product & model (Thought starter)

- Sub category



TS propose “Plan 3” for thought starter

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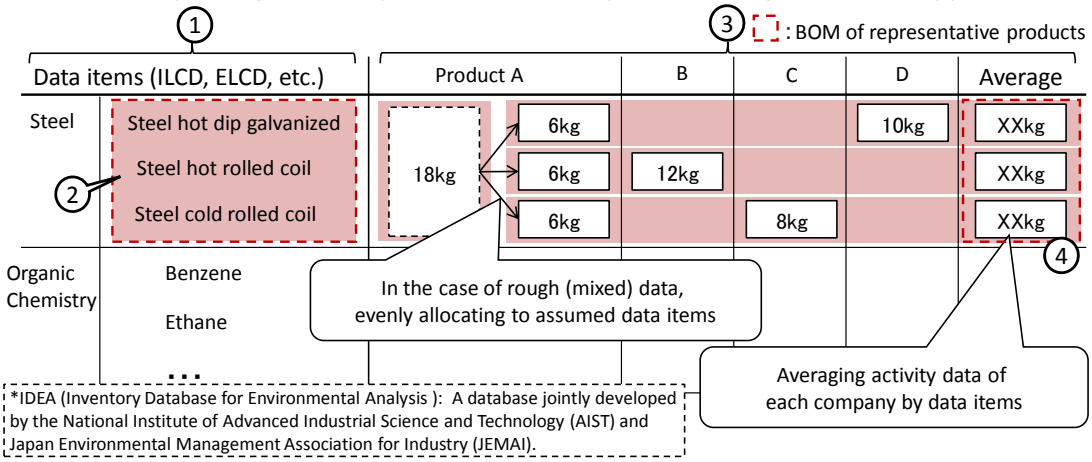
BOM - Setting and Steps (Thought starter)

- Setting and Steps of BOM for Representative Product

[Setting & Steps]

- Data items: based on the data items from major LCI databases
  - ① Listing data items from ILCD, ELCD, ecoinvent, GaBi, and IDEA*.
  - ② TS members examined above listed data and extracting data items on materials & electronic parts of storage products. By referring to BOM used for existing PCRs, firstly setting a simple BOM configuration to use for screening 14 impact categories.
- Activity data: averaged value of storage products
  - ③ Averaging activity data of each product for each data item.
  - ④ Finally setting an actually needed BOM configuration through the screening process above.



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Structure of BOM (Thought starter)

- Structure of BOM
  - Example : Steel

Category	Name	Check for Data				
		ILCD	ELCD	ecoinvent	GaBi	IDEA
Steel	Steel hot rolled coil	Y	Y		Y	Y
Steel	Steel cold rolled coil				Y	Y
Steel	Steel hot dip galvanized	Y	Y		Y	Y
Steel	Steel electrogalvanized				Y	Y
Steel	Steel organic coated				Y	
Steel	Steel magnetic					
Steel	Steel sections	Y	Y		Y	Y
Steel	Stainless steel				Y	Y
Non-ferrous metal	XXXX					
...						
...						
.						
Plastics	XXXX					
...						
...						
.						

See, the result of study (Annex B)

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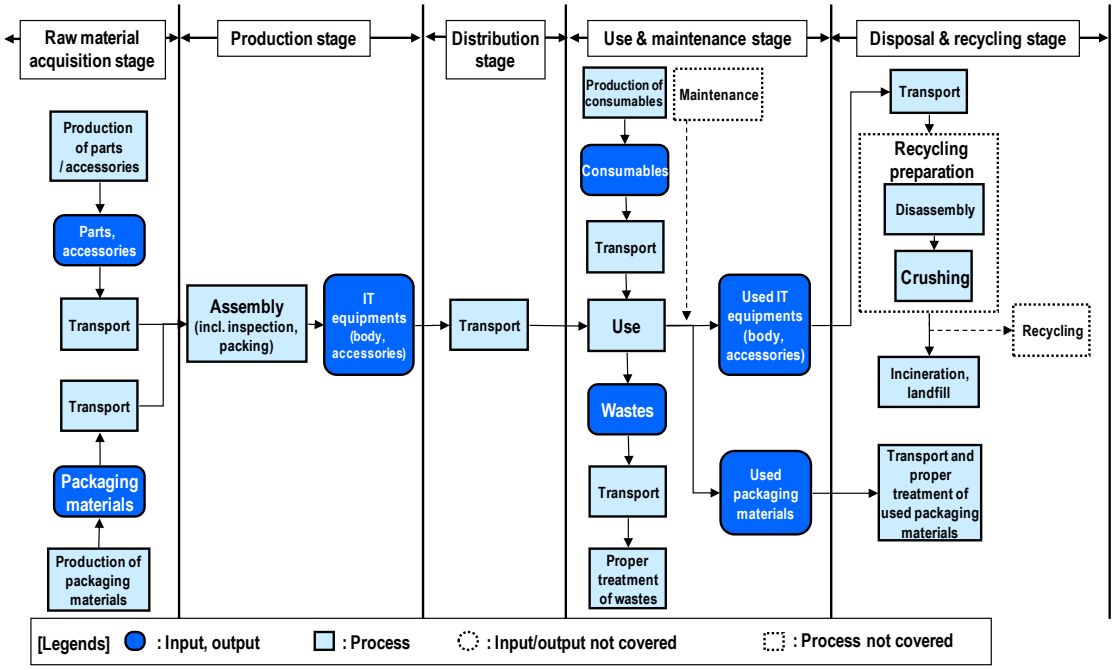
System boundary / System diagram (Thought starter)

- Outline



Source : CFP-PCR "IT equipment", PA-CI-04, Carbon Footprint of Products Communication Program in Japan

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Assumptions related to transportation scenario (Thought starter)

- Actual conditions in Europe have to be considered when assuming transportation scenario.

- Both PCR Basic Modules "CPC Division 45 - Office, accounting and computing machinery" and "CPC Division 47 - Radio, television and communication equipment and apparatus" of International EPD® System shows some general points of view to calculate environmental impact regarding transportation process:

  "Transport of the product to customer shall, as a first option, be based on the actual transportation distances. As a second option, it could be calculated as the average distance of a product of that product type transported with different means of transport or, if also such data is not available be calculated as a fixed long transport such as e.g.1,000 km distance transport with lorry or 10,000 km by airplane, according to product type."
  (9.1 TRANSPORT TO AN AVERAGE CUSTOMER, PCR Basic Module "CPC Division 45 - Office, accounting and computing machinery")

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Assumptions related to transportation scenario (Thought starter)

- PCR "CPC 45264 - Laser printers used with data processing machines", based on the basic module "CPC 45", shows more specific scenario (but distance only):
  - *"transport of laser printer to customer: because it could be difficult to evaluate the distance travelled, it is considered as 100 km"*
    (6.1.3 DOWNSTREAM MODULE)

- PCR "CPC 47223 - Home and SOHO Gateway", based on the basic module "CPC 47", describes much less specific requirement:
  - *"Transport and distribution scenario shall be representative for the considered geographical area. Specific distribution (e.g. a weighted average distribution mode and route) may be included."*
    (9 DOWNSTREAM MODULE)

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Assumptions related to transportation scenario (Thought starter)

- Both ETSI TS 103 199 and ITU-T/L.1410 shows generic processes to be included in system boundary, but no mention is made of transportation scenarios:

Generic process	Generic process categories	Unit processes (for each category)	Product flow unit	Important issues
G1. Transports and Travel	Road Air Ship Train	Mandatory: Direct (during transport) emissions Fuel supply chain (see note) Optional Vehicle production Infrastructure production	ton×km, kg×km, Cton×km	Chargeable weight = Cton×km (function that also considers volume or density)

(Annex A (normative): Generic processes, ETSI TS 103 199)

- IEC/TR 62725 just analyses some existing methodologies and shows some general points of view to calculate, but no mention is made of transportation scenarios.

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Assumptions related to transportation scenario (Thought starter)

- Chapter 6 of GHG Protocol ICT Sector Guidance shows parameters to be considered but no mention is made of transportation scenarios.
  - ➢ Additional parameters to be considered at upstream transportation are listed as follows:
    - *Type of transportation equipment used*
    - *Type of fuel used*
    - *Transport load factor (e.g. partial or full load)*
    - *Empty truck return rate*

    (6.3.1 Calculating cradle-to-gate GHG Emissions of IH by the component characterization method)

Parameter	*Metric*
Location(s) of final product assembly	Nodal point(s) – by region or country
Location(s) of warehouse / distribution center / retail	Nodal point(s) – by region or country
Location(s) of final product installation	Nodal point(s) – by region or country
Transport mode	Selection of modal mix – e.g., surface mix (truck, rail, marine vessel), air transport (plane)
Transport mode emission factors	kg CO_2e per kg of shipped product weight per km travelled – e.g., air travel, marine travel, truck travel, rail travel. Additional factors to be considered include: • Transportation equipment used (e.g., heavy gross weight transport vehicle) • Fuels used (e.g., diesel from petroleum refinery) • Load factor of the means of transport used • Empty return rate of the means of transport used
Final product shipping weight	Kg

(6.3.5 Calculating IH GHG emissions for the gate-to-grave stages)

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Assumptions related to transportation scenario (Thought starter)

- As for transportation scenario in PEFCR, parameters below shall be set:
  - Distance
  - Means of transport
  - Loading ratio
  - Empty return rate

- For example, a final product will be distributed as conditions below:
  - Distance
    - ✓ Inside Europe : 1,000km
    - ✓ Overseas : Distance between ports described in literatures
  - Means of transport
    - ✓ Inside Europe : Truck
    - ✓ Overseas : Ship
  - Loading ratio : 65% for truck, 100% for ship
  - Empty return rate : 25% for truck, 0% for ship

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Assumptions related to transportation scenario (Thought starter)

- Two issues regarding transportation scenario:
  1. Are there appropriate numbers for the parameters in European context?
  2. Can the scenario be prioritized next to actual data?
     - Can PEF studies be guaranteed comparability ?

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Assumptions related to use scenario (Thought starter)

- Power consumption and operating time have to be derived from use phase scenario.

- CFP-PCR "IT equipment" of Carbon Footprint of Products Communication Program in Japan shows specific scenario:
  "GHG emissions from maintaining IT equipment shall be excluded from the assessment since they make small contributions to the entire life cycle of a product."
  (10-3 Data collection items)
  "Collect data on energy consumption amount by using the measurement method prescribed in the ["measurement method of energy efficiency" of "the Act"]."*
  (10-3 Primary data collection method and requirements)
  "Operating time [h]=24 [h/d] × 365 [d/y] × Use period [y]"
  (10-4 Scenario)
  *"the Act": Act on the Rational Use of Energy (a law in Japan)

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Assumptions related to use scenario (Thought starter)

- SNIA Emerald™ Power Efficiency Measurement Specification shows power efficiency measurement methods of storage products.

- As for use phase scenario, following two parameters can be estimated from these documents:
  - Power consumption: SNIA Emerald™
  - Operating time: CFP-PCR in Japan
    - ✓ Operating time [h]=24 [h/d] × 365 [d/y] × Use period [y]

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Assumptions related to End of Life scenario (Thought starter)

- Actual conditions in Europe have to be considered when assuming End of Life (EoL) scenario.

- Both PCR Basic Modules "CPC Division 45 - Office, accounting and computing machinery" and "CPC Division 47 - Radio, television and communication equipment and apparatus" of International EPD® System shows some general recommendations regarding EoL scenarios:
  "Recommendations for source separation and recycling shall be given, as well as recommendations for other waste treatment of product parts if relevant."
  "The potential benefit of recycling and waste treatment of the products according to the specified scenarios shall be presented in the EPDs."
  (9.3 RECYCLING DECLARATION AND WASTE TREATMENT, PCR Basic Module "CPC Division 45 - Office, accounting and computing machinery")

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Assumptions related to End of Life scenario (Thought starter)

- PCR "CPC 45264 - Laser printers used with data processing machines", based on the basic module "CPC 45", only shows general ideas:
  "The laser printer and each of its components may have a specific lifetime, at the end of this time the laser printer or its components will be disposed. The choice of the treatments should be based on scenarios that reflect national situation. Among the possible options it is possible to consider also the regeneration and reuse of the components."
  (6.1.3 DOWNSTREAM MODULE)

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Assumptions related to End of Life scenario (Thought starter)

- Regarding EoL treatment, PCR "CPC 47223 - Home and SOHO Gateway" mentions some other documents:
  "The recyclability and recoverability rates of the Home and SOHO gateway product refer to the mass of product at the End of Life phase and shall be calculated in accordance with the IEC 62635:2012 standard. Both values shall be declared in the EPD.
  The product end of life shall be classified according to European Waste Catalogue (EWC). In particular, regarding product disposal, the EPD must include classification of product according to the WEEE European framework (2012/19/EU) and subsequent modifications and integrations as well as the reference of series standard of ISO 1043 and ISO 11469 on plastic parts identification in order for treatment facilities classification. Batteries incorporated into products shall be managed in compliance with Directive 2006/66/EC with its amendments (if applicable)."
  (9.2.1 RECYCLING DECLARATION AND WASTE TREATMENT)

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Assumptions related to End of Life scenario (Thought starter)

- Both ETSI TS 103 199 and ITU-T/L.1410 shows EoL treatment processes to be included in system boundary, but no mention is made of EoL scenarios:

	Process categories	EoLT process unit processes (for each category)	Product flow unit	Important issues
G6. End of Life Treatment				
G6.1 EHW treatment	EHW (destruction and energy recovery) Special EHW landfill	In general: Recovery/treatment	mass, (energy content)	
G6.2 Other Waste treatment	Diverse recycling Energy recovery (e.g. incineration, see note) Landfill	In general: Recycling/recovery/treatment	mass, (energy content)	
D. EoLT	D1. Preparation for Re-use of ICT Equipment D2. ICT specific EoLT D2.1 Storage/Disassembly/Dismantling/Shredding D2.2 Recycling D2.2.1 Battery recycling *ICT specific metal/mechanical parts/fractions EoLT* D2.2.2 PCBA recycling D2.2.3 Cable recycling D2.2.4 Mechanics recycling D2.2.5 Other ICT recycling D3. Other EoLT	Recycling, recovery and treatment	Piece/ mass	
NOTE: Energy recovery of incineration processes is optional				

(Annex C (normative): EoLT processes , ETSI TS 103 199)

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Assumptions related to End of Life scenario (Thought starter)

- IEC/TR 62725 recommends processes to be included in the EoL scenario:

"Scenario necessary to quantify GHG emissions from preparation for disposal, recycling, reuse

–collection, packaging and transport of end-of-life products;

–dismantling of components from end-of-life products;

–shredding and sorting.

Scenario necessary to quantify GHG emissions from disposal, recycling, reuse

–material recycling processes;

–energy recovery processes;

–incineration and sorting of bottom ash;

–landfilling, landfill maintenance."

(6.10 End-of-life stage scenario)

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Assumptions related to End of Life scenario (Thought starter)

- Chapter 6 of GHG Protocol ICT Sector Guidance shows parameters to be considered but no mention is made of transportation scenarios.

Parameter	*Metric*
Product constituent materials - weight	Weight (kg) of constituent materials, e.g., circuit boards, frames / chassis, metals, polymers, etc.
Disposition of product constituent materials – percentage	Percentage (%) of constituent materials receiving end-of-life treatment, e.g., full recycling, incineration / energy recovery, landfill disposal w/ landfill gas recovery

(6.3.5 Calculating IH GHG emissions for the gate-to-grave stages)

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Assumptions related to End of Life scenario (Thought starter)

- As for EoL scenario in PEFCR, parameters below shall be set:
  - Waste treatment methods
  - Recycling (or reuse) fraction of material
  - Proportion of material in the product that is used for energy recovery

※ These parameters will be required to calculate resource use and emission profile using the formula in PEF guide;

$$\left(1-\frac{R_1}{2}\right)\times E_V+\frac{R_1}{2}\times E_{recycled}+\frac{R_2}{2}\times\left(E_{recyclingEoL}-E^*_V\times\frac{Q_S}{Q_P}\right)+R_3\times$$
$$\left(E_{ER}-LHV\times X_{ER,heat}\times E_{SE,heat}-LHV\times X_{ER,elec}\times E_{SE,elec}\right)+\left(1-\frac{R_2}{2}-R_3\right)E_D-\frac{R_1}{2}\times E^*_D$$

- One issue regarding EoL scenario:
  1. Are there appropriate numbers for the parameters in European context?

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References

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References

- PCR Basic Module “UN CPC Division 45 - Office, accounting and computing machinery”, Version 2.0, International EPD® System
  http://environdec.com/en/PCR/Detail/?Pcr=7068

- Product Category Rules “UN CPC 45264 - Laser printers used with data processing machines”, PCR 2010:04, Version 1.1, International EPD® System
  http://environdec.com/en/PCR/Detail/?Pcr=5930

- PCR Basic Module “UN CPC Division 47 - Radio, television and communication equipment and apparatus”, Draft version 0.5, dated 2009-08-11, International EPD® System
  http://environdec.com/en/PCR/Detail/?Pcr=5900

- Product Category Rules “UN CPC 47223 - Home and SOHO Gateway”, PCR 2013:10, Version 1.0, date 2013-07-17, International EPD® System
  http://environdec.com/en/PCR/Detail/?Pcr=9135

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References

- ETSI TS 103 199 - V1.1.1 - Environmental Engineering (EE); Life Cycle Assessment (LCA) of ICT equipment, networks and services; General methodology and common requirements
  http://www.etsi.org/deliver/etsi_ts/103100_103199/103199/01.01.01_60/ts_103199v010101p.pdf

- ITU-T/L.1410 - Methodology for the assessment of the environmental impact of information and communication technology goods, networks and services
  http://www.itu.int/rec/T-REC-L.1410-201203-I/en

- IEC/TR 62725 - Analysis of quantification methodologies of greenhouse gas emissions for electrical and electronic products and systems
  http://www.iec.ch/dyn/www/f?p=103:22:0::::FSP_ORG_ID,FSP_LANG_ID:1314,25
  http://webstore.iec.ch/webstore/webstore.nsf/artnum/047668!opendocument

- GHG Protocol Product Life Cycle Accounting and Reporting Standard ICT Sector Guidance - Chapter 6: Guide for assessing GHG emissions of Hardware (draft)
  http://www.ghgprotocol.org/files/ghgp/GHGP-ICT-Hardware-v3-2-26JAN2013.pdf

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References

- SNIA Emerald™ Power Efficiency Measurement Specification, Version 2.0.2
  http://snia.org/sites/default/files/EmeraldMeasurementV2_0_2.pdf

- The 2013 SNIA Dictionary
  A glossary of storage networking, data, and information management terminology
  http://www.snia.org/education/dictionary

- CFP-PCR “IT equipment”, PA-CI-04, Carbon Footprint of Products Communication Program in Japan
  http://pcr-library.edf.org.tw/data/japan/JEMAI201310_Electronics_IT%20Equipment.pdf

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Annex B Overview of Existing PCRs

1st Physical consultation meeting of IT equipment pilot

Overview of existing PCRs

6th March 2014

MIZUHO and JEMAI

Mizuho Information & Research Institute, Inc.

Japan Environmental Management Association for Industry (JEMAI)

Contents

- Purpose of the study
- Search of existing PCRs
  for the same product category
- Identification of differences
  between screened PCRs and PEF guides

Summary of the study (1)

1. We have found existing PCRs and sector guidelines which cover "storage" and include applicable information to a PEFCR,
   - *IT equipment(Japan),*
   - *PCR Basic Module ver. 2.0 (Sweden),*
   - *Personal computer (Korea),*
   - *ETSI/ TS 103 199,*
   - *ITU-T/L.1410,*
   - *IEC/TR 62725, and,*
   - *GHG protocol ICT sector guidance,* but,
2. As none of them comply fully with the PEF guide requirements, we have to develop "storage" PEFCR, filling with the gaps between existing PCRs and PEF guide, such as;
   - Data quality requirement ,
   - Requirements on generic data collection,
   - Allocation rules,
   - Downstream scenarios, and,
   - Selection of relevant impact categories.

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Summary of the study (2)

3. We have to gather more information and utilize our findings from "PEF screening" in the next step to fill the gaps, and,

4. We would like our stakeholders to help gathering information (such as scenarios in EU) and conducting "PEF screening" (if possible).

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Purpose of the study

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Purpose of the study

1. To search existing PCRs for the same product category (→ “storage”) to find a basis for PEFCR development process.

2. To identify the differences between discovered PCRs (in 1.) in terms of criteria of “PEF Guide” to be filled in PEFCR development process.

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Background information

- According to Guidance for EF pilot phase (ver. 3.4);

(From clause 2.4)

- Before starting the development of a new PEFCR, the Technical Secretariat shall carry out a thorough search to identify if PCRs for the same product category have been developed.
- When the Technical Secretariat finds that a PCR exists for the same or overlapping product category in one or more other program(s), the Technical Secretariat shall perform an analysis identifying the consistency of the existing PCR(s) against the criteria set in this Guidance and in the PEF Guide.
- Existing PCRs need to be evaluated only up to the point where a decision can be made whether they should be used as a basis for the development of a PEFCR or not. Only those PCRs identified as suitable basis for a PEFCR need to be evaluated further with the necessary detail.

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Search of existing PCRs
for the same product category

To search existing PCRs for the same product category (→"storage") to find a basis for PEFCR development process.

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Scope of the search

We searched existing PCRs which could be a basis for our PEFCR development process, among following areas;

1. PCRs following ISO 14025 or 14067
   - PCRs in a narrow sense

   1-A. GEDnet PCR library

   1-B. PCRs not included in GEDnet PCR library
2. Global/International sector specific guidelines
   - PCRs in a broad sense, such as GHG protocol's sector guidance, IEC's TR …
3. Others

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(Ref.) GEDnet PCR library

- GEDnet;
  - Is the Global Type III Environmental Product Declarations Network, founded in 1999,
  - Is an international non-profit association of Type III Environmental Product Declaration organizations and practitioners,
  - The overall purpose of which is to foster co-operation and encourage information exchange among its members and other parties operating or developing Type III Environmental Product Declaration (EPD) programs and to discuss key issues in developing such programs, and,
  - Provides PCR library service.

GEDnet http://gednet.org/

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Steps of the search

1. Sought the PCRs belonging to NACE code “C26.2” in each area(1-A,1-B,2 and 3 in slide 7).
   - *“C26.2” is the reference NACE code which covers “IT equipment” we have proposed.*
2. Selected the PCRs which include “storage” by checking their “scope”.
   - *E.g.: A PCR for “keyboard,” which belong to “C26.2” but doesn’t cover “storage,” will be excluded in this step*

Candidates of a basis PCRs for Storage PEFCR

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1-A. GEDnet PCR library - Step 1

- Step1: We have found 14 PCRs in GEDnet library which belong to “C26.2” proposed by us.

NACE codes		GEDnet PCR
C26.2	**Manufacture of computers and peripheral equipment**	a. IT equipment (Japan) b. Notebook Computer (Japan) c. Optical Disk Drive (Japan) d. PC- built in optical disk drivers (Korea) e. TFT-LCD monitors (Korea) f. Integrated computer (Taiwan) g. Desktop Computer (Taiwan) h. Notebook Computer (Taiwan) i. Slate – Tablet PC (Taiwan) j. TFT-LCD Display (Taiwan) k. USB Flash Drive (Taiwan) l. Mouse (Taiwan) m. Keyboard (Taiwan) n. E-Reader (Taiwan)

Proposed NACE codes for our pilot

→ **Following slides will provide their details.**

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1-A. GEDnet PCR library –Step 2

- Step2 → We have found “IT equipment”(Japan) clearly covers “storage” .

	PCR	Scope
a	**IT equipment (Japan)** “Storage” is included	• Electronic computers (server computers excluding blade system) •Magnetic disk unit (subsystem) • **File storage unit** • Tape array unit • Optical character reader (OCR) • Automatic teller machine (ATM) • Switching equipment (L2 switch) • PON equipment (ONU) •Electronic switching equipment
b	Notebook Computer (Japan) “Storage” is NOT included	•Notebook personal computers that can be powered by batteries, including those with tablet function •Does not include PDA type computers
c	Optical Disk Drive (Japan) “Storage” is NOT included	•A device for business or consumer use which uses optical disks to read or write data. • Includes both internally and externally connected drivers, but excludes products whose main application is viewing DVDs

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→ Continuing in to next slide 13

1-A. GEDnet PCR library – Step 2

- Step2→ No other PCR covers “storage” than “IT equipment”.

	PCR	Scope
d	PC- built in optical disk drivers (Korea) “Storage” is NOT included	•The PC built-in CD-ROM, CD-R/RW, DVD-ROM, DVD-R(-RW, +RW, RAM), CD-RW/DVD drivers
e	TFT-LCD monitors (Korea) “Storage” is NOT included	•TFT-LCD monitor, including the monitor body, cable, power cord and packaging materials
f	Integrated computer (Taiwan) “Storage” is NOT included	•Integrated computer is a desktop computer system in which computers and computer display function as a single unit which receive its AC power through a single cable.
g	Desktop Computer (Taiwan) “Storage” is NOT included	•Desktop computer is a computer whose main unit is designed to be located in permanent location, often on a desk or on floor.

→ Continuing in to next slide

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1-A. GEDnet PCR library – Step 2

- Step2→ No other PCR covers “storage” than “IT equipment”.

	PCR	Scope
h	Notebook Computer (Taiwan) “Storage” is NOT included	•The notebook computer is a small size personal computers, which is portable due to its light weight
I	Slate – Tablet PC (Taiwan) “Storage” is NOT included	•Slate – Tablet PC is an electronic device which integrates display, computer system, and input/output interface unit into a single body
J	TFT-LCD Display (Taiwan) “Storage” is NOT included	•The TFT-LCD display is an electronic product capable of converting received electronic signals into visible video signals. The formation of the visible video signals in the TFT-LCD display is due to the conversion of external electronic signals in the display’s internal control circuit and then presented as the image on the TFT-LCD panel.
k	USB Flash Drive (Taiwan) “Storage” is NOT included	•The USB flash drive is a drive which uses flash memory and USB interface to interact with computers or other multimedia device for data exchange.

→ Continuing in to next slide

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1-A. GEDnet PCR library – Step 2

- Step2→ No other PCR covers “storage” than “IT equipment”.

	PCR	Scope
l	Mouse (Taiwan) “Storage” is NOT included	•The mouse refers to a computer peripheral equipmemt which is a pointing input device, and is capable of performing functions through sending message to the computer, such as open, close, move, copy, pasete and other functions.
M	Keyboard (Taiwan) “Storage” is NOT included	•Keyboard is a wired or wireless device used to input characters or commands to control the computer operations.
n	E-Reader (Taiwan) “Storage” is NOT included	•E-Reader is a potable 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 play.

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1-A. GEDnet PCR library – Conclusions

- For GEDnet PCR library,
  - "IT Equipment" (Japan) covers "storage".
    → A candidate for the basis of our PEFCR development
  - No other PCRs cover "storage".

We'll share the requirements and guidance of PCR of "IT equipment" in "3. Identification of differences," together with other candidates found in 1-B and 2.

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1-B. PCRs not included in GEDnet PCR library

- Step1 → We checked Type III programs and found some PCR (or its basic module)s belonging to "C26.2" .

• USA(SCS)	→ Unclear about existence of PCRs
• USA(UL)	→ No relevant PCRs
• France(PEP Ecopassport)	→ No relevant PCRs
• Denmark(MVD)	→ No relevant PCRs
✓ Sweden(Environdec)	→ "PCR Basic Module ver. 2.0"
✓ Korea(KEITI)	→ "Guidelines for Energy-Using Products"
• Thailand(TGO)	→ No relevant PCRs

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1-B. PCRs not included in GEDnet PCR library

- Step2

  → We examined the selected PCRs to see if they include “storage”.

PCR	Scope
PCR Basic Module ver. 2.0 (Sweden) “Storage” can be included	•CPC division 45 •Office, accounting and computing machinery •No product declarations belonging to this category
Guidelines for Energy-Using Products (Upper level of PCR) “Storage” can be included	•Products taken into consideration are durable goods that require use of energy at product use phase. •400 product declarations belonging to this guideline (as of Feb 2014) •As an example of specific category, following will be considered. Appendix 3. COOL021:Personal computer ✓ This is applied to desktop and monitor-mounted computers with rated power consumption of 1,000W or less that are designed to be continuously positioned on a desk or the floor for use mainly in households and offices.

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1-B. PCRs not included in GEDnet PCR library – Conclusions

■ For PCRs not included in GEDnet PCR library,

- “PCR Basic Module ver. 2.0”(Sweden) and “Guidelines for Energy-Using Products” (Korea) cover broad range of energy using products including “storage,” although there is no lower level of criteria specified to “storage”.

  → Candidates for quasi-basis of our PEFCR development

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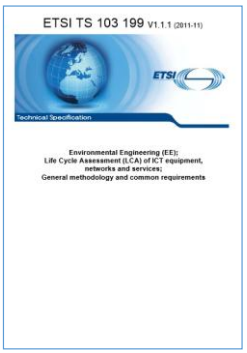
2. Sector specific guidelines

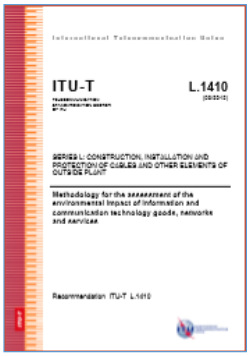
- Step1&2

  → We found 4 Global/International sector specific guidelines which cover “C26.2” (including “storage”).

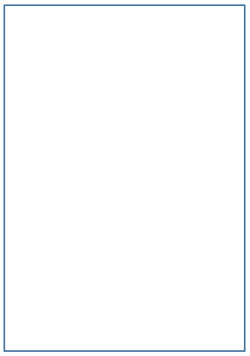
ETSI/ TS 103 199



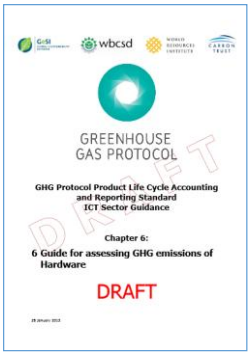
ITU-T/L.1410



IEC/TR 62725



GHG protocol*



* GHG protocol Product Life Cycle Accounting and report Standard ICT sector guidance

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2. Sector specific guidelines

These guidelines provide general guides applicable to all IT equipment or electronic products.

Code or abbr.	Title
ETSI/ TS 103 199	Environmental Engineering (EE); Life Cycle Assessment (LCA) of ICT equipment, networks and services; General methodology and common requirements
ITU-T/L.1410	Methodology for the assessment of the environmental impact of information and communication technology goods, networks and services
IEC/TR 62725	Analysis of quantification methodologies of greenhouse gas emissions for electrical and electronic products and systems
GHG Protocol ICT Sector Guidance (Draft)	GHG protocol Product Life Cycle Accounting and report Standard ICT sector guidance (Chapter 6: Guide for assessing GHG emissions of Hardware)

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2. Sector specific guidelines

- We would like to utilize 4 sector guidelines as “troves” of reference information for developing PEFCR.
- Because,
  - They seem to be too general to be used as a basis for PEFCR “storage”,
  - But, they include helpful information to draft a PEFCR in conformity with PEF guide requirements.

E.g. : Unit of analysis (Functional unit)

- While PEF guide requires that the unit of analysis shall defined according to the following aspects: “**what**”, “**how much**”, ”**how well**”, “**how long**”, many of PCRs following ISO 14025 define functional unit of IT equipment as “**sales unit**”, which doesn’t meet PEF guide fully.
- On the other hand, a sector guideline recommend that functional unit should define “**the magnitude of the ICT hardware‘s duty or service**”, “**the duration of its duty or service life under assessment**” and “**the expected level of quality**”, which is similar to PEF guide.
- Sector guidelines provide such kind of helpful information.

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3. Others

We searched other relating initiatives, but no PCR or sector specific guidance that covers “Storage” was found.

Initiative	Title
ADEME-AFNOR stakeholder platform (France)	No PCR covers “Storage”.
Carbon Footprint Labels, Carbon trust (UK)	No Sector specific guidance covers “storage”.
The Sustainable Consortium (USA)	Although there is Category Sustainability Profile for computer, release is limited.

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Conclusions of the search

- Through the search of existing PCRs, we found;
  - I. Candidates for the basis of “storage” PEFCR;
    - “IT equipment” (Japan)
    - “PCR Basic Module ver. 2.0” (Sweden) as quasi-basis
    - “Guidelines for Energy-Using Products with specification for “Personal computer” (Korea) as a quasi-basis
  - II. Troves of reference information to develop PEFCR;
    - ETSI/ TS 103 199
    - ITU-T/L.1410
    - IEC/TR 62725
    - GHG Protocol ICT Sector Guidance (Draft)

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2. Identification of differences
between screened PCRs and PEF guides

To identify the differences between discovered PCRs (in 1.) in terms of criteria of “PEF Guide” to be filled in PEFCR development process

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Items to discuss in this part

A) Are there any PCRs which meet criteria of the PEF guide perfectly?

B) *(If No for A)* Which criteria of the PEF guide are NOT met by existing PCRs ?

- ➢ They will be the issues to be discussed in PEFCR drafting process.

C) *W*hich PCRs provide helpful information to draft PEFCR, in terms of the criteria of PEF guide?

- ➢ They will be the basis descriptions from which we will start our drafting process.

- We would like to complete item A & B in this physical MTG.
- We would like to share our findings and exchange opinions regarding item C, as a first step of PEFCR drafting.

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Key requirements from the PEF guide

1. Unit of analysis (Functional unit)
2. System boundary
3. System diagram
4. Data quality requirement
5. Specific data collection
6. Generic data collection
7. Allocation rules
8. Downstream scenarios
9. Relevant impact categories

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Unit of analysis (1)

■ Requirements

Requirement for PEF studies (PEF Guide)

- The unit of analysis for a PEF study shall be defined according to the following aspects:
  - — The function(s)/service(s) provided: “what”;
  - — The extent of the function or service: “how much”;.
  - — The expected level of quality: “how well”;
  - — The duration/life time of the product: “how long”;
  - — The NACE code(s).

Requirements for PEFCR (PEF Guide)

- PEFCRs shall specify the unit(s) of analysis.

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Unit of analysis (2)

■PCRs and sector guidelines’ descriptions

Existing PCRs	Description
IT Equipment (Japan)	•Sales unit (per machinery or per equipment)
PCR Basic Module ver. 2.0 (Sweden)	•The declared unit shall be defined as one unit of product, including its packaging
Personal computer (Korea)	•The calculation of the GHG emissions for a product should be based on per-unit basis as treated in the market. [5.1.1]
ETSI/ TS 103 199	• The following functional unit shall be applied where applicable: ✓Annual ICT Equipment use or ✓Total ICT Equipment use per lifetime of ICT Equipment.
GHG Protocol ICT Sector Guidance (Draft)	•The functional unit needs to clearly define 1. the magnitude of the ICT hardware‘s duty or service 2. the duration of its duty or service life under assessment 3. the expected level of quality

** Other 2 guidelines provide similar descriptions.*

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Unit of analysis (3)

■**Conclusions**

- While all PCRs specify the unit of analysis, the definitions (="sales unit") don't meet PEF guide fully.
- On the other hand, sector guidelines such as ETSI or GHG protocol provide similar guidance which are specific to IT equipment.

→ We can apply the sector guidelines' definitions of functional unit to "unit of analysis" of storage.

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System boundary (1)

■ **Requirements**

Requirement for PEF studies (PEF Guide)

- The system boundary shall be defined following general supply-chain logic, including all stages from raw material extraction through processing, production, distribution, storage, use stage and end-of-life treatment of the product (i.e. cradle-to-grave), as appropriate to the intended application of the study.
- The system boundaries shall include all processes linked to the product supply chain relative to the unit of analysis

Requirements for PEFCR (PEF Guide)

- The PEFCR shall specify the system boundaries for product category PEF studies, including specification of relevant life cycle stages and processes that should be generally assigned to each stage (including temporal, geographical, and technological specifications).
- Any deviation from the default cradle-to-grave approach shall be explicitly specified and justified, e.g. exclusion of the unknown use-stage or end-of-life of intermediate products

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System boundary (2)

■PCRs and sector guidelines' descriptions

Existing PCR	Description
IT Equipment (Japan)	1. Raw material acquisition stage ✓ Process related to production and transport of "parts/accessories" ✓ Process related to production and transport of "containers/packaging" 2. Production stage ✓ Process related to assembly (incl. inspection and packing) of IT equipment (body/accessories) 3. Distribution stage ✓ Transport process of "shipped item" from production site to user 4. Use and maintenance stage ✓ Process related to use of IT equipment 5. Disposal and recycling stage ✓ Process related to transport of "used IT equipment (body/accessories)" from user to each treatment facility ✓ Process related to recycling preparation (disassembly) of "used IT equipment (body/accessories)" ✓ Process related to recycling preparation (crushing) of "used IT equipment (body/accessories)" ✓ Process related to landfill of materials not to be recycled ✓ Process related to incineration of materials not to be recycled ✓ Process related to disposal/recycling of "waste containers/packaging"

"Specification of relevant life cycle stages and processes that should be generally assigned to each stage" is met.

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System boundary (3)

■PCRs and sector guidelines' descriptions

Existing PCR	Description
IT Equipment (Japan)	(Continued from previous slide) •Stage, process, and flow, to be covered as cut-off target ✓ Impact other than when using capital goods ✓ Impact of construction ✓ Impact of durable goods used for multiple years ✓ Impact of containers/packaging and transport materials ✓ Of indirect materials, impact of versatile items ✓ Impact of indirect departments such as clerical division and research division, etc. ✓ Impact on the use and maintenance stage when not be able to model a valid scenario ✓ Impact of land use change

"Any deviation from the default cradle-to-grave approach shall be explicitly specified and justified, e.g. exclusion of the unknown use-stage or end-of-life of intermediate products " is met.

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System boundary(4)

■PCRs and sector guidelines' descriptions

Existing PCR	Description
PCR Basic Module ver. 2.0 (Sweden)	• Upstream processes (from cradle-to-gate); ✓ Extraction and production of raw material for all main parts and components. ✓ Transportation of raw material. ✓ The manufacturing of primary and secondary packaging • Core processes (from gate-to-gate) ✓ External transportation to the core processes ✓ Manufacturing process for main parts and components ✓ Internal transports within the manufacturing plant ✓ Assembly of the final product ✓ Maintenance (e.g. of the machines) ✓ Preparation of the final product ✓ Waste treatment of waste generated during manufacturing; ✓ Impacts due to the electricity production • Downstream processes (from gate-to-grave) ✓ Transportation from final manufacturing to customer ✓ Lifetime operation of the product including power losses and emissions ✓ Maintenance, replacements of parts, during life time ✓ Recycling of material after end of life ✓ Recycling or handling of packaging materials after use ✓ The customer or consumer use of the product ✓ End-of-life processes of packaging waste and any wasted part of the product.

"Specification of relevant life cycle stages and processes that should be generally assigned to each stage" is met.

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System boundary(5)

■PCRs and sector guidelines' descriptions

Existing PCR	Description
PCR Basic Module ver. 2.0 (Sweden)	(Continued from previous slide) •The technical system shall not include: ✓ Manufacturing of production equipment, buildings and other capital goods. ✓ Business travel of personnel. ✓ Travel to and from work by personnel. ✓ Research and development activities.

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System boundary(6)

■PCRs and sector guidelines' descriptions

Existing PCR	Description
Personal computer (Korea)	• The system boundaries for energy-using products include the pre-manufacturing phase, manufacturing phase, use phase, and end of life phase. [5.2] • The pre-manufacturing phase includes the processes of extraction and processing of raw materials. (No indication about intermediate component production.) [5.2] • It is assumed that there are no spare parts applicable in the stage of use. [4.3]

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System boundary (7)

■Conclusion

- Both Japan's "IT equipment" and Swedish "PCR Basic Module ver. 2.0 " PCRs define system boundary of IT equipment, which seem to be in conformity with PEF guide;
  - Including specification of relevant life cycle stages and processes that should be generally assigned to each stage.
  - Specifying deviations from the default cradle-to-grave approach, e.g. exclusion of the unknown use-stage or of intermediate products

→ We can start our system boundary setting from Japan's "IT equipment" and Swedish "PCR Basic Module ver. 2.0 "

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System diagram (1)

■ Requirements

Requirements for PEFCR (PEF Guide)

- A system boundary diagram should be included in the scope definition.

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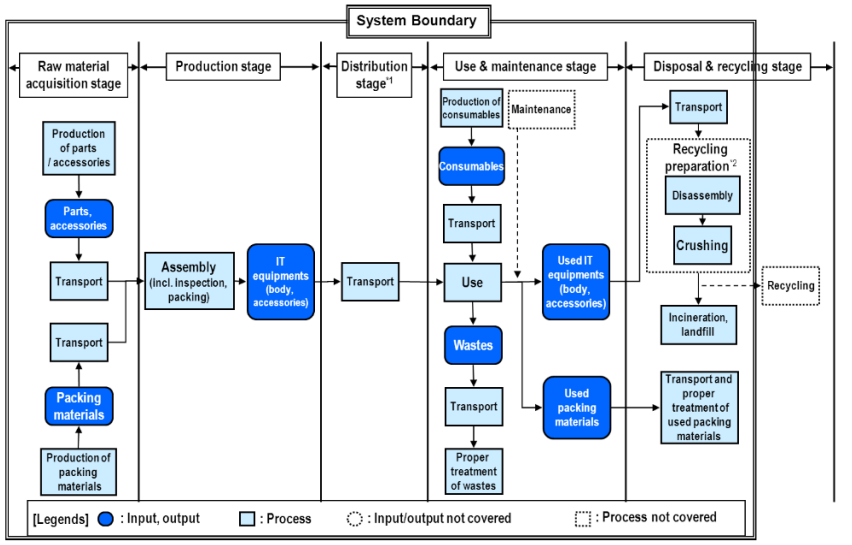
System diagram (2)

■PCRs and sector guidelines' descriptions

IT Equipment (Japan)



*2: As for recycling, up to and including recycling processes shall be calculated. In this PCR, "disassembly" and "crushing" processes are applied.

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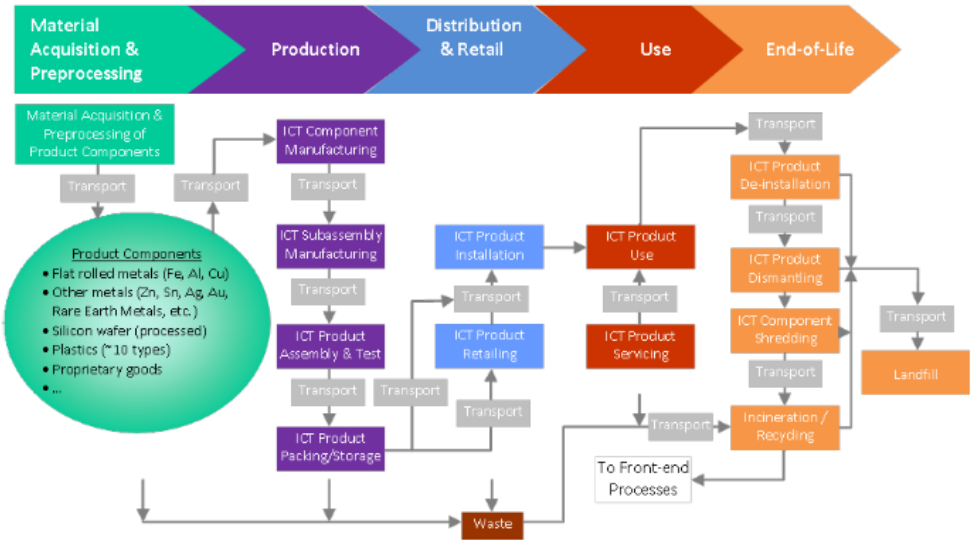
System diagram (3)

■PCRs and sector guidelines' descriptions

GHG Protocol ICT Sector Guidance (Draft)



System diagram (3)

■Conclusion

- Japan's "IT equipment" and GHG protocol ICT sector guidance(draft) provide system diagrams of IT equipment, which are similar to each other.

→ We can start our system diagram drawing from Japan's "IT equipment" and GHG protocol .

Data quality requirement (1)

■ Requirements

Requirements for PEFCR (PEF Guide)

- PEFCRs shall provide further guidance on data quality assessment scoring for the product category with respect to time, geographical and technological representativeness.
- For example, it shall specify which data quality score relating to time representativeness should be assigned to a dataset representing a given year.

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Data quality requirement (2)

■PCRs and sector guidelines' descriptions

Existing PCR	Description
IT Equipment (Japan)	• Common "Criteria on primary data quality" is applied by program. ✓Criteria on time coverage • It shall be the term of the most recent one year, or the term which can be justified as equivalent to the most recent one year. ✓Criteria on geographical coverage • Locality shall be taken into account in CFP quantification. Based on the data of each region, CFP shall be appropriately quantified, However, in the case that locality does not exist or is significantly small, it may not be taken into account. • When multiple sites are included in primary data collection range, primary data shall be collected from the sites accumulating more than 50% of total production or procurement volume of all sites by using less biased method. Or, it shall be the range which can ensure equivalent validity. ✓Criteria on technology coverage • It shall be the production technology of applicable product, or shall be the production technology of similar product which can ensure equivalent validity to the production technology of the applicable product.

These descriptions don't match "Further guidance on data quality assessment **scoring** for the product category with respect to time, geographical and technological representativeness"

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Data quality requirement (3)

■PCRs and sector guidelines' descriptions

Existing PCR	Description
PCR Basic Module ver. 2.0 (Sweden)	• Following "DATA QUALITY RULES" are provided. ✓ Specific data (also referred to as primary data) shall be used for the Core Module. Specific data are gathered from the actual manufacturing plant(s) where specific processes are carried out and data from other parts of the life cycle traced to the specific product system under study, e.g. materials or electricity provided from a contracted supplier being able to provide data for the actual delivered services, transportation taking place based on the actual fuel consumption and related emissions, etc. ✓ For the electricity used in the process, there are two alternatives: the company buys the energy from the electricity mix on the actual market or from a specific supplier. While in the first case the national electricity mix shall be adopted, in the second case a specific energy mix could be used if available. Electricity production impacts should be accounted for in this priority: • RECS or Guarantee of origin from supplier • Electricity supplier's residual energy mix • National mix/electricity mix on the actual market (preferably residual mix, otherwise national mix

These descriptions don't much "Further guidance on data quality assessment **scoring** for the product category with respect to time, geographical and technological representativeness"

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Data quality requirement (4)

■PCRs and sector guidelines' descriptions

Existing PCR	Description
Personal computer (Korea)	• Data quality indicators specifying collection method (e.g. measured, calculated, estimates) for each measured data, calculation results, and estimated data should be managed and presented accordingly in order to allow quality evaluation of the data collected. [5.3.1.2.2]

These descriptions don't match "Further guidance on data quality assessment **scoring** for the product category with respect to time, geographical and technological representativeness"

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Data quality requirement (5)

■PCRs and sector guidelines' descriptions

These descriptions just represent the preference for primary data

ETSI/ TS 103 199

- Following general requirements are provided;
  - In general the practitioner used shall reduce bias and uncertainty as far as practicable by using the best quality data achievable.
  - Also, high accuracy and preciseness is preferred.
  - In addition data which is more specific with respect to time, geography and technology takes precedence over data which is less specific.
  - Consequently primary data are generally preferred to secondary data.
- Specification of which processes specific data shall be collected, is provided as "Specific requirements on data and data sources"
  - For support activities (e.g. ICT manufacturer support activities and operator support activities) primary data shall be used for all individual **processes under the financial or operational control of the organization undertaking the LCA**, and data shall be representative of the processes for which they are collected.

Common requirement for primary data collection

These descriptions don't match "Further guidance on data quality assessment **scoring** for the product category with respect to time, geographical and technological representativeness"

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Data quality requirement (6)

■Conclusions

- No PCRs or sector guidelines provide "further guidance on data quality assessment scoring for the product category with respect to time, geographical and technological representativeness," which is required by PEF guide.

→ We have to develop "further guidance on data quality assessment scoring for the product category with respect to time, geographical and technological representativeness," which can be applied to IT equipment.

✓ Survey of other precedent PEFCRs (e.g. paper) and Conducting "PEF screening" will bring us concrete ideas.

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Specific data collection (1)

■ Requirements

Requirements for PEFCR (PEF Guide)

- PEFCRs shall:
  1. Specify for which processes specific data shall be collected;
  2. Specify the requirements for the collection of specific data;
  3. Define the data collection requirements for each site for:
     - ✓Target stage(s) and the data collection coverage;
     - ✓Location of data collection (domestically, internationally, specific factories, and so on);
     - ✓Term of data collection (year, season, month, and so on);

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Specific data collection (2)

■PCRs and sector guidelines' descriptions regarding;

1. PEF shall specify for which processes specific data shall be collected;
2. PEF shall specify the requirements for the collection of specific data;

Existing PCR	Description
IT Equipment (Japan)	•**Raw material acquisition stage** ✓Primary data have to be collected regarding ; • "Parts/accessories": **Mass by each material** which is input to product production site • "Containers/packaging": **Input amount of containers/packaging** to product production site ✓Primary data collection method and requirements : The sum of mass by material for each part/accessory or the sum of mass by part shall be confirmed whether it is not much deviated from the total mass. •**Production stage** ✓Primary data have to be collected regarding ; • "Energy" **: Input amount of energy** to product production process ✓Primary data collection method and requirements :Not stipulated

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Specific data collection (3)

Existing PCR	Description
IT Equipment (Japan)	(Continued form previous slide) •**Distribution stage** ✓Primary data have to be collected regarding ; [The fuel consumption method] • "**Fuel consumption**" for each transport mean [The fuel cost method] • "**Fuel economy**" for each transport mean • "**Transport distance**" for each transport mean [The ton-kilometer method] • "**Transport load**" for each transport mean ✓Primary data collection method and requirements :Not stipulated •**Use and maintenance stage** ✓Primary data **or scenario** have to be applied regarding ; • "Electricity**": Input amount of electricity** to the use period • "Consumables": **Input amount of consumables** to the use period ✓Primary data collection method and requirements : • Data on electricity consumption amount shall be collected in accordance **with "standards of judgment for manufacturers with regard to the improvement of the performance for the respective specified equipment" of the Act**.

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Specific data collection (4)

Existing PCR	Description
IT Equipment (Japan)	(Continued form previous slide) •**Disposal and recycling stage** ✓Primary data **or scenario** have to be applied regarding ; • "Used IT equipment (body/accessories)": — Mass of items to be disassembled — Mass of items to be crushed — Landfill volume of the component — Incineration volume of the material not to be recycled — (Component from fossil resource) Incineration volume of the component ✓Primary data collection method and requirements : • Weight of packing materials at the time of shipping may be used by assuming that all the packing materials are disposed of and/or recycled.

"IT equipment" specifies:
1. For which processes specific data shall be collected;
2. The requirements for the collection of specific data;

regarding each lifecycle stage.

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Specific data collection (5)

■**PCRs and sector guidelines' descriptions regarding ;**

1. PEF shall specify for which processes specific data shall be collected;
2. PEF shall specify the requirements for the collection of specific data;

Existing PCR	Description
PCR Basic Module ver. 2.0 (Sweden)	• Specific data (also referred to as primary data) shall be used for the Core Module. • Specific data are gathered from the actual manufacturing plant(s) where specific processes are carried out and data from other parts of the life cycle traced to the specific product system under study, e.g. materials or electricity provided from a contracted supplier being able to provide data for the actual delivered services, transportation taking place based on the actual fuel consumption and related emissions, etc.

"PCR Basic Module ver. 2.0 " generally defines:
1. For which processes specific data shall be collected;
2. The requirements for the collection of specific data;

regarding each lifecycle stage.

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Specific data collection (6)

■**PCRs and sector guidelines' descriptions regarding ;**

1. PEF shall specify for which processes specific data shall be collected;
2. PEF shall specify the requirements for the collection of specific data;

Existing PCR	Description
Personal computer (Korea)	Pre-manufacturing phase [5.3.1.1.1]: • No obligation (shall) for primary data. Transportation phase [5.3.1.1.2] : • Collect data on transportation modes (trucks, trains, ships, and airplanes) and transportation distances for each transportation route taken. Use phase [5.3.1.1.3] : • Total power consumption of a personal computer according to use during its lifespan is calculated using given scenario. Following data need not be collected [5.3.1.1.5]. • Data on capital goods such as facilities and buildings, and expendables that are not directly related to product production (work uniforms, gloves, lubricants, etc.) • Data on energy use for transportation within a business site • Data on energy use for employees' commuting by company-owned cars. • Spare parts applicable in the stage of use

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Specific data collection (7)

■**PCRs and sector guidelines' descriptions regarding ;**

1. PEF shall specify for which processes specific data shall be collected;
2. PEF shall specify the requirements for the collection of specific data;

ETSI/ TS 103 199

"ETSI/ TS 103 199" specifies "for which processes specific data shall be collected" regarding each lifecycle stage.

Tag	Life cycle stage	Unit process	Type of data		
			Equipment	Network	Service
A	Equipment Raw Material Acquisition				
A1	Raw material extraction		Generic data	Generic data	Generic data
A2	Raw material processing		Generic data	Generic data	Generic data
B	Production				
B1	ICT equipment production				
B1.1		Parts production (for further details refer to Annex B	Specific data	Specific data	Specific data
B1.2		Assembly	Specific data	Specific data	Specific data
B1.3		ICT manufacturer support activities	Specific data	Specific data	Specific data
B2	Support equipment production				
B2.1		Support Equipment manufacturing	Specific data: Amounts, etc. Generic data: processes	Specific data: Amounts, etc. Generic data: processes	Specific data: Amounts, etc. Generic data: processes
B3	ICT specific site construction				
B3.1		ICT specific site construction	Specific data: Amounts, etc. Generic data: processes	Specific data: Amounts, etc. Generic data: processes	Specific data: Amounts, etc. Generic data: processes
C	Use				
C1	ICT equipment use		Specific data	Specific data	Specific data
C2	Support equipment use		Specific data	Specific data	Specific data
C3	Operator support activities		Specific data	Specific data	Specific data
C4	Service provider support activities		Not applicable	Specific data	Specific data
D	Equipment End of Life Treatment				
D1	FFF Preparation for Re–use of ICT Equipment		Specific data	Specific data	Specific data
D2	ICT specific EoLT		Specific data	Specific data	Specific data
D2.1		Storage/Disassembly/Dismantling/ Shredding	Specific data	Specific data	Specific data
D2.2		Recycling	Specific data	Specific data	Specific data
D3	Other EoLT		Generic data	Generic data	Generic data

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Specific data collection (8)

■**PCRs and sector guidelines' descriptions regarding ;**

3. Define the data collection requirements for each site for:
   - Target stage(s) and the data collection coverage;
   - Location of data collection (domestically, internationally, specific factories, and so on);
   - Term of data collection (year, season, month, and so on);

Existing PCR	Description
IT Equipment (Japan)	• Refer to slide "Data quality requirement (2)"
PCR Basic Module ver. 2.0 (Sweden)	• Refer to slide "Data quality requirement (3)"
Personal computer (Korea)	• Refer to slide "Data quality requirement (4)"

"IT equipment" (Japan)'s description is close to the requirement of PEF guide

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Specific data collection (9)

■**Conclusions**

- Regarding following PEF requirements
  - PEFCRs shall:
    1. Specify for which processes specific data shall be collected;
    2. Specify the requirements for the collection of specific data;
  - ➢ "IT equipment"(Japan) and "ETSI/ TS 103 199" provide helpful information which may be our basis in developing PEFCR .

- Regarding following PEF requirements
  - PEFCRs shall:
    3. Define the data collection requirements for each site for: …
  - ➢ "IT equipment"(Japan) provides helpful information which may be our basis in developing PEFCR .

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Generic data collection (1)

Requirements for PEFCR (PEF Guide)

- The PEFCR shall specify:
  - ✓ Where the use of generic data is permitted as an approximation for a substance for which specific data is not available;
  - ✓ The level of required similarities between the actual substance and the generic substance;
  - ✓ The combination of more than one generic dataset, if necessary.

Existing PCR	Description
IT Equipment (Japan)	• Each PCR or sector guideline defines "where the use of generic data is permitted as an approximation for a substance for which specific data is not available," by specifying "for which processes specific data shall be collected" → refer to "Specific data collection" • However, "the level of required similarities between the actual substance and the generic substance" is not provided by these 3 PCRs
PCR Basic Module ver. 2.0 (Sweden)	
Personal computer (Korea)	
Sector guidelines	

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Generic data collection (2)

■**Conclusion**

- Each PCR defines “where the use of generic data is permitted as an approximation for a substance for which specific data is not available”, by specifying “for which processes specific data shall be collected”.
  → Considering of “Specific data collection” will bring us solutions on “where the use of generic data is permitted as an approximation for a substance for which specific data is not available”,

- On the other hand, no PCRs or sector guidelines provide “the level of required similarities between the actual substance and the generic substance”.
  → We have to create our own criteria, with utilization of our findings from “PEF screening” .

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Allocation rules (1)

■ **Requirements**

Requirements for PEFCR (PEF Guide)

- The PEFCR shall further specify multi-functionality solutions for application within the defined system boundaries and, where appropriate, for upstream and downstream stages.
- If feasible/appropriate, the PEFCR may further provide specific factors to be used in the case of allocation solutions.
- All such multi-functionality solutions specified in the PEFCR must be clearly justified with reference to the PEF multi-functionality solution hierarchy.
- Where subdivision is applied, the PEFCR shall specify which processes are to be sub-divided and the principles that such subdivision should adhere to.
- Where allocation by physical relationship is applied, the PEFCR shall specify the relevant underlying physical relationships to be considered, and establish the relevant allocation factors.
- Where allocation by some other relationship is applied, the PEFCR shall specify this relationship and establish the relevant allocation factors. For example, in the case of economic allocation, the PEFCR shall specify the rules for determining the economic values of co-products.

- For multi-functionality in end-of-life situations, the PEFCR shall specify how the different parts are calculated within the mandatory formula provided.

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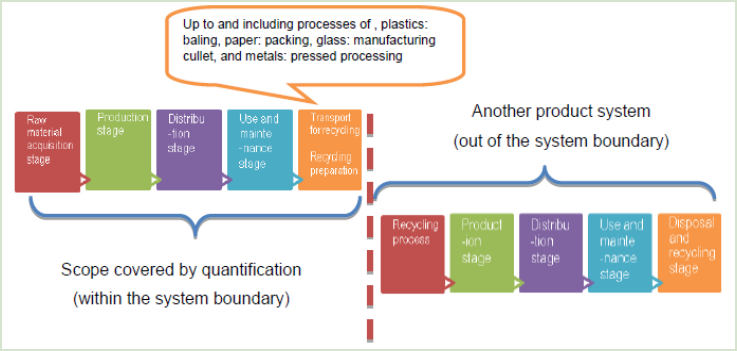
Allocation rules (2)

■PCRs and sector guidelines' descriptions

Existing PCR	Description
IT Equipment (Japan)	• Provides primary data collection item for allocation ✓ "Production volume of "contents in the body" in Production stage • Regarding allocation on "end-of-life situations", program operator requires; ✓ Of waste, for the items to be recycled, the boundary of its product system shall be the range from the transportation process for recycling preparation site to the recycling preparation process. Items leaving from the product system and already available for recycling treatment shall not be allocated.

So-called 100/0 method



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Allocation rules (3)

■PCRs and sector guidelines' descriptions

Existing PCR	Description
PCR Basic Module ver. 2.0 (Sweden)	• Provides only generic description ✓ In practice the inputs and outputs of the system should be partitioned between its different products or functions in a way that reflects the underlying physical relationships between them; i.e. they should reflect the way in which the inputs and outputs are changed by quantitative changes in the products or functions delivered by the system. ✓ Where physical relationship alone cannot be established or used as the basis for allocation (or they are too time consuming), the inputs should be allocated between the products and functions in a way that reflects other relationships between them.
Personal computer (Korea)	• The allocation standard based on weight ratios applies • When a product unit other a weight-based unit is used, use the product unit for allocation • Apply the price ratios when it is deemed exceptionally difficult to perform allocation based on weight ratios [5.5]

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Allocation rules (4)

■PCRs and sector guidelines' descriptions

Existing PCR	Description
ETSI/ TS 103 199	• Facility & Transports ✓ Facility data for production facilities shall preferably be allocated to product systems based on relevant physical data (i.e. area × layer for printed circuit boards, good die area for ICs, weight for other components according to Table B.1). ✓ Transports shall be allocated based on chargeable weight or volume whichever limits the transport capacity. Empty return trips need also to be considered if applicable. • Recycling ✓ The impacts of Raw Material Recycling (G7) shall be allocated between life cycles, in practice between Raw Material Acquisition (A1-A2) and EoLT (D), according to the following principles: ✓ The material resource depletion impact and related elementary flow shall be fully allocated to the life cycle that depletes the material resource (e.g. put the material on landfill). ✓ The 100/0 allocation method shall be used for calculating primary Raw Material Acquisition impact. ✓ The 50/50 allocation method shall be applied when possible to allocate both the use of recycled input material in the raw material acquisition stage and the recycling of materials in the EoLT stage.

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Allocation rules (5)

■Conclusion

- Relevant PCRs and sector guidelines provide allocation rules which can be applied to PEFCR.

→ We can utilize them to specify allocation rules for "storage" PEFCR.
→ In addition, we should create appropriate allocation rules for "storage," incorporating precedent allocation rules and our findings in the next "PEF screening".

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Downstream scenarios (1)

■ **Requirements**

Requirements for PEFCR (PEF Guide)
- The PEFCR shall specify downstream scenarios so as to ensure comparability and consistency among PEF studies.

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Downstream scenarios (2)

■**PCRs and sector guidelines' descriptions**

Existing PCR	Description
IT Equipment (Japan)	• Provides scenarios on use phase, transportation and EOL. • Use phase (scenario for operating time) a. Electronic computers (server computers excluding blade system) Operating time [h] = 24 [h/d] x 365 [d/y] x Use period [y] b. Magnetic disk units (subsystem) Operating time [h] = 24 [h/d] x 365 [day/year] x Use period [y] c. File storage unit Operating time [h]=24 [h/d] × 365 [d/y] × Use period [y] d. Tape array unit Operating time [h] = (Backup active hours per day [h/d] + Backup inactive hours per day [h/d]) × 365 [d/y] × Use period [y] e. …. ✓ Scenarios for "Optical character reader (OCR)" ,"Automatic teller machines (ATM)", "Switching equipment (L2 switch)", "PON equipment (ONU)", "Electronic switching equipment" are provided in same ways.

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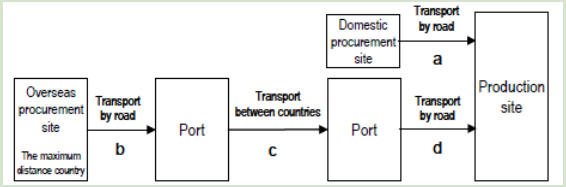
Downstream scenarios (3)

■PCRs and sector guidelines' descriptions

Existing PCR	Description
IT Equipment (Japan)	(Continued from previous slide) • Transportation → Annex D. a. Raw material acquisition stage



Japan-specific scenarios

	Distance	Means
a/b/d	500km	10-ton truck, loading ratio: 50%
c	Transport distance from "a country whose transport distance is the maximum among all the countries of raw materials procured" to the domestic country	Container ship (4,000 TEU or less)

Same kind of transportation scenarios are applied to transportation in other lifecycle stages.

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Downstream scenarios (4)

■PCRs and sector guidelines' descriptions

Existing PCR	Description
IT Equipment (Japan)	(Continued from previous slide) • EOL → Annex E. a. Used IT equipment (body/accessories) are disassembled and crushed for recycling preparation. In this case, mass of used IT equipment to be disassembled/crushed are set as follows, respectively. ✓ Mass of used IT equipment to be disassembled is assumed as mass of used IT equipment (body/accessories) ✓ Mass of used IT equipment to be crushed is assumed as mass of used IT equipment (body/accessories) b. Materials disassembled and crushed will be then recycled (e.g., refining, etc.) or landfilled. In this case, recycling process (refining, etc.) shall be excluded from the assessment, and mass of landfilled materials not to be recycled shall be specified by using the following equitation: ✓ Mass of landfilled materials not to be recycled = Mass of used IT equipment (body, accessories) x (1 - Recycling ratio) ✓ Recycling ratio here shall be specified by business by quoting from literature or statistical data, etc. (its validity shall be verified). If it is difficult to set a recycling ratio, recycling ratio may be set as 0 % (= assumed that all materials are landfilled).

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Downstream scenarios (5)

■PCRs and sector guidelines' descriptions

Existing PCR	Description
PCR Basic Module ver. 2.0 (Sweden)	• No specific scenarios are provided.
Personal computer (Korea)	• In transportation phase, Standard Air Freight and Maritime Travel Distances Table for both domestically and from overseas is given. [Appendix B] • In use phase, the ratio among daily under off mode, sleep mode, and idle mode, and the lifespan are given. [COOL21] • In End of Life phase, as regards to the recycling rates for items of which recycling is obligatory, usage of the minimum mandatory recycling rates for individual products and packaging materials defined by the Ministry of Environment is assigned.[5.3.1.1.4]
Sector guidelines	• No specific scenarios are provided.

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Downstream scenarios (6)

■Conclusion

- While "IT equipment"(Japan) and "Personal computer"(Korea) provide some downstream scenarios,
- Many of them are specific to Japan or Korea, or not specific to storage.

→ We should gather more information to develop scenario, which is specific to Europe market and storage.

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Relevant impact categories (1)

■ **Requirements**

Requirements for PEFCR (PEF Guide)
- PEFCRs shall specify and justify any exclusion of the default EF impact categories, especially those related to the aspects of comparability.

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Relevant impact categories (2)

■**PCRs and sector guidelines' descriptions**

Existing PCR	Description
IT Equipment (Japan)	• No guidance on exclusion of the default EF impact categories (Treated carbon (GHG) only)
PCR Basic Module ver. 2.0 (Sweden)	• No guidance on exclusion of the default EF impact categories
Personal computer (Korea)	• No guidance on exclusion of the default EF impact categories (Treated carbon (GHG) only)
ETSI/ TS 103 199 General guidance only	• For other impact categories there is no methodological consensus in the LCA community, thus the practitioner shall decide which impact categories to consider and how to calculate them, based on the studied ICT product system and purpose of the LCA study.
ITU-T/L.1410	• No guidance on exclusion of the default EF impact categories (Treated carbon (GHG) only)
IEC/TR 62725	• No guidance on exclusion of the default EF impact categories (Treated carbon footprint only)
GHG protocol	• No guidance on exclusion of the default EF impact categories (Treated carbon footprint only)

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Relevant impact categories (3)

■**Conclusion**

- No PCRs or sector guidelines provide guidance on exclusion of the default EF impact categories

→ We have to consider this guidance from "scratch".
→ "PEF screening" will be important process to consider "exclusion of the default EF impact categories" quantitatively.

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Conclusions

A) Are there any PCRs which meet criteria of PEF guide perfectly?

No.

- While we found following PCRs and sector guidelines, which include helpful information to develop "storage" PEFCR,
  - *IT equipment(Japan)*
  - *PCR Basic Module ver. 2.0 (Sweden)*
  - *Personal computer (Korea)*
  - *ETSI/ TS 103 199*
  - *ITU-T/L.1410*
  - *IEC/TR 62725*
  - *GHG protocol ICT sector guidance*
- All of them fall short of full compliance with PEF guide requirements.

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Conclusions

B) *(If No for A)* Which criteria of PEF guide are NOT met by existing PCRs ?

➡ Particularly, the following criteria;

- Data quality requirement
- Generic data collection
- Allocation rules
- Downstream scenarios
- Relevant impact categories

The items above are most significant ones.
We have other items to discuss to draft PEFCR such as;
- How to treat land use change impacts in PEFCR
- …

✓ These discussion points to meet PEF guide are also potential opportunity to improve PEF guide.

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Conclusions

C) Which PCRs provide helpful information to draft PEFCR, regarding the criteria of PEF guide?

➡ Following information;

- Unit of analysis → ETSI's guidance
- System boundary → "IT equipment" and ETSI's guidance
- System diagram → "IT equipment" and GHG protocol's diagram
- Specific data collection → "IT equipment" and ETSI's guidance on "for which processes specific data shall be collected"
- Downstream scenarios → "IT equipment" 's way of scenario setting

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Summary

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Summary of the study (1)

1. We have found existing PCRs and sector guidelines which cover "storage" and include applicable information to a PEFCR,
   - *IT equipment(Japan),*
   - *PCR Basic Module ver. 2.0 (Sweden),*
   - *Personal computer (Korea),*
   - *ETSI/ TS 103 199,*
   - *ITU-T/L.1410,*
   - *IEC/TR 62725, and,*
   - *GHG protocol ICT sector guidance,* but,
2. As none of them comply fully with the PEF guide requirements, we have to develop "storage" PEFCR, filling with the gaps between existing PCRs and PEF guide, such as;
   - Data quality requirement ,
   - Requirements on generic data collection,
   - Allocation rules,
   - Downstream scenarios, and,
   - Selection of relevant impact categories.

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Summary of the study (2)

3. We have to gather more information and utilize our findings from “PEF screening” in the next step to fill the gaps, and,

4. We would like our stakeholders to help gathering information (such as scenarios in EU) and conducting “PEF screening” (if possible).

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and

Japan Environmental Management Association for Industry (JEMAI)

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Annex C Stakeholder comments and answers

0	1	2	3	4	5	6	7	8	Technical Secretariat Comments	
Affiliation	**No**	**Page**	**Line number**	**Clause No./ Subclause No./ Annex** (e.g. 3.1)	**Paragraph/Figure/ Table/ Note** (e.g. NOTE1)	**Type of comment**[1]	**Comment**	**Change proposed**	**Change accepted, partially accepted or rejected?**	**Justification for acceptance, rejection or partial acceptance**
Bureau Veritas CODDE	1	21	423	Annex 1	table (generic bill of materials)	te	The integrated circuits will certainly be the cause of significant environmental impacts, and available technologies can have very different impacts. Therefore it would be interesting to have a more precise definition	Differentiation between silicon and gallium arsenide based components Differentiation of the different packagings (PBGA, LQFP, SSOP,etc.)	partially accepted	We will insert the differentiation into the BOM based on granularity of datasets on DBs.
Bureau Veritas CODDE	2	21	423	Annex 1	table (generic bill of materials)	te	The actual BOM doesn't take into consideration the solder paste. That past can cause non negligeable impacts, mainly on the abiotic depletion indicator, as it can contain silver	Addition of solder paste to the BOM	noted	In our PEFCR, we will set a rule that collecting specific data in downstream parts level e.g. PCB is enough for calculation because we would like the PEFCR to be as feasible for practitioners as possible. Thinking along this idea, we expect that we can erase some upperstream parts from our BOM, and production process of solder paste, as same as these upperstream parts e.g. capacitor and resistor, will be considered inside boundaries of downstream parts's secondary data.
Bureau Veritas CODDE	3	21	423	Annex 1	table (generic bill of materials)	te	The actual BOM doesn't take into consideration the printed circuit board finishing (gold, copper, HAL...). The use of rare material can have an important impact on the abiotic depletion indicator	Addition of PCB finishing to the BOM	noted	Similar to our reply to the comment No.2, we recognize that PCB finishing is inside the boundary of PCB's secondary data.
Bureau Veritas CODDE	4	21	423	Annex 1	table (generic bill of materials)	te	There are different kinds of printed circuit boards with different environmental impacts. Therefore it would be interesting to have a more precise definition	Differentiation between the number of layers Differentiation between the types of substrate (CEM1, FR4, etc.)	partially accepted	We will insert the differentiation into the BOM based on granularity of datasets on DBs.
Bureau Veritas CODDE	5	21	423	Annex 1	table (generic bill of materials)	te	There are different kinds of capacitors and resistors (SMD or not, tantale, electrolytic, etc.) with various impacts. It would be interesting to have a more precise definition of these components	Differentiation between the types of resistors and capacitors	noted	As mentioned in our reply to the comment No.2, we expect that we can erase capacitor and resistor from our BOM and these parts will be evaluate within boundaries of downstream parts's secondary data.
Bureau Veritas CODDE	6	10	205	6.2	System diagram	te	In the disposal & recycling stage, the special end of life treatment (seolt) of specific components (as defined in the WEEE directive (2012/19/UE), annex VII) should be specified as it can cause significant impacts	Addition of this step to the diagram	noted	We will consider this issue throughout PEF screening, in conjunction with other EoL process e.g. refurbishment.

0	1	2	3	4	5	6	7	8	Technical Secretariat Comments	
Affiliation	**No**	**Page**	**Line number**	**Clause No./ Subclause No./ Annex** (e.g. 3.1)	**Paragraph/Figure/ Table/ Note** (e.g. NOTE1)	**Type of comment**[1]	**Comment**	**Change proposed**	**Change accepted, partially accepted or rejected?**	**Justification for acceptance, rejection or partial acceptance**
Bureau Veritas CODDE	7	21	439	Annex 1		te	Transportation scenario: conservative generic data should be set in case no specific data is available.	The PEP ecopassport program generic data could be used: -Worldwide transport (intercontinental): 19000 km by ship plus 1000 km by truck -Intracontinental transport: 3500 km by truck -Local transport: 1000 km by truck	accepted	The stated scenario will be applied.
Bureau Veritas CODDE	8	21	448	Annex 1		te	Use phase scenario: different functioning modes should be taken into consideration, e.g. on, off, stand-by, etc.	Addition of different functioning modes and definition of their power consumption and time distribution over the life span of the product.	noted	It depends on unit of analysis setting which is still under discussion and will be considered throughout PEF screening with reference to general power measurement methodologies.
Bureau Veritas CODDE	9	21	455	Annex 1		te	End of life: the special end of life treatment (seolt) of specific components (as defined in the WEEE directive (2012/19/UE), annex VII) should be specified as it can cause significant impacts	Addition of a list of the concerned materials and component	noted	We will consider this issue throughout PEF screening, in conjunction with other EoL process e.g. refurbishment.
Alcatel-Lucent	10	10		6.2	System diagram		Please consider including "Packaging materials" and "Production of Packaging materials" as input / processes in the "Production Stage". They can contribute significantly to the system.		rejected	"Packaging materials" and "Production of Packaging materials" are already existing in the "Raw material acquisition stage". Showing us adequacy in detail to move these into "Production Stage" would be appreciated.
Alcatel-Lucent	11	10		6.2	System diagram		Please consider including "Repair of IT equipment" in the "Use & maintenance stage". Its output would loop back into the "Use" process. Also for the Repair process, an input would be "Parts, accessories" and an output would be "Wastes".		noted	The significance of the process depends on failure rate of e.g. HDD. We will consider this issue throughout PEF screening, in conjunction with maintenance process.
Alcatel-Lucent	12	10		6.2	System diagram		Why is "Maintenance" not included? This can contribute significantly to the "Use" stage.		noted	We will consider this issue throughout PEF screening.
Alcatel-Lucent	13	10		6.2	System diagram		In the "Disposal & recycling stage" why is "Recycling" excluded? This will contribute significantly to the overall impact of this stage as well as affecting the other stages.		accepted	"Recycling"will be included.

0	1	2	3	4	5	6	7	8	Technical Secretariat Comments	
Affiliation	**No**	**Page**	**Line number**	**Clause No./ Subclause No./ Annex** (e.g. 3.1)	**Paragraph/Figure/ Table/ Note** (e.g. NOTE1)	**Type of comment**[1]	**Comment**	**Change proposed**	**Change accepted, partially accepted or rejected?**	**Justification for acceptance, rejection or partial acceptance**
Alcatel-Lucent	14	20		Annex I			why are the BOM materials limited to just the "electronic" components category level? Wouldn't it be necessary to have a further breakdown of these electronic components and include their materials such as precious / semi-precious metals, rare / rare earth metals, as well as organics / inorganics, ceramics, etc.?		noted	We will consider this issue throughout PEF screening. Though, in our understanding, it is not feasible for storage makers to collect data in material level. And we recognize that production processed of such materials are included in the boundary of secondary datasets which represent production processes of electric parts.
Huawei Technologies		10		6.2		te	Surely "Recycling" cannot be out of the scope of the PEFCR of IT Equipment. This is contradicts both the PEF Guide and especially ETSI TS 103 199 LCA technical specification and also ITU L1410 LCA Recommendation. Effect of including recycling is expected to provide significant impact in the Resource Depletion mid-point impact category for the IT Equipment containing metals with relatively high Resource Depletion mid-point impact indices.	Include Raw Material Recycling in the compulsory processes in the product system studied.	accepted	"Recycling"will be included.
Huawei Technologies						ge	The present work should closely monitor the work done by ETSI/ITU who standardize jointly Full LCA of ICT Goods. Align the PEFCR with the ETSI/ITU work.		accepted	We will closely monitor the ETSI/ITU's work to refrect our effort.

1 Type of comment: ge = general te = technical ed = editorial