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**INTERNATIONAL ELECTROTECHNICAL COMMISSION**

**TECHNICAL COMMITTEE No. 111: ENVIRONMENTAL STANDARDIZATION FOR ELECTRICAL AND ELECTRONIC PRODUCTS AND SYSTEMS**

**TC 111 AHG 13 - Study report for POSSIBLE CIRCULAR ECONOMY  
STANDARDIZATION WITHIN TC 111**

Please find attached the AHG 13 final report kindly provided by AHG 13 itself for information.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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## **Study report for POSSIBLE CIRCULAR ECONOMY STANDARDIZATION WITHIN TC 111**

AHG 13 of IEC TC111 has prepared this study report.

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## 1 INTRODUCTION

The European Union (EU) and China introduced the concept of circular economy (CE) as a solution that will allow society to reduce harm to the environment and to close the loop of the product lifecycle.

Circular economy is an economic system that represents a change of paradigm in the way that human society is interrelated with nature and aims to prevent the depletion of resources, close energy and materials loops, and facilitate sustainable development through its implementation at the micro (enterprises and consumers), meso (economic agents integrated in symbiosis) and macro (city, regions and governments) levels (Vanessa Prieto-Sandoval, et al (2017). Attaining this circular model requires cyclical and regenerative environmental innovations in the way society legislates, produces and consumes.

Circular economy entails gradually decoupling economic activity from the consumption of finite resources and designing waste out of the system. Underpinned by a transition to renewable energy sources, the circular model builds economic, natural, and social capital. It is based on three principles: Design out waste and pollution, Keep products and materials in use and Regenerate natural systems (Ellen MacArthur Foundation,2017).

The Circular Economy in the EU aims at establishing a program of action to close the loop of product life cycles, i.e., when a product reaches the End-of-Life stage, its materials are kept within the economy so that 'waste' is transformed into a resource (EU COM (2015)). To be specific, the program of action includes:

- ✓ To support to raise global awareness on Circular Economy Policy
- ✓ To consider the needs for publishing the globally harmonized standard on Circular Economy (including timely transition to global level)

Other parts of the world beside the EU including China, Japan and Korea are known to promulgate regulations, laws and standards on circular economy. Although no explicit information of CE was available from other regions such as North and South America, those regions also are equipped with regulations, laws and standards on CE.

To attain the goal of CE, electrical and electronic equipment (EEE) sectors focus on standardization regarding material efficiency (ME). Therefore there is a strong need for understanding the international standardization works on ME of EEE in the EU and outside EU. Based on this understanding, we should explore a possibility of harmonization of standards related to ME of EEE in IEC/TC 111.

Specific aspects of EEE related to material efficiency of EEE includes: durability; ability to repair; facilitate re-use, use or re-used components; ability to re-manufacture; recyclability; recoverability; recycling; use of recycled materials; use of critical raw materials; recyclability of critical raw materials; documentation and/or marking regarding information relating to material efficiency of the product.

The goal of this study report is to deliver recommendation(s) to IEC/TC 111 as to the areas of CE related standardization. In order to achieve this goal, current standards and standardization activities (developed, under development, or under consideration) related to CE in the EU and outside EU are gathered and organized according to a set of criteria. The organized standards are then analysed in order to identify priority areas for future standardization.

## 54 2 Regulations, programs and standards related to CE/ME in the European 55 Union

56 Waste management is one of the major issues related to CE. Operators in the recycling chain use the  
57 European standards (EU COM M/518) in order to be able to verify compliance with the requirements  
58 in the standard(s).

59 In 2015 the European Commission requested the European standardization committees CEN,  
60 CENELEC and ETSI to jointly draft new European standards and other standardisation  
61 deliverables on Ecodesign requirements related to Material Efficiency Aspects of energy-  
62 related products. This standardization request (EU COM M/543) has the objective to support  
63 the implementation of the Ecodesign Directive (EU directive 2009/125/EC).

64 It is expected that the increased focus on material and resource efficiency aspects in the  
65 application of the Ecodesign Directive 2009/125/EC should make a sizeable contribution to  
66 the transition towards a more circular economy by making consumer goods more durable,  
67 resource-efficient and recyclable.

68 This standardisation request covers three main aspects of the material efficiency, namely:

- 69 ✓ Extending product lifetime
- 70 ✓ Ability to re-use components or recycle materials from products at end-of-life and
- 71 ✓ Use of re-used components and/or recycled materials in products.

72  
73 In September of 2016, a technical body was set up to undertake the development of the  
74 requested deliverables. It is called joint CEN-CENELEC Committee JTC10. The CEN-  
75 CLC/JTC 10 has created 6 Working Groups that are responsible for the development of the  
76 standardisation deliverables:

- 77
- 78 ✓ WG 1 'Terminology'
- 79 ✓ WG 2 'Durability'
- 80 ✓ WG 3 'Upgradability, Ability to repair, Facilitate Re-Use, Use or re-used components'
- 81 ✓ WG 4 'Ability to re-manufacture'
- 82 ✓ WG 5 'Recyclability, recoverability, RRR index, Recycling, Use of recycled materials'
- 83 ✓ WG 6 'Documentation and/or marking regarding information relating to material  
84 efficiency of the product'

85  
86 Regulations and programs related to EEE in the EU are listed in Table 1.

87 Table 1 – Regulations and programs in the EU

Regulation	Eco-Design directive (2009/125/EC) Standardization Request M/543 on Material efficiency ( <a href="http://ec.europa.eu/growth/tools-databases/mandates/index.cfm?fuseaction=search.detail&amp;id=564">http://ec.europa.eu/growth/tools-databases/mandates/index.cfm?fuseaction=search.detail&amp;id=564</a> ) Energy Labelling Regulation (2017/1369/EU), WEEE Directive (2012/19/EU), RoHS Directive (2011/65/EU), REACH regulation (2006/1907/EC)
Program	Circular Economy Package ( <a href="http://www.europarl.europa.eu/RegData/etudes/BRIE/2017/599288/EPRS_BRI%282017%29599288_EN.pdf">http://www.europarl.europa.eu/RegData/etudes/BRIE/2017/599288/EPRS_BRI%282017%29599288_EN.pdf</a> ) Plastics Strategy ( <a href="http://ec.europa.eu/environment/circular-economy/pdf/plastics-strategy.pdf">http://ec.europa.eu/environment/circular-economy/pdf/plastics-strategy.pdf</a> ) CRM Lists and Strategy ( <a href="http://ec.europa.eu/growth/sectors/raw-materials/specific-interest/critical_en">http://ec.europa.eu/growth/sectors/raw-materials/specific-interest/critical_en</a> )

88

89 Specific aspects of material efficiency related to EEE in the EU are shown in Table 2.

Table 2 – Specific aspects of material efficiency of EEE in the EU standards

Specific aspects	Regulation	Standard	Target Products
Durability	2009/125/EC	prEN45552	Energy-related Products*
Ability to repair	2009/125/EC and product specific Implementing Measures	prEN45554	Energy-related Products
Facilitate re-use, use or re-used components	2009/125/EC and product specific Implementing Measures	prEN45554, prEN45556	Energy-related Products
Ability to re-manufacture	2009/125/EC and product specific Implementing Measures	prEN45553	Energy-related Products
Recyclability,	2009/125/EC and product specific Implementing Measures	prEN45555	Energy-related Products
Recoverability	2009/125/EC and product specific Implementing Measures	prEN45555	Energy-related Products
Use of recycled materials (recycling)	2009/125/EC and product specific Implementing Measures	prEN45557	Energy-related Products
Use of CRM	2009/125/EC and product specific Implementing Measures	prEN45558	Energy-related Products
Recyclability of CRM	2009/125/EC and product specific Implementing Measures	prEN45555	Energy-related Products
Documentation and/or Marking related to ME	2009/125/EC and product specific Implementing Measures	prEN45559	Energy-related Products
Waste management	WEEE Directive (2012/19/EU)	EN50419 EN 50625-1 EN 50625-2-1 EN 50625-2-2 EN 50625-2-3 EN 50625-2-4 TS 50625-3-1 TS 50625-3-2 TS 50625-3-3 TS 50625-3-4 TS 50625-3-5 TS 50625-4 TS 50625-5 TR 50625-6 EN 50614	EEE in general
Hazardous Substances	RoHS Directive (2011/65/EU), REACH regulation (2006/1907/EC,	EN 50581, IEC/EN 63000, IEC/EN-62321-series, IEC/EN 62474	EEE
Eco Design	2009/125/EC	IEC 62430	EEE

91 \* Energy-related Products are products which use energy, or do not use energy but have an  
 92 indirect impact on energy consumptions, such as water using devices, building insulation  
 93 products and windows, etc.

94

### 95 3 Regulations, programs and standards related to CE/ME in China

96 China Circular Economy targets reducing, reusing and recycling activities conducted in the  
 97 process of production, circulation and consumption. Each activity has its own target, e.g.,  
 98 material, product, components, and packaging, among others. The regulations and standards  
 99 in China are focused on specific products and product groups.

100 Regulations and programs related to EEE in China are listed in Table 3.

101 Table 3 – Regulations and programs in China

Regulation	Cleaner Production Promotion Law Circular Economy Law of the People's Republic of China Made in China 2025 strategy
Program	Pilot project of circular economy National circular economy pilot catalogue Green-design product, Green plant, Green supply chain and Green industrial park catalogue

102

103 Specific aspects of material efficiency of EEE related to the standards in China are shown in  
 104 Table 4.

105 Table 4 – Specific aspects of CE of EEE in the Chinese standards

Specific aspects	Regulations or standards	Target User	Target product
Facilitate re-use, use or re-used components	Guideline for the assessment on the reuse and recycling system of waste EEE	Recycler, Third party etc.	WEEE
Ability to re-manufacture	General specification for remanufacturing of waste copiers, printers and duplicators	Remanufacturer	Waste copiers, printers, duplicators
Recyclability	Recyclability rate assessment of the EEE	Manufacturer	Room air conditioners and household refrigerators Washing machines, TV and computers Copier and printer Small and medium three-phase asynchronous motor
Recoverability	General technical specifications of recovering for waste EEE	Manufacturer and recycler	WEEE
Use of recycled materials (Recycling)	<WEEE recycling (general)> Guide for pollution control of WEEE take-back and treatment	Recycler, third party	WEEE
	<WEEE recycling (product specific)> Guide for resources utilization of WEEE recycler	Recycler, third party	WEEE

Specific aspects	Regulations or standards	Target User	Target product
	Technical specifications to resources utilization evaluation	Recycler, third party	Waste TV; Waste refrigerator
	Requirement on WEEE recycling for the following types of EEE	Manufacturer and recycler	PC, Notebook, Printer, Copy Machine, PDP, LCD and CRT TV and their display
	Requirements of disassembly and treatment for waste EEE	Manufacturer and recycler	Small IT equipment and Mobile Phones, appliances containing refrigerants
Material efficiency*	Guidance on material efficiency considerations in environmentally conscious design of electrical and electronic products	Manufacturer	EEE
Documentation and/or marking related to ME	WEEE recovery - Terminology End of life information exchange for EEE between manufacturers and recyclers	Manufacturer and recycler	WEEE
Waste management	Regulations on Waste Electrical and Electronic Equipment, Order No. 551, 2008	Manufacturer	EEE
Hazardous Substances	Requirements of concentration limits for certain restricted substances in EEE  Determination of six regulated substances (RoHS regulated)	Manufacturer	EEE
Ecodesign	General principles of ecological design product evaluation  General assessment principles for electrical and electronic eco-design products  Guidelines for recoverable material selection of EEE  Guide of design for recycling of EEE	Manufacturer	EEE
	Green Manufacturing System Building-EEE Eco-design association standards  Technical Specification of the product assessment of eco-designed EEE	Manufacturer	Air conditioner, Washing machine, Household refrigerator, Cooker hood, Household induction cooker, Electric cooker, Water storage water heater, Air purifier, Induction cooker for commercial use, Commercial kitchen refrigerator, Commercial electric water heater, Electronic toilet, Lead acid battery, Optical, network terminal, Ethernet switch, Electric kettle, Floor sweeping robot, Fresh air system, Smart toilet lid, Indoor heater, Lithium battery, Printer and multifunction integrated machine, TV set, PC, Tablet PC, Mobile communication terminal



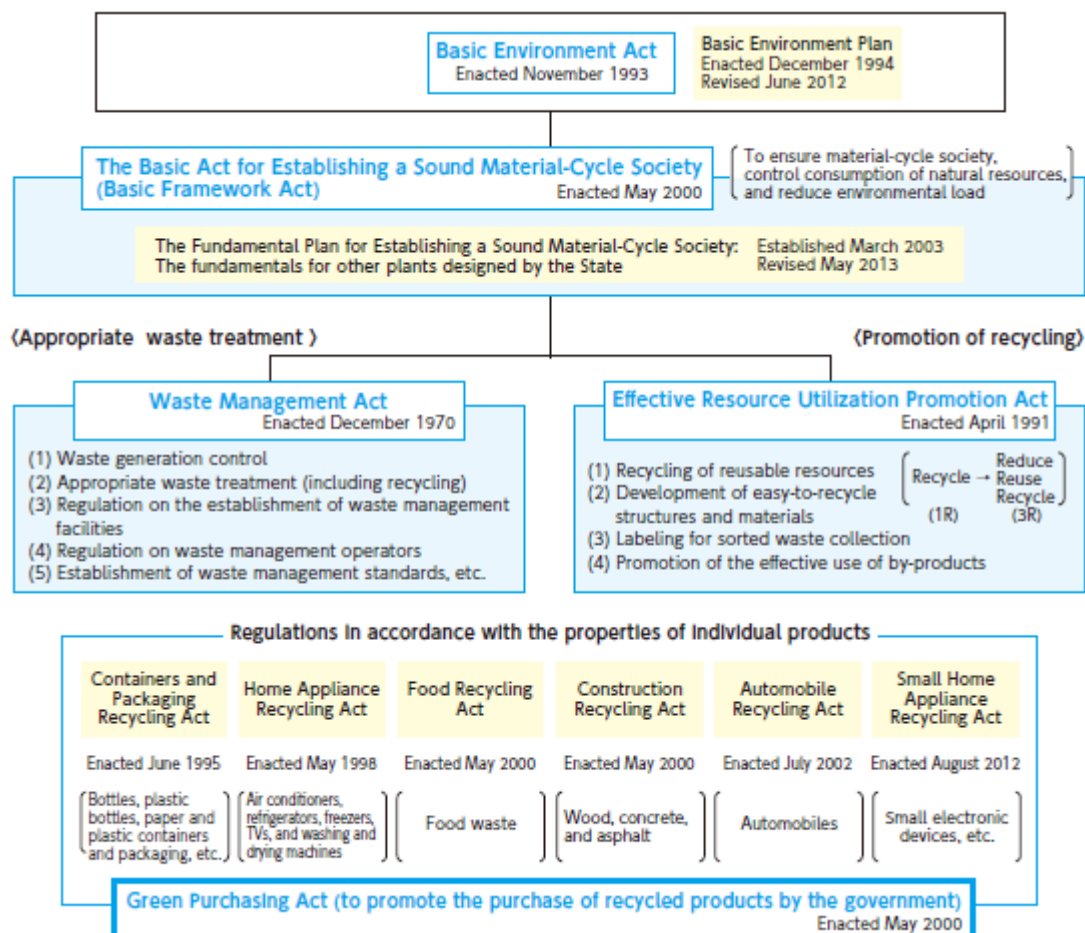
Specific aspects	Regulations or standards	Target User	Target product
CE product	General principle for circular economic assessment of EEE	Manufacturer	WEEE

106

#### 107 4 Regulations, programs and standards related to CE/ME in Japan

108 The Law for Promotion of Effective Utilization of Resources designates specific industries and  
 109 products (10 industries/69 products in total) requiring efforts towards 3R, and defines  
 110 voluntary efforts to be taken. The latter is termed standards of judgment (SJ), which is  
 111 voluntary in nature; however, if the compliance efforts of businesses are significantly  
 112 insufficient in light of the standards of judgment, official recommendations, proclamations, or  
 113 orders will be issued and penalties apply if an order is violated. The Law also stipulates 3R  
 114 measures taken at the product's manufacturing stage, consideration for 3R at the design  
 115 stage, labelling for selected waste collection, voluntary collection by manufacturers, and  
 116 development of the recycle system.

117 Figure 1 shows the legal framework related to waste managements and 3R. The detailed version of a  
 118 Sound Material-Cycle Society in Japan and related legal systems for EEE are shown in Annex  
 119 B.



120

121 Figure 1 – Japanese framework of legal system related to waste managements and 3R

122 Target industries and products related to EEE are:

- 123 – Designated resource-reusing industries (5 in total): industries that should use recycled  
 124 resources/parts as raw materials. For instance, the copy machine manufacturer should  
 125 increase volume of recycle parts used (use of recycled parts)

- 126 – Specified resource-saving products (19 in total): products such as air conditioner that  
 127 should be designed to save resources and have longer service life. For instance, air  
 128 conditioner should adopt highly durable components and provide repair opportunities to  
 129 consumers (durability, ability to repair)
- 130 – Specified reuse-promoted products (50 in total): products that should be designed to be  
 131 easily reused/recycled. For instance, TV should reduce the number of screws to remove  
 132 parts easier and display the name of synthetic resin (Facilitate re-use, use or re-used  
 133 components, and marking)
- 134 – Specified resource-recycled products (2 in total): products that require business operators  
 135 to undertake self- collection /recycling. For instance, PC and compact secondary battery  
 136 manufacturers and importers should collect used products with various target-recycling  
 137 rates (Recycling)

138 Regulations and programs related to EEE in Japan are listed in Table 5.

139 Table 5 – Regulations and programs in Japan

Regulation	<p>Basic law on establishing a sound material-cycle society (Basic principles: 3R, thermal recovery, appropriate disposal)</p> <p>Law for the promotion of effective use of resources (Promotion of 3R activities)</p> <p>Waste management and public cleansing law (Appropriate waste treatment)</p> <p>Small electric devices recycling law (small electric devices)</p> <p>Containers and packaging material recycling law</p> <p>Home appliances recycling law (air conditioner, refrigerator/freezer, TV, washing machine/dryer)</p> <p>Special measures for using rare metals in small electrical devices (part of the waste management and public cleansing law)</p>
Program	Promotion of recycling of small household appliance for Tokyo 2020 Olympic medals to be created by urban mine*

140

141 Table 6 shows specific aspects of material efficiency of EEE related to the standards in Japan.

142 Table 6 – Specific aspects of material efficiency of EEE in the Japanese standards

Specific aspects	Regulations or standards	Target user	Target product
Durability, Ability to repair (Designed to save resources and have longer service life)	SJ* Voluntary initiatives**	Manufacturer	Home appliances***, PC, Copying machines (multifunction devices)
Facilitate re-use, use or re-used components	SJ Voluntary initiatives	Manufacturer	Home appliances, PC, Copying machines (multifunction devices), Devices using compact rechargeable batteries
Ability to re-manufacture	Voluntary initiatives	Manufacturer	Copying machines (multifunction devices)
Recyclability Recoverability	SJ Voluntary initiatives	Manufacturer	Home appliances, PC, Copying machines (multifunction devices)
Use of recycled materials (Recycling)	SJ	Manufacturer	PC, compact rechargeable battery

Specific aspects	Regulations or standards	Target user	Target product
	SJ Voluntary initiatives	Manufacturer	Copying machines (multifunction devices)
	Home Appliance recycling law JIS C 9911 - Calculation and display methods of recycled and reuse indicator of EEE	Manufacturer	Air conditioner, Refrigerator/freezer, TV sets, Washing machine and Clothes dryers
	Small electric devices recycling law	Manufacturer	Small electric devices
Use of CRM	Special measures for using rare metals in small electrical devices (part of the waste management and public cleansing law)	Manufacturer	Small electric devices
Recyclability of CRM	Voluntary initiatives (pilot projects)	Manufacture and recycler	e.g. Neodymium magnets used in air conditioner
Documentation and/or marking related to ME	JIS C 9912 - The marking for identification of plastic parts for EEE	Manufacturer	Home appliances
Waste management	Waste management and public cleansing law	Manufacturer and recycler	WEEE, all types of waste
Hazardous Substances	Voluntary initiatives JIS C 0950**** -The marking for presence of the specific chemical substances for electrical and electronic equipment	Manufacturer	EEE

143

## 144 **5 Regulations, programs and standards related to CE/ME in Korea**

145 There are three major issues related to CE/ME of EEE in Korea. They are structure, recycling  
146 and management system issues of EEE.

147 Structure related issues are:

148 Easy separation, use of general tool for separation, joint type, disassembly time, easy access  
149 to components, less weight and miniaturization of the EEE and unifying the packaging  
150 materials.

151 Recycling related issues are:

152 The number of material types, use of labels and stickers, using recycled plastic, plastic  
153 material indication, using recyclable plastic and using synthetic resins in package materials

154 Management System related issues are technology development efforts to trigger recycling,  
155 eco-friendly design, considering environmental stress process, providing recycling information  
156 and enhancing activities based on the advice.

157 Table 7 shows regulations related to the standard, programs and type of products in Korea.

158

Table 7 – Regulations and programs in Korea

Regulation	Transition towards the environmentally friendly industrial structure Act facilitating transition towards the environmentally friendly industrial structure  Resource circulation of EEE Act for resource circulation of EEE and automobiles
Program	Certification system of the quality of the remanufactured products  Assessment system for enhancing the materials and structure of EEE

159 Table 8 shows specific aspects of material efficiency of EEE related to the standards in Korea.

160 Table 8 – Specific aspects of material efficiency of EEE in the Korean standards

Specific aspects	Regulations or standards	Target user	Target product
Facilitate re-use, use or re-used components	Act for resource circulation of EEE and automobiles	Manufacturer	EEE and automobiles
Ability to re-manufacture	Quality certification criteria for the remanufactured products	Remanufacturer	All remanufactured products including EEE
Recyclability Recoverability	KS C (IEC/TR 62635)	Manufacturer	EEE
Use of recycled materials (Recycling)	Act for resource circulation of EEE and automobiles	Manufacturer	EEE and automobiles
Waste management	WEEE	Manufacturer and recycler	EEE
Hazardous Substances	RoHS	Manufacturer	EEE

161

## 162 6 IEC standards and specific aspects of material efficiency of EEE related to 163 its standards

164 There are two IEC standards related to material efficiency of EEE. They are: IEC/TR 62824  
165 "Guidance on Material Efficiency of EEE" and IEC/TR 62535 "Guidelines for end-of-life  
166 information provided by manufacturers and recyclers and for recyclability rate calculation of  
167 electrical and electronic equipment".

## 168 7 Analysis and Discussion of the international standardizations related to 169 CE/ME of EEE

170 Tables 1 to 8 lists collected information about the current status of international  
171 standardization related to CE/ME of EEE. This information was analysed with respect to  
172 specific aspects of ME. Based on the participation of membership of AHG13, three countries  
173 and one region have provided information including China, Japan, Korea and the EU.  
174 Information from the rest of the IEC member countries is insufficient to warrant analysis.

175 Specific aspects of ME for EEE are major environmental attributes of EEE. Long before the  
176 introduction of the CE/ME program in the EU in 2015 those environmental aspects have been  
177 integral parts for consideration in the design, manufacture, distribution, use and end-of-life of  
178 EEE not only in the EU but also other parts of the world. However, the CE/ME program  
179 triggers proliferation of the material efficiency issue in the electric and electronics industries.

180 In particular, standardization on the specific aspects of ME for EEE by JTC10 in the EU draws  
181 attention from the governments, industries and standardization bodies.

182 Table 9 shows twelve specific aspects of ME for EEE considered in the regulations and  
183 standards of the three countries and the EU.

184 Table 9 –Specific aspects of ME for EEE considered in the standards

Specific aspects	EU	China	Japan	Korea
Durability	v		v	
Ability to repair	v		v	
Facilitate re-use, use or re-used components	v	v	v	v
Ability to re-manufacture	v	v	v	v
Recyclability	v	v	v	v
Recoverability	v	v	v	v
Use of recycled materials (Recycling)	v	v	v	v
Use of CRM	v		v	
Recyclability of CRM	v		v	
Documentation and/or marking related to ME	v	v	v	
Waste management	v	v	v	v
Hazardous substances	v	v	v	v
ECD	v	v	v	v

185

186 The following eight specific aspects of ME are common aspects among the analysed  
187 standards. As the most extensive standardization work on ME is currently done in the EU, see  
188 Annex A for further information for bullet point 1 to 5

189 1. Facilitate re-use or re-used components

190 2. Ability to re-manufacture

191 3. Recyclability

192 4. Recoverability

193 5. Use of recycled materials (Recycling)

194

195 Each country has its own waste management standards available for bullet point 6. European  
196 Standards such as EN 50625 series and EN 50614 will be offered by CLC to IEC (Dresden  
197 Agreement).

198 6. Waste management

199

200 International standards such as IEC 63000, IEC 62321 and IEC 62474 are available for bullet  
201 point 7.

202 7. Hazardous substances

203

204 International standard IEC62430 is available for bullet point 8. ECD standard covers ME  
205 aspects but does not address circularity aspects in detail.

206 8. ECD

207

208 When addressing specific ME aspects in international standardization, it is desirable to  
209 consider five specific aspects as a minimum (See above bullet point 1 to 5) and should avoid  
210 any duplicating work already done in IEC 62430.

211 In the context of circular economy, material efficiency needs to consider activities from cradle  
212 to cradle. The cradle-to-cradle consideration of material efficiency is equivalent to  
213 consideration of material circularity. Therefore, we suggest as AHG13 to use Material  
214 Circularity (MC) covering CE/ME aspect in an international standardization context.

215 Material Circularity involves activities from cradle to cradle. The amount of material loss  
216 determines the degree of circularity.

217 The ECD standard (IEC 62430) covers ME aspects but does not address Material Circularity  
218 aspects in detail. We suggest building a new concept of international standardization called  
219 Circularity Design. Circularity design should focus on material circularity in terms of  
220 minimizing material loss with respect to quality and quantity of a product and service in its  
221 entire life cycle stages.

## 222 **8 Recommendations to IEC/TC 111**

223 1. Develop a new standard focused on Circularity Design of EEE; principles,  
224 requirements and guidance.

225 - Consider IEC TRs (62824 and 62635), TC56 Dependability and any other  
226 relevant standards covering ME/CE aspects.

227 2. Follow up ME assessment topic using JTC10 standards (assessment methods for  
228 ME) and any other relevant international works for future consideration in TC111.

229 3. Pursue collaboration with ISO TC207 and evaluate collaboration with TC323  
230 including harmonization of terms and definitions and basic concepts of ME and  
231 CE

232 4. Disband AHG13.

233

234

## Annex A

### 235 **A.1 EU standards and standardization activities related to material efficiency** 236 **of EEE Deliverables**

237 TR45550 - Definitions related to material efficiency:

238 This Technical Report constitutes a collection of common terms used in deliverables prepared  
239 in accordance with Standardisation Request M/543. The purpose of such a collection is to  
240 provide a single definition for key terms used in different deliverables from the M/543  
241 standardization request.

242 The source of the terms and definitions can be documents developed under the M/543  
243 standardization request or any text referenced by such documents. Whenever possible, the  
244 proposed definitions are consistent with the ones given in European and International  
245 standards dealing with environmental aspects of products in scope of M/543.

246

247 TR45551 - Guide on writing product specific standardization deliverables:

248 (likely to be withdrawn)

249

250 EN45552 - Assessing the durability of ErPs:

251 This standard defines parameters and methods as a framework in order to assess the  
252 durability of ErPs. It is intended to be used in preparation of product-specific standardization  
253 deliverables or methods on durability assessment. The user of this standard can apply the  
254 outlined approach in order to determine the most applicable options for a durability  
255 assessment for their particular product group under normal services conditions.

256

257 EN45553 - Assessing ability to re-manufacture ErPs:

258 This standard provides a method for assessing energy-related products to facilitate  
259 remanufacturing. It identifies seven general process steps, which are crucial to the re-  
260 manufacturing process. Each of the seven steps is linked to several product properties of the  
261 energy-related product. Therefore, to assess the ability to re-manufacture an energy-related  
262 product these product properties that are linked to the re-manufacture process have to be  
263 assessed accordingly. Product specific technical committees shall use the herein presented  
264 general assessment methods to develop product specific standards.

265

266 EN45554 - Assessing ability to repair, reuse and upgrade ErPs :

267 This standard provides non product-specific parameters and methods relevant for ErPs to  
268 assess:

269 the ability to repair products

270 the ability to reuse products, or parts thereof,

271 the ability to upgrade products, excluding remanufacturing.

272

273 It also includes horizontal/generic parameters and methods relevant for assessing the ability  
274 to access or remove certain parts, accessories or consumables from products to facilitate  
275 repair, reuse or upgrading.

276 This standard is general in nature. It is not intended to be directly applied, but may be cited  
277 together with product specific or product group harmonized standards. It provides a  
278 framework to guide vertical standardization groups in the development of product group  
279 specific methods for assessing the ability of ErPs to be repaired, upgraded or prepared for re-  
280 use.

281 EN45555 - Assessing the recyclability and recoverability of ErPs:

282 To judge the recycling potential of an ErP in terms of how easy it is to recycle/recover  
283 materials from the product or to what extent a product can undergo recycling/recovery, the  
284 concepts of recyclability and recoverability are introduced/used.

285  
286 This document will elaborate on recyclability and recoverability in a horizontal, cross-product  
287 way. However, a correct assessment can only be done in a product-specific way, taking into  
288 account specific parameters of a specific product group. This standard defines a series of  
289 parameters that may be considered to calculate product specific recycling and recoverability  
290 rates.

291  
292 EN45556 - Assessing the proportion of re-used components in ErPs:

293 This standard provides a general methodology for assessing the proportion of re-used  
294 components in an ErP. Two calculation methods based on mass of re-used components and  
295 the number of re-used components are presented. While writing product specific standards on  
296 assessing the proportion of re-used components product specific technical committees shall  
297 apply the most suitable methods for their product group.

298  
299 EN45557 - Assessing the proportion of recycled content in ErPs:

300 This standard provides a general methodology for assessing the proportion of recycled  
301 material in an ErP. This standard is to be used as a general guideline, when drafting product  
302 specific standards.

303  
304 EN45558 - Use of critical raw materials in ErPs:

305 This standard specifies a procedure relating to the declaration on the use of critical raw  
306 materials in ErPs.

307  
308 The main intended use of this document is to provide a means for information on the use of  
309 CRMs to be exchanged up and down the supply chain and with other relevant stakeholders by  
310 applying the IEC 62474 materials declaration standard.

311  
312 This standard does not include product-specific provisions, and can be applied directly to any  
313 type of ErP. Any product-specific provisions that are related to CRM are expected to be fully  
314 based on and use the principles and procedures of this standard.

315  
316 Process chemicals, emissions during product manufacturing and packaging are not in scope  
317 of this standard.

318  
319 EN45559 - Providing information on material efficiency aspects of ErPs:

320 This standard aims to set up a general methodology for the communication of material  
321 efficiency aspects of ErPs. It is intended to be used by technical committees as input for the  
322 development of a communication strategy at a horizontal, generic or product or product-group  
323 level.

324  
325 It is related to nearly all other standardization deliverables developed under the  
326 standardization request M/543. While the other standardization deliverables will provide  
327 methodologies to assess or measure specific material efficiency aspects, this document  
328 focuses on the communication methodology of the various material efficiency aspects.

### 329 **A.1.1 Timeline**

330 The first CEN-CENELEC deliverable under M/543 on terminology was scheduled to be  
331 published in June 2018 while all the others were planned to be published in March 2019. In  
332 ETSI, the first deliverable, TR 103 476, was published in February 2018. This TR covers the  
333 definition of approaches, concepts and metrics of Circular Economy in Information and  
334 Communication Technology (ICT) and was revised to address the Circular Economy aspects  
335 of ICT infrastructure goods under the M/543.



336 CEN-CLC/JTC10 circulated Secretary Enquiries for all deliverables within the timescales for  
 337 development of deliverables as set by CEN-CENELEC. However, whereas for many areas of  
 338 standardisation the state of the art is already well known, this is not always the case for  
 339 material efficiency. This situation requires significant and challenging discussions within the  
 340 working groups, delaying the overall standardization process. This results in, for most  
 341 deliverables, additional consultation is needed with national standards bodies and others, i.e.  
 342 requiring that a second Secretary Enquiry be circulated rather than a formal Enquiry, as  
 343 originally planned. Delays are expected to vary from a few months up to a year or more.

#### 344 **A.1.2 Standardisation deliverables Overview**

345 In the course of 2017, JTC10 revised the list of standardisation deliverables and developed a  
 346 new work program composed of ten CEN and CENELEC deliverables plus three deliverables  
 347 to be prepared by ETSI.

348 **Table A.1 – Standardization Deliverables by CEN - CENELEC**

Deliverable type and Number	Standardization Deliverables	Expected Publication date or Status
TR45550	Definitions related to material efficiency	Plan March 2019 - Delay ~12m
TR45551	Guide on writing product specific standardization deliverables	Plan March 2019 - Delay ~5m
EN45552	Assessing the durability of ErPs	Plan March 2019 - Delay ~10m
EN45553	Assessing ability to re-manufacture ErPs	Plan March 2019 - Delay ~7m
EN45554	Assessing ability to repair, reuse and upgrade ErPs	Plan March 2019 - Delay ~7.5m
EN45555	Assessing the recyclability and recoverability of ErPs	Plan March 2019 - Delay ~7.5m
EN45556	Assessing the proportion of re-used components in ErPs	Plan March 2019 - Delay ~4m
EN45557	Assessing the proportion of recycled content in ErPs	Plan March 2019 - Delay ~12m
EN45558	Use of critical raw materials in ErPs	Expected March 2019
EN45559	Providing information on material efficiency aspects of ErPs	Expected March 2019

349

350 **Table A.2 – Standardization Deliverables by ETSI**

Deliverable type and Number	Standardization Deliverables	Expected Publication date and Status
TR	Study on existing definitions and concepts for material efficiency (in the framework of circular economy) relevant for ICT network infrastructure goods	Expected End 2017 - Delayed
ES or EN	Specific metrics, methods and parameters for assessment of material and resource efficiency aspects of ICT network infrastructure goods in the context of circular economy	Expected Dec-2018 – status unknown
TR 103 476 V1.1.2	Circular Economy (CE) in Information and Communication Technology (ICT); Definition of approaches, concepts and metric	Published (February 2018)

351

352

## Annex B

353

### B.1 The vision of a Sound Material-Cycle Society in Japan

355

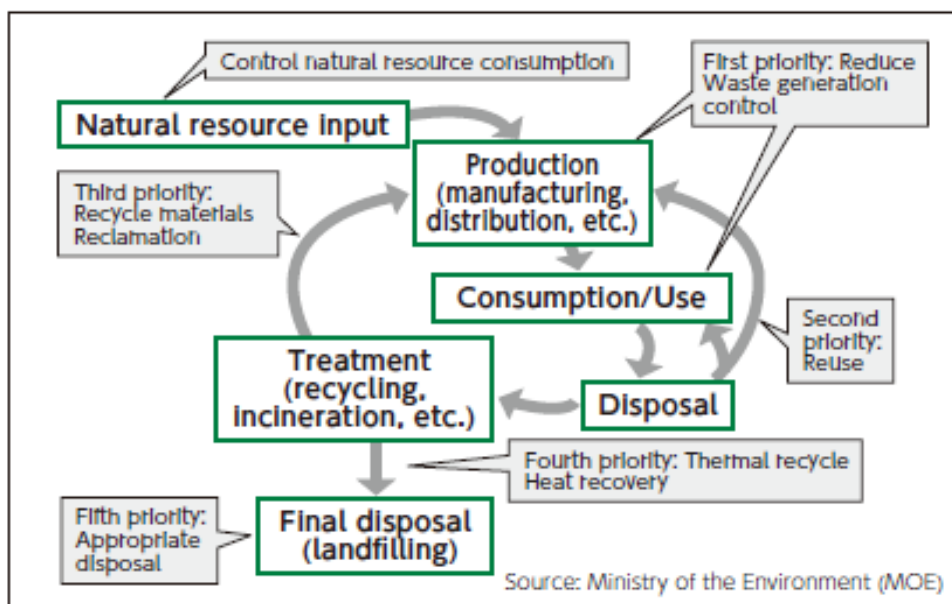
356 In 2000, the Basic Act for Establishing a Sound Material-Cycle Society (Basic Framework Act)  
 357 was enacted to achieve the following purposes: to move away from the current economic  
 358 system based on mass production, mass consumption and mass disposal, which is facing  
 359 serious problems, such as an enormous increase in waste resulting from rapid economic  
 360 development as well as the resulting shortage of final disposal sites; and to promote the  
 361 establishment of a sound material-cycle society designed to ensure the implementation of 3R  
 362 (Reduce, Reuse, and Recycle) and the appropriate management of waste.

363 The Basic Recycling Act defines the vision of a sound material-cycle society that reduces  
 364 natural resource consumption and minimizes environmental impact. At the same time, the law  
 365 specifies the order of priority in the management of recyclable resources as well as the roles  
 366 of different entities (national and local governments, business operators, and consumers).

367 The Basic Recycling Act also legally established, for the first time, the basic principle that  
 368 recyclable resources should be processed in the following order of priority: (1) generation  
 369 control, (2) reuse, (3) recycling, (4) thermal recovery, and (5) appropriate disposal.

370 In defining the roles of different entities, this law distinguishes between the principle of waste  
 371 generator responsibility, which places the responsibility for the management and recycling of  
 372 waste on consumers and business operators that dispose of waste, and the principle of  
 373 extended producer responsibility (EPR), which places the responsibility for the manufacture,  
 374 design and post-use management of products on their manufacturers. Figure B.1 shows the  
 375 vision of a sound material-cycle society in Japan.

376



377

378

379

Figure B.1– The vision of a sound material-cycle society in Japan.

380 The Basic Recycling Act defines all waste, both valuable and non-valuable, simply as "waste."  
 381 With a view to realizing a sound material-cycle society that reduces natural resource  
 382 consumption and minimizes environmental impact, the law assumes that it is necessary to  
 383 reduce the amount of products that are disposed of as waste; that generated waste must be  
 384 considered "recyclable material" to be used effectively to promote appropriate circulation of  
 385 materials (reuse, recycling, and thermal recovery); and that waste that cannot be recycled  
 386 must be properly disposed of.

387

388 Specific recycling laws for EEE enacted such as Home Appliance Recycling Act and Small  
389 Home Appliance Recycling Act.

390

## 391 **B.2 Home Appliance Recycling Act (enacted in 1998)**

392 Since the period of rapid economic growth, home appliances, such as TVs, air conditioners,  
393 refrigerators, and washing machines, have been widely used in Japan as essential household  
394 items. Such home appliances were disposed of as bulky waste; however, proper disposal  
395 involved difficulties due to their size and weight. Although they contained large amounts of  
396 useful resources, including iron, aluminium, and glass, most home appliances were landfilled.  
397 There was also public concern over the depletion of the ozone layer by CFCs as well as  
398 environmental pollution by heavy metals and other hazardous substances contained in waste  
399 home appliances. Against this background, the Act on the Recycling of Specified Kinds of  
400 Home Appliances (Home Appliance Recycling Act) was enacted in 1998 in order to establish a  
401 new recycling system aimed at imposing new obligations on home appliance manufacturers  
402 and retailers.

403

404 The Home Appliance Recycling Act obligates home appliance retailers to accept four types of  
405 waste home appliances (air conditioners, TVs, refrigerators and freezers, and washers and  
406 dryers) from consumers (waste generators) and to deliver them to manufacturers;  
407 manufacturers to recycle waste products; and consumers (waste generators) to pay collection  
408 and transportation fees as well as recycling charges when disposing of their home appliances.  
409

410

### 410 **B.2.1 Target**

411 Home air conditioners, TVs (cathode-ray tube, LCD, and plasma TVs), Refrigerators and  
412 freezers, Washing machines and dryers

413

### 414 **B.2.2 Responsibilities of different entities**

#### 415 (1) Consumers

416 Delivering waste home appliances to retailers and covering recycling costs. Consumers  
417 (waste generators) who use home appliances cover costs for the collection, transportation  
418 and recycling of waste products.

#### 419 (2) Home appliance retailers

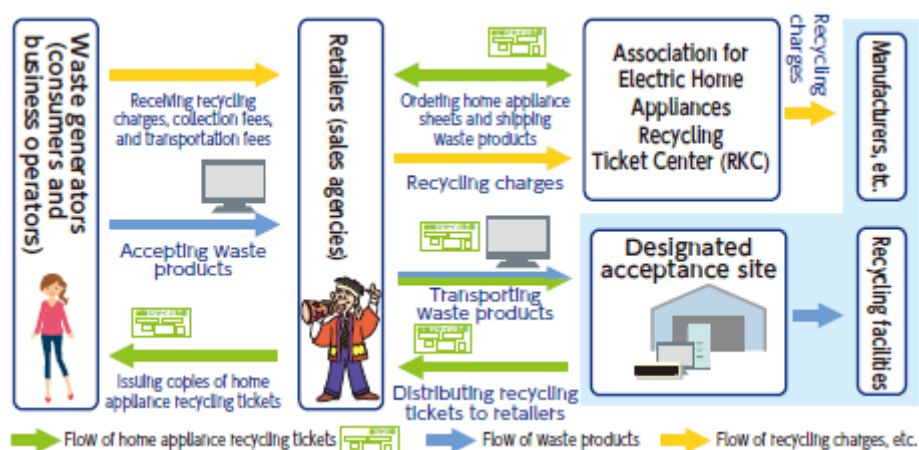
420 Accepting waste home appliances and delivering them to manufacturers. Retailers accept  
421 end-of-life home appliances from consumers (waste generators) and deliver them to home  
422 appliance manufacturers.

#### 423 (3) Home appliance manufacturers

424 Recycling waste home appliances. Manufacturers recycle waste home appliances received  
425 from retailers. When recycling waste products, manufacturers also recover and destroy CFCs  
426 used as coolants or heat insulators in air conditioners and refrigerators.

427 Figure C.2 shows the flows of recycling costs and waste home appliance.

428



429

430 Figure B.2 Flows of recycling costs and waste home appliances (example: collection by  
431 retailers)

432

### 433 **B.3 Small Home Appliance Recycling Act (enacted in 2012)**

434 Small home appliances, such as mobile phones, digital cameras, and audio devices, contain  
 435 large amounts of useful metals, including iron, aluminum, copper, and precious metals.  
 436 Nevertheless, except for iron and aluminum, most such metals were landfilled without being  
 437 recycled, or otherwise improperly disposed of in Japan and elsewhere by unauthorized waste  
 438 collectors. Also, some small home appliances that contain lead and other hazardous metals  
 439 require particularly careful handling. In light of such circumstances, the Act on the Promotion  
 440 of the Recycling of End-of-life Small Electronic Devices and Other Electrical Appliances  
 441 (Small Home Appliance Recycling Act) was enacted in 2012 in order to make effective use of  
 442 useful metals contained in small home appliances and to properly dispose of them.

443

444 The Small Home Appliance Recycling Act supports an incentive-oriented system that enables  
 445 interested parties (consumers, business operators, municipalities, retailers, certified operators,  
 446 etc.) to develop their own waste collection and recycling methods in cooperation with each  
 447 other and to recycle waste in accordance with their own circumstances. End-of-life small  
 448 home appliances contain valuable resources. Therefore, this act aims to develop a system  
 449 that allows interested parties to make profits from recycling through their own efforts to  
 450 efficiently collect end-of-life products from across their region.

451

#### 452 **B.3.1 Target**

453 Designated by government ordinance from among electronic devices and other electrical  
 454 appliances used by general consumers in their daily lives, such as PCs, mobile phones,  
 455 digital cameras, clocks and hair dryers, that can be efficiently collected and transported and  
 456 particularly need to be recycled

457

#### 458 **B.3.2 Responsibilities of different entities**

459 (1) General consumers

- 460 ▪ Sorted disposal

- 461 ▪ Delivering end-of-life products to municipalities or retailers commissioned by certified  
 462 operators

463 (2) Municipalities

- 464 ▪ Sorted collection

- 465 ▪ Delivering end-of-life products to certified operators

466 (3) Certified operators

- 467 ▪ Accepting end-of-life small home appliances

- 468 ▪ Recycling

469 (4) Waste-generating business operators

- 470 ▪ Sorted disposal

- 471 ▪ Outsourcing disposal operations to certified operators or other entities that are capable of  
 472 properly recycling end-of-life products

473 (5) Retailers

- 474 ▪ Cooperating in efficiently collecting end-of-life products from consumers by measures such  
 475 as installing collection boxes in municipalities

476 (6) Manufacturers

- 477 ▪ Developing new designs, parts, and materials to reduce recycling costs

- 478 ▪ Using materials obtained from recycling

479

#### 480 **B.3.3 Recycling System**

481

482 (1) General consumers disposing of end-of-life small home appliances sort their waste  
 483 products and dispose of them in compliance with the collection procedure specified by the  
 484 municipalities they live in.

485 \* End-of-life small electrical appliances for industrial use disposed of as waste are  
 486 delivered to certified business operators as industrial waste.

487 (2) Municipalities collect the end-of-life products disposed of to deliver them to appropriate  
 488 recycling operators, including certified operators.

489 (3) Recycling operators dismantle and crush the end-of-life products, sort the waste into  
 490 different types of metals and plastics, and deliver them to metal refineries or other business  
 491 operators.

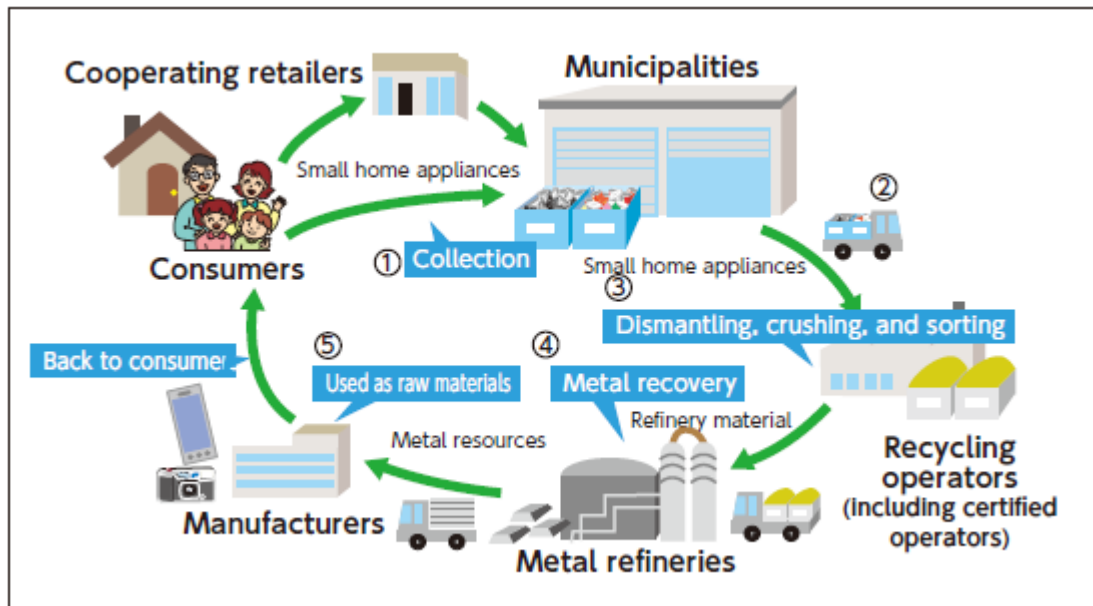
492 (4) Metal refineries recycle the end-of-life products that have been dismantled, crushed and  
 493 sorted into metals and plastic materials.

494 (5) Recycled metals and other materials are used as raw materials for products.

495 In this way, the small home appliances collected from consumers are recycled and returned to  
 496 consumers as products.

497

498 Figure B.3 shows the flows of recycling system for Small Home Appliance.



499

500

501

Figure B.3 The flows of recycling system for Small Home Appliance

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