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SERIES L: ENVIRONMENT AND ICTS, CLIMATE
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CONSTRUCTION, INSTALLATION AND PROTECTION
OF CABLES AND OTHER ELEMENTS OF OUTSIDE
PLANT

Circular economy in information and communication technology; definition of approaches, concepts and metrics

ITU-T L-series Recommendations – Supplement 28



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Supplement 28 to ITU-T L-series Recommendations

Circular economy in information and communication technology; definition of approaches, concepts and metrics

Summary

In order to facilitate a shift to a more sustainable economy, a circular economy (CE) has been proposed as one of the main ways forward. In this context, CE combined with information and telecommunication technologies (ICTs) could enable decoupling of economic growth and environmental impact [b-Ellen]. Due to a seemingly imprecise understanding of the topic of CE and its main aspect resource efficiency (RE), it will be necessary to summarize and then standardize the manner in which CE and RE are quantified.

Supplement 28 to ITU-T L-series Recommendations investigates current approaches, concepts and metrics of CE and RE and their applicability for ICT infrastructure goods.

This Supplement:

- 1) introduces CE and RE,
- 2) describes CE as used in the ICT industry,
- 3) describes existing CE and RE metrics and examples of their use.
- 4) proposes next steps in CE and RE standardization.

The scope of this Supplement includes the following aspects: upgradability, repairability, removability, durability, reusability, recyclability, recoverability, refurbishability and remanufactureability. The following additional parameters, indicators and metrics are included: recycled content, use of critical raw materials and proportion of re-used parts.

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Introduction

In order to facilitate a shift to a more sustainable economy, circular economy (CE) has been proposed as one of the main ways forward. In this context, CE combined with information and telecommunication technologies (ICTs) could enable decoupling of economic growth and environmental impact [b-Ellen]. Due to the seemingly scattered understanding of the topic of CE and its main aspect resource efficiency (RE), it will be necessary to summarize and then standardize the manner in which CE and RE are quantified.

In 2015, the European Commission issued Mandate 543 (M/543), *Standardization Request with regard to ecodesign requirements on material efficiency aspects for energy-related products* [b-EU_M/543] requesting European standardization organisations to develop needed standards. ETSI EE accepted this mandate for ICT infrastructure goods. However, the present document was initiated before Mandate 543 and is not seen as an ETSI TC EE deliverable for Mandate 543. Nevertheless, the present document is expected to provide valuable input for the Mandate 543 work.

ITU-T SG5 (Q13/5) has made preliminary descriptions of RE for ICT goods [b-ITU-T L.Suppl.5], which have been considered in the development of the present document which focuses more broadly on CE aspects for ICT infrastructure goods. Furthermore, the Methodology for Ecodesign of Energy-related Products (MEErP) report, as used in the framework of the Ecodesign Directive (2009/125/EC) [b-Biointelligence], has been used as background information for materials efficiency aspects.

This Supplement was developed jointly by ETSI TC EE and ITU-T Study Group 5 and published respectively by ITU and ETSI as Supplement ITU-T L.Suppl.28 and ETSI Technical Report ETSI TR 103 476, which are technically equivalent.

Supplement 28 to ITU-T L-series Recommendations

Circular economy in information and communication technology; definition of approaches, concepts and metrics

1 Scope

This Supplement aims to provide an overview of the most important existing aspects, parameters, indicators, metrics, results, and business models used for estimating the resource efficiency (RE) and circular economy (CE) characteristics of ICT infrastructure goods as input for further standardization.

This Supplement is intended to provide an aid for all users of CE and RE concepts within the ICT infrastructure sphere.

2 References

None.

3 Definitions

3.1 Terms defined elsewhere

This Supplement uses the following terms defined elsewhere:

3.1.1 re-use [b-ISO 22628], [b-2008/98/EC]: Any operation by which component parts of end-of-life products are used for the same purpose for which they were conceived.

3.1.2 recycling [b-ISO 22628], [b-2008/98/EC]: Reprocessing in a production process of the waste materials for the original purpose or for other purposes, excluding processing as a means of generating energy.

3.1.3 recovery energy [b-ISO 22628], [b-2008/98/EC]: Reprocessing in a production process of the waste materials for the original purpose or for other purposes, together with processing as a means of generating.

3.2 Terms defined in this Supplement

This Supplement defines the following terms:

3.2.1 aspect: Field of CE.

NOTE – Examples include removability, durability, recyclability, reparability.

3.2.2 assessment method: Procedure for determining the value of a metric or indicator and validating it. The method could include measurement and calculation.

3.2.3 indicator: Quantifiable representation of a parameter.

NOTE – Example includes service output per material input.

3.2.4 metric: Measurable representation of a parameter or indicator.

NOTE – Examples include mass of product, disassembly time and re-used parts.

3.2.5 parameter: Entity representing an aspect.

NOTE – Examples include Rcyc and Rcov.

3.2.6 recycled content (RC): Proportion, by mass, of recycled material in a product or packaging.

NOTE – Only pre-consumer and post-consumer materials should be considered as recycled content [b-ISO 14021].

3.2.7 pre-consumer material: Material diverted from the waste stream during a manufacturing process.

NOTE – Excluded is reutilization of materials such as rework, regrind or scrap generated in a process and capable of being reclaimed within the same process that generated it [b-ISO 14021].

3.2.8 post-consumer material: Material generated by households or by commercial, industrial and institutional facilities in their role as end-users of the product which can no longer be used for its intended purpose.

NOTE – This includes returns of material from the distribution chain [b-ISO 14021].

3.2.9 refurbishment: Processing hardware and/or software of an ICT good, a plug-in unit or system module of a used ICT good for reuse through e.g., testing, cleaning and repair.

NOTE – Refurbished ICT goods could be re-used by the owner or resold.

3.2.10 remanufacturing: Process in which one or more part(s) are reworked to compose a new part/good.

NOTE – More commonly used in mechanical engineering where mechanical part/product is reworked to correspond to a new part/product, e.g., car engine.

3.2.11 repair: Restore to working order.

4 Abbreviations and acronyms

This Supplement uses the following abbreviations and acronyms:

ADSL	Asymmetric Digital Subscriber Line
B2B	Business-to-Business
B2C	Business-to-Customer
Btu	British thermal unit
CAPEX	Capital Expenses
C2C	Cradle to Cradle
CE	Circular Economy
CFC	Chlorofluorocarbons
CPU	Central Processing Unit
ECD	Environmentally Conscious Design
EDE	Electronic Disposal Effectiveness
EEE	Electrical and Electronic Equipment
EOL	End-of-Life
EoLT	End-of-Life Treatment
ErP	Energy related Products
EU	European Union
GDP	Gross Domestic Product
GSM	Global System for Mobile Communications
HCFC	Hydrochlorofluorocarbons

IC	Integrated Circuit
ICT	Information and Communication Technology
IEC	International Electrotechnical Commission
LCA	Life Cycle Assessment
LCD	Liquid Crystal Display
LCI	Life Cycle Inventory
LTE	Long Term Evolution
MCI	Material Circularity Indicator
MR	Material Reutilization
OPEX	Operating Expenses
PAS	Planning Advisory Service
PCBA	Printed Circuit Board Assembly
RAN	Radio Access Network
RBUR	Reusability Benefit Rate
RBVR	Recovery Benefit Rate
RC	Recycled Content
RCR	Recyclability rate of a Part
R_{cov}	Recoverability rate
R_{cyc}	Recyclability rate
R_{reuse}	Reusability rate
RE	Resource Efficiency
RoHS	Restrictions of Hazardous Substances
RRR	Reusability/Recyclability/Recoverability rate of a Part
RP	Resource Productivity
RUR	Reusability rate of a Part
RVR	Recoverability rate of a Part
WCDMA	Wideband Code Division Multiple Access
WEEE	Waste Electrical and Electronic Equipment

5 Introduction to circular economy concepts

Circular economy (CE) is a wide ranging concept which covers the full lifecycle of both goods and business models. In general CE is about closing the loop between different life cycles through design that enables greater recycling and reuse in order to use raw materials, goods and waste in a more efficient way and to increase energy performance. Thus CE is associated with strategies to keep goods out of landfill and incineration [b-Huysman]. CE deals with both environmental and economic aspects. In an ideal CE, all waste generated would be reused as raw material in production processes. It is clear that discarded goods represent a valuable source of raw materials [b-Mueller]. However, in practice trade-offs have to be made with parameters such as reliability and cost. Resource efficiency (RE) is sometimes used interchangeably with the CE concept. However, RE focus more on efficient use of resources and on minimizing the environmental impact of a good



during its life cycle. An example of a generalized resource efficiency (RE) definition is dealing with the benefits obtained from the use of natural resources [b-Biointelligence]. Furthermore, materials efficiency is used in parallel with RE, or as a more precise concept dealing with raw materials only, excluding energy. In the present document, RE is seen as a sub-category of CE and materials efficiency as a part of RE.

In the present document, CE and RE aspects and parameters/metrics/indicators are discussed.

Researchers have attempted to provide an understanding of the scope and limitations of particular existing resource efficiency indicators in order to assist policy makers and the scientific community in the application and further development of indicators [b-Huysamn_Sala].

As shown in Figure 1, both for CE and RE, the full life cycle of the good should be taken into account.

Through the design stage, it is possible to influence all the most important aspects; minimizing material usage and environmental impacts. Goods can be designed to be used longer, repaired, upgraded, refurbished, remanufactured and/or eventually recycled instead of being thrown away. One important point of view is to avoid use of hazardous and rare earth materials when possible. [b-COM (2015)614] In addition to reducing the materials, the focus is on energy usage during the whole life cycle of goods, which means improved efficiency in the production and use stages.

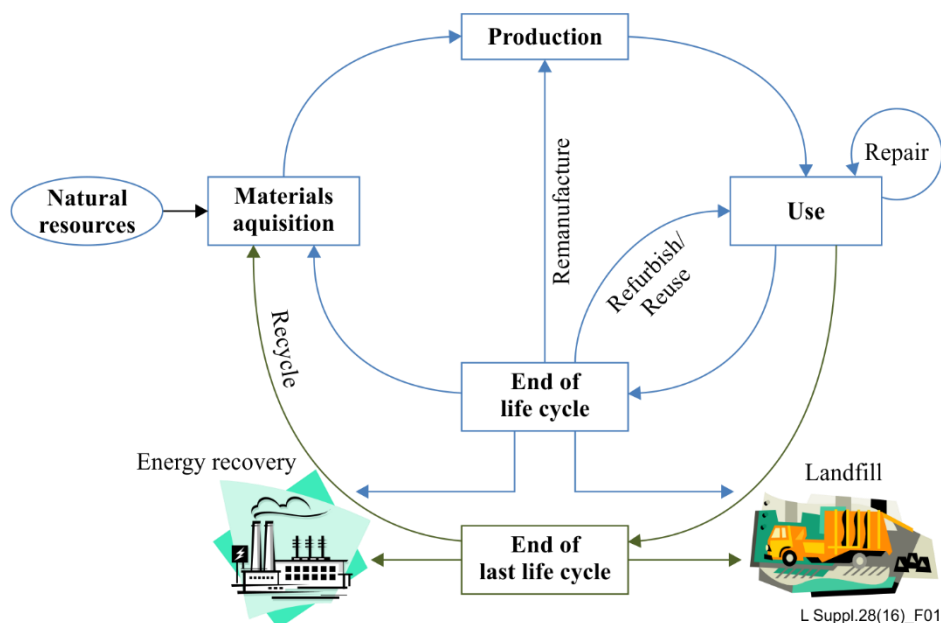


Figure 1 – Interventions and other mechanisms that influence the flows in the material life cycle of ICT goods (adapted from [b-Smalen])

NOTE – End of last life cycle means that the ICT infrastructure good can no longer be circulated.

In addition to Figure 1, Figure 2 shows some relationships between various CE aspects which are described in more detail in clause 7.