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PLANT

E-waste management framework for countries

Recommendation ITU-T L.1030

ENVIRONMENT AND ICTS, CLIMATE CHANGE, E-WASTE, ENERGY EFFICIENCY; CONSTRUCTION, INSTALLATION AND PROTECTION OF CABLES AND OTHER ELEMENTS OF OUTSIDE PLANT

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E-waste management framework for countries

Summary

Recommendation ITU-T L.1030 provides an e-waste management framework for countries. It summarizes the different steps that countries need to adopt in order to put in place an e-waste management system. The different steps of the e-waste management system described in this Recommendation will be further elaborated in future Recommendations. In addition, the Recommendation provides highlights concerning the environmental impact of improper handling of e-waste as well as the economic opportunities that could emerge from the sustainable management of e-waste.

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FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

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Introduction

Recommendation ITU-T L.1030 identifies the main steps for the design and implementation of an e-waste management system. It takes into consideration the different standards and supplements produced by ITU-T as well as other key standardization bodies.

It notes the environmental impact of e-waste if improperly handled, as well as the economic opportunities it could provide if properly managed. This Recommendation was drafted with support from and in consideration of activity in other standards developing organizations (SDOs) and other types of organizations.

Recommendation ITU-T L.1030 is designed to ensure that countries have a simple blueprint for e-waste management systems, that complements the different focused standards produced on the various steps of this framework. It is also meant to address the ICT divisions within countries which could play an important role in designing and facilitating the proper e-waste management systems in cooperation with the entities in charge of the environment.

Recommendation ITU-T L.1030

E-waste management framework for countries

1 Scope

This Recommendation provides a set of guidelines that countries can refer to when designing or adjusting their e-waste management systems. It provides guidance on policy/legal frameworks, resource mobilisation, collection mechanisms, financial mechanisms and engagement with all relevant stakeholders.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

For all revision update to be checked

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| [ITU-T L.1000] | Recommendation ITU-T L.1000 (2011), <i>Universal power adapter and charger solution for mobile terminals and other hand-held ICT devices.</i> |
| [ITU-T L.1001] | Recommendation ITU-T L.1001 (2012), <i>External universal power adapter solutions for stationary information and communication technology devices.</i> |
| [ITU-T L.1002] | Recommendation ITU-T L.1002 (2016), <i>External universal power adapter solutions for portable information and communication technology devices.</i> |
| [ITU-T L.1010] | Recommendation ITU-T L.1010 (2014), <i>Green battery solutions for mobile phones and other hand-held information and communication technology devices.</i> |
| [ITU-T L.1020] | Recommendation ITU-T L.1020 (2018), <i>Circular economy: Guide for operators and suppliers on approaches to migrate towards circular ICT good and networks.</i> |
| [ITU-T L.1021] | Recommendation ITU-T L.1021 (2018), <i>Extended producer responsibility – Guidelines for sustainable e-waste management.</i> |
| [ITU-T L.1100] | Recommendation ITU-T L.1100 (2012), <i>Procedure for recycling rare metals in information and communication technology goods.</i> |
| [ITU-T L.1400] | Recommendation ITU-T L.1400 (2011), <i>Overview and general principles of methodologies for assessing the environmental impact of information and communication technologies.</i> |
| [ITU-T L.1410] | Recommendation ITU-T L.1410 (2014), <i>Methodology for environmental life cycle assessments of information and communication technology goods, networks and services.</i> |

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 audit [b-ISO/IEC 17000]: Systematic, independent, documented process for obtaining records, statements of fact or other relevant information and assessing them objectively to determine the extent to which specified requirements are fulfilled.

3.1.2 component [b-SBC, 2011b]: Element with electrical or electronic functionality connected together with other components, usually by soldering to a printed wiring board, to create an electronic circuit with a particular function (for example an amplifier, radio receiver, or oscillator).

3.1.3 distributor [b-EU, 2012/19/EU]: Any natural or legal person in the supply chain, who makes an EEE available on the market. A distributor may also be a producer.

3.1.4 electrical and electronic equipment (EEE) [b-EU, 2012/19/EU]: Equipment which is dependent on electric currents or electromagnetic fields in order to work properly and equipment for the generation, transfer and measurement of such currents and fields and designed for use with a voltage rating not exceeding 1 000 volts for alternating current and 1 500 volts for direct current.

3.1.5 e-waste [b-UNEP]: Electrical or electronic equipment that is waste, including all components, sub-assemblies and consumables that are part of the equipment at the time the equipment becomes waste.

3.1.6 generation (of WEEE) [b-UNU, 2014]: The weight of discarded products (waste) due to national consumption from a national territory in a given reporting year prior any activity (collection, reuse, treatment or export).

3.1.7 orphan waste [b-Hester]: Products deposited for recycling that are the responsibility of a company that is either no longer present in the market or has not paid for its recycling.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 circular economy (based on [b-EMcA]): An economy that is restorative and regenerative by design, which aims to keep products, components and materials at their highest utility and value at all times.

NOTE – A concept that distinguishes between technical and biological cycles, the circular economy is a continuous, positive development cycle. It preserves and enhances natural capital, optimises resource yields, and minimises system risks by managing finite stocks and renewable flows. A circular economy works effectively at every scale.

3.2.2 disposal (based on [b-StEP, 2014]): Material that cannot be recycled into raw material for use in manufacture of new electrical and electronic equipment (EEE) or other products would need to be disposed of using other methods, such as energy recovery or landfill.

3.2.3 exporter of WEEE (based on [b-Basel]): Any person under the jurisdiction of the state of export who arranges for waste electrical and electronic equipment (WEEE) to be exported.

3.2.4 extended producer responsibility (EPR) (based on [ITU-T L.1021]): An environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle with two related features of that policy: the shifting of responsibility (physically and/or economically; fully or partially) upstream toward the producer and away from municipalities, and to provide incentives to producers to incorporate environmental considerations in the design of their products.

NOTE – EPR is a policy principle to promote total life cycle environmental improvements of product systems by extending the responsibility of the manufacturers of the product to various parts of the entire life cycle of the product, and especially to the take-back, recycling and final disposal of the product.

3.2.5 formal sector (based on [b-PMID]): E-waste represented by that which is regulated by environmental protection laws specifically designed for e-waste.

3.2.6 gate fees (based on [b-Chalmin]): The "exchange value" associated to waste electrical and electronic equipment. It identifies the monetary flow from collection or treatment facilities operators to producer compliance schemes when the e-waste value is higher than management costs, e.g., recovery, recycling, re-use. The inverse money transfer takes place when e-waste management activities generate a net cost for the facility. Some of the factors that concur to determine the gate fee are the potential energy generated, the presence of recoverable materials and the ratio between secondary and primary raw materials price.

3.2.7 illegal traffic (based on [b-Basel]): Any trans-boundary movement of hazardous wastes or other wastes that has not been notified nor received consent, or whose consent has been obtained "through falsification, misrepresentation or fraud"; whose content "does not conform in a material way with the documents" or "that results in deliberate disposal" ([b-Basel], article 9).

3.2.8 lifetime (or residence time) (based on [b-PMID]): The time that electrical and electronic equipment spends at household businesses and the public sector, including the exchange of second hand equipment among and between households, and businesses.

3.2.9 importer of WEEE (based on [b-Basel]): Any person under the jurisdiction of the state of import who arranges for waste electrical and electronic equipment (WEEE) to be imported.

3.2.10 producer (based on [b-EU, 2012/19/EU]): Any natural or legal person, established in a state, who manufactures or markets or resells electrical and electronic equipment (EEE) under his own name or trademark; places on the market of that state, on a professional basis, EEE from a third country or from another state; or sells EEE by means of distance communication directly to private households or to users other than private households in a state, and is established in another state or in a third country.

3.2.11 put-on-the-market (based on [b-EU, 2012/19/EU]): First making available of a product on the market within the territory of a Member State on a professional basis.

3.2.12 recovery (based on [b-EU, 2012/19/EU]): Any operation the principal result of which is waste serving a useful purpose by replacing other materials that would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy.

3.2.13 recycling (based on [b-EU, 2012/19/EU]): Any recovery operation by which waste materials are reprocessed into products or materials whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for back-filling operations.

3.2.14 re-use (based on [b-StEP, 2012a]): Re-use of electrical and electronic equipment or its components is to continue the use of it, for the same purpose for which it was conceived, beyond the point at which its specifications fail to meet the requirements of the current owner and the owner has ceased use of the product.

3.2.15 treatment (based on [b-EU, 2012/19/EU]): Recovery or disposal operations, including preparation prior to recovery or disposal.

3.2.16 used electrical and electronic equipment (based on [b-StEP, 2014]): Any electrical and electronic equipment (EEE) that is discarded by the owner as waste with the intention of re-use for the same purpose for which it was conceived, beyond the point at which its specifications fail to meet

the requirements of the current owner and the owner has ceased use of the product. Products could be donated or traded before or in this phase.

3.2.17 waste electrical and electronic equipment (WEEE) (based on [b-EU, 2012/19/EU]): Electrical or electronic equipment which is "Any substance or object which the holder discards or intends or is required to discard" [b-EU, 2008/98/EC], "including all components, sub-assemblies and consumables which are part of the product at the time of discarding".

NOTE – WEEE is a complex mixture of materials and components that because of their hazardous content, and if not properly managed, can cause major environmental and health problems. Moreover, the production of modern electronics requires the use of scarce and expensive resources (e.g., around 10% of total gold worldwide is used for their production). To improve the environmental management of WEEE and to contribute to a circular economy and enhance resource efficiency the improvement of collection, treatment and recycling of electronics at the end of their life is essential.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AC	Alternating Current
CE	Circular Economy
CFC	Chlorofluorocarbons
CRT	Cathode Ray Tube
DC	Direct Current
DVD	Digital Versatile Disc
EEE	Electrical and Electronic Equipment
EHS	Environment, Health and Safety
EPR	Extended Producer Responsibility
EoL	End of Life
e-waste	electronic waste
ICT	Information and Communication Technology
ID	Identifiers
IT	Information Technology
KPI	Key Performance Indicator
LCA	Life Cycle Assessment
LCD	Liquid Crystal Display
PCB	Printed Circuit Board, Polychlorinated Biphenyl
PCS	Producer Compliance Scheme
POM	Put-On-the-Market
ppm	parts per million
RE	Resource Efficiency
RFID	Radio Frequency Identification
StEP	Solving the E-waste Problem
SWOT	Strengths, Weaknesses, Opportunities and Threats

TV	Television
UPA	Universal Power Adapter
WEEE	Waste Electrical and Electronic Equipment

5 Conventions

This Recommendation uses the following conventions:

Al	Aluminium
Ag	Silver
Au	Gold
Cu	Copper
Fe	Iron
Pd	Palladium

6 Scope for regulation and standardization

This Recommendation aims to draw the attention of policymakers to one of the main environmental problems and economic opportunities of our time: the generation of waste electrical and electronic equipment (WEEE).

The increasing amount of WEEE or electronic waste (e-waste) is still an emerging global environmental threat in terms of management and disposal due to the hazardous components therein. This threat has become more significant over the past two decades in most countries due to the enormous uptake of information and communications technology (ICTs), and specifically with the introduction of mobile telephony and now the recent migration from analogue to digital technologies. The use of ICT equipment and products comes with an known rate at which these gadgets become obsolete due to technology advancements and hence the need to be replaced by their owners which has led to an enormous increase in the generation of related waste.

E-waste is now considered as one of the fastest growing solid waste in the world. In developed countries, it amounts to 1% of total solid waste on average.

The management of e-waste has thus experienced rapid changes in response to a variety of developments which include among others: components used and the need to recover, reuse and recycle; changes in energy consumption associated with both the manufacturing and use of equipment; and the expanding global market for reused and counterfeited/substandard devices. There are a variety of economic, environmental and social factors that influence the end of life (EoL) management of WEEE

There are many reasons why countries should establish or reinforce their e-waste management national systems. According to the European Union (EU) WEEE directive, the appropriate management of WEEE is paramount due to the presence of hazardous substances, such as "mercury, cadmium, lead, hexavalent chromium, polychlorinated biphenyls (PCBs) and ozone-depleting substances" [b-EU, 2012/19/EU]. Consequently, if not treated properly, WEEE could have significant negative environmental, economic, and social effects.

It has been observed, for instance, that improper management of e-waste can have severe effects on human health, causing allergies, respiratory diseases and cancer [b-Puckett]. Furthermore, leaching, open-air burning and heating, as well as uncontrolled discharge of scrap, acids, cyanides and other by-products from processing operations pollute the soil, groundwater and food [b-Terazono]. On the contrary, effective recycling of e-waste has a direct positive impact on the environment, economy and society.

Prevention is paramount as 20-50 million tonnes of e-waste is generated globally each year [b-UNEP, 2013a]. E-waste is one of the fastest growing waste streams in the world. E-waste is also an economic opportunity. Equipment can contain rare metals, including gold, silver, palladium, lithium, ruthenium, antimony, indium and tin [b-UNEP, 2013a], as well as base metals (e.g., copper, lead and zinc). E-waste is a rich source of precious metals compared to primary ores [b-ATMI]. The case is often made that for every ton of ore at a gold mine only 5 g of gold can be extracted, whereas 1 ton of mobile phones can contain up to 400 g of gold [b-SMG]. One ton of used mobile phones (around 6000 handsets) contains approximately 3.5 kg of silver, 340 g of gold, 140 g of palladium and 130 kg of copper. The combined present value is just over \$25000. Moreover, one ton of personal computer waste contains more gold than 17 tons of gold ore [b-ATMI].

The extraction of precious and base metals from e-waste is a major economic driver due to their associated value, as summarized in Table 1 [b-ATMI].

Table 1 – Weight vs. value distribution

Weight vs. value distribution %	Fe (wt%)	Al (wt%)	Cu (wt%)	Plastics (wt%)	Ag (ppm)	Au (ppm)	Pd (ppm)
TV-board	28%	10%	10%	28%	280	20	10
PCBs	7%	5%	20%	23%	1000	250	110
Mobile phone	5%	1%	13%	56%	1380	350	210
Portable audio	23%	1%	21%	47%	150	10	4
DVD-player	62%	2%	5%	24%	115	15	4
Calculator	4%	5%	3%	61%	260	50	5
Value-share	Fe	Al	Cu	Sum PMs	Ag	Au	Pd
TV-board	4%	11%	42%	43%	8%	27%	8%
PCBs	0%	1%	14%	85%	5%	65%	15%
Mobile phone	0%	0%	7%	93%	5%	67%	21%
Portable audio	3%	1%	77%	19%	4%	13%	2%
DVD-player	13%	4%	36%	47%	5%	37%	5%
Calculator	0%	5%	11%	84%	7%	73%	4%

As primary materials are increasingly more difficult and expensive to extract, recycling becomes an attractive option. Recycling would, in fact, contribute to preserving natural resources and move toward more sustainable production practices.

The use of secondary raw materials allows energy savings [b-Cui] and greenhouse gas emission avoidance [b-Khaliq]. For example, recycling 1 kg of aluminium saves 95% of the energy required for primary production as shown in Table 2 [b-Cui].

Table 2 – Recycled materials energy savings over virgin materials

#	Materials	Energy savings (%)
1	Aluminium	95
2	Copper	85
3	Iron and steel	74
4	Lead	65
5	Zinc	60
6	Paper	64
7	Plastics	>80