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WG PSC

**revisED Status Report on**

**Standardization Activities for E-waste and Rare Metals**

This document is a revision of “status report on standardization activities for e-waste and rare metals”. The EG GICT&EMF had three input documents ASTAP-34/INP-33, ASTAP-35/INP-09 and ASTAP-35/INP-10 to update and revise the status report. There were pertinent updates in the parts of the terms and definitions, member-countries laws and regulations on e-waste and rare metal management, related international activities, case study and best practices in APT members. The EG agreed to send the revised status report to the plenary for approval to publish the first revision of the status report.

The purpose of this report is to share information of management systems related to e-waste & rare metals in order to understand hazards & values of e-waste and rare metals. The EG GICT&EMF meeting of ASTAP-33 (ASTAP-33/INP-33) agreed to revise the published status report to reflect the updated status of each counties and international organizations. APT members and international organizations are more concerned with environmental issues, and greenhouse gases. As new environmental policies and technologies for carbon neutrality evolve, the present status report should be updated in order to reflect the strategies of APT member countries and international organizations.

ASTAP-35/INP-09 and ASTAP-35/INP-10 updated the “Table of Contents”, “Clause 2: Terms and Definitions", “Clause 5: Related national laws and regulations on e-waste and rare metal management”, “Clause 6: Related international activities”, “Clause 7: Case study and best practices in APT members”. Both documents were discussed line by line at the EG GICT&EMF meeting by the editor (Bum Sung KIM). Typically, Nepal delegation emphasized the significance of the present status report to the developing countries and mentioned they will contribute Nepal’s chapter on the next ASTAP meeting. EG GICT&EMF meeting concluded that it is expected that the sharing of policies on e-waste of the APT member countries, international standardization organizations (ITU, IEC, ISO) and international organizations (UNEP, OECD, etc.) will have a big contribution in establishing new policies in developing countries.

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**APT STATUS REPORT**

**ON**

**STANDARDIZATION ACTIVITIES   
FOR E-WASTE AND RARE METALS   
(1st Revision)**

**Edition: April 2023**

**Adopted by**

**30th APT Standardization Program Forum (ASTAP-30)**

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**APT Status Report on Standardization Activities for E-waste and Rare Metals (Revision)**

**1. Scope**

The scope of this report includes introduction of e-waste & rare metal related strategies, activities & management systems of international standardization organizations to Asia Pacific Telecommunication members. Additionally scope of this report is to presents some countries’ and regions’ success stories on adequate e-waste management that could be used as a guidance or best practice and may be adopted by countries working on developing adequate e-waste management systems, too.

The purpose of this supplement is to only present the different procedures and processes which countries have adopted to adequately manage their e-waste, and not to decide or select the best methods or practices.

**2. Terms and Definitions**

WEEE Waste electrical and electronic equipment

OGF Operation Green Fence

USD mn Millions of US Dollars

EoL With respect to a product supplied to customers, indicating the product is in the end of its useful life

EPR Extended Producer Responsibility

EcoAS Eco-Assurance System

RFMB Recycling Fund Management Board

SDGs Sustainable Development Goals

RECP Resource-Efficient Clean Production

NEPRA National Electric Power Regulatory Authority

WPRPW Working Party on Resource Productivity and Waste

PPP Public Private Partnership

WTE Waste-To-Energy

ITU International Telecommunication Union

ITU-T International Telecommunication Union Telecommunication Standardization Sector

ITU-D International Telecommunication Union Telecommunication Development Sector

WTSA-12 The World Telecommunication Standardization Assembly which is held in 2012

ICT Information and Communication Technologies

OEM Original Equipment Manufacturer

UN Intergovernmental organization to promote international co-operation

ISO International Organization for Standardization e-Stewards Electronics waste

recycling standard created by Basel Action Network (BAN)

BAN Non-governmental organization working to combat the export of toxic waste

ETBC Non-profit organization that promote responsible recycling and green design in the electronic industry

CEN The European Committee for Standardization

CENELEC The European Committee for Electrotechnical Standardization

LGE Multinational electronic company (LG electronics) in South Korea

NEC Japanese multinational provider of informational technology services and products

OECD Organization for Economic Co-operation and Development

UNU United Nations University

GeSI Global e-Sustainability Initiative

StEP International initiative for solving the E-waste problem

UNEP United Nations Environment Program

DfE Design of Environment

LPUR Law for the Promotion of Utilization of Resources\

DOE Department of Environment

EPA Environmental Protection Agency

DRS Deposit Refund System

SHEA Small Household Electrical Appliances

RRW Regulated Recycle Waste

**3. The status and problems of e-waste and rare metals**

International trends around the world indicate that Electrical and Electronic Equipment (WEEE) waste or e-waste is one of the fastest growing waste stream. Rapid economic growth in Asia and the increasing trans-boundary movement of secondary resources will increasingly require both 3R endeavors (reduce, reuse, recycle) in each country and appropriate control of international material cycles. To meet these needs, the prevention of environmental pollution and efficient utilization of resources will both be important.

Certain countries in the world have adopted a number of legislations and policies both in public as well as private sector in order to cater the problem occurring due to excessive e-waste production. The success stories of these countries can act as a stimulus for other countries to develop an adequate E-waste management system.

**4. Related national policies, plans and management systems**

In the wake of current scenario different developing and developed nations of Asia have paid a great stress on minimizing these waste, passed a number of legislations and held numerous conferences in order to devise certain strategies to lessen the amount of E-waste generated every year. Japan Home appliance Recycling Law in 1998 and the Law for the Promotion of Utilization of Resources (LPUR) encourages efforts among producers to decrease the waste, reuse the recycling materials and enhances the recyclability of EEE through the adoption of Design of Environment (DfE). Similarly Legislation made by Taiwan which is called the Waste Disposal Act under which Environmental Protection Agency (EPA) has integrated different management actors. Malaysia, has officially regulated EQSWR in 2005 which was enforced by Malaysian’s Department of Environment (DOE). Recently they have implemented the Cleansing Management Act in 2015 and this policy is being administered by Solid Waste Corporation.

**5. Related national laws and regulations on e-waste and rare metal management**

**5.1 Bangladesh: E-waste management**

Bangladesh adopted its National Environmental Policy in 1992, The Environmental Conservation Act in 1995 and Medical Waste Management Rules in 2008. Currently there are no regulations specifically dealing with e-waste. However, the Government of Bangladesh has given top priority to the preparation of ‘WEEE (Management and Handling) Rules’ in 2011. In addition, the Government has already prepared a National 3R (Reduce, Reuse and Recycle) Strategy incorporating some aspects of e-waste management. Furthermore, two Rules, the Hazardous Waste Management Rule (under preparation) and the draft Solid Waste Management Rule (under consultation) could also accommodate the issues related to e-waste. Currently, there is no inventory of e-waste in Bangladesh. It is estimated that every year Bangladesh produces about 2.8 million tonnes of e-waste out of which 2.5 million is contributed by the e-waste generated from ship breaking yards. As for EoL management of electrical and electronic equipment, reuse is a common practice in Bangladesh. Dismantling and recycling is also a growing business, mainly undertaken by the informal sector. Most of the e-waste in Bangladesh is dumped in open landfills, farming land and open water bodies causing severe health an environmental impacts**.**

Bangladesh adopted its first National Environmental Policy in 1992 highlighting and regulating all the activities that pollutes and destroy the environment. Following this Environmental court act was issued regarding the preservation of environment and e-waste management and recycling. Government of Bangladesh also drafted National 3R strategy and in that draft e-waste issues were addressed. In 2008 Bangladesh drafted medical waste management rules in order to manage the e-waste in medical sector.

The latest initiative is Electrical and Electronic Waste (Management and Handling) Rules, 2011 which has the following features: These rules apply to every producer(s), dealer(s), collection centre(s), refurbisher(s), dismantler(s), recycler(s), auctioneer(s) consumer(s) or bulk consumer(s) involved in the manufacture, sale, purchase and processing of electrical and electronic equipment or components. It defines Responsibilities of the producer, Responsibilities of dealers, Responsibilities of refurbisher, Responsibilities of collection centers, and Responsibilities of consumer or bulk consumer, Responsibilities of dismantler, Responsibilities of recycler / reprocessor.

In 2018, Bangladesh approved a national e-waste management policy, which aims to regulate the generation, collection, transportation, storage, and disposal of e-waste in the country. In 2021, Bangladesh’s Department of Environment (DOE) published rules for management of hazardous e-waste under the “Bangladesh Environmental Protection Act”, 1995. This document covers rules regarding various products including home appliances, monitoring and control equipment, medical equipment, automatic machines, IT and communication equipment. In addition, the document allocates responsibilities to each member of the value chain. The published document also contains regulations regarding the substances covered by the EU RoHS Directive to effectively reduce their usage. This document came into force upon publication.

These regulations mandate the handler of the subject products to register the product with the DOE, submit a WEEE management plan and obtain environmental clearance. According to the new regulations, the manufactures have been directed to take substantial measures to ensure over 50% WEEE collection within five year of implementation. These measures include, establishment of waste collection centers, allocation of separate fund for WEEE management and, proper disposal of non-recyclable waste. The WEEE traders, sellers and collectors will be able to receive the waste at designated collection centers. To facilitate the transfer of the waste from consumer to the waste handlers, information regarding the waste handlers and collection centers will displayed on the products.

In 2021, the first e-waste recycling plant in Bangladesh was inaugurated in Dhaka. The plant has the capacity to process 500 tons of e-waste per month and is expected to help reduce the amount of e-waste that is improperly disposed of in the country. E-waste awareness campaigns: The government of Bangladesh has launched several awareness campaigns aimed at educating the public about the importance of proper e-waste management. For example, in 2020, the Department of Environment launched a campaign called "E-waste is not waste, it's a resource" to raise awareness about the value of e-waste and the need to properly manage it. The government of Bangladesh has also established several e-waste collection centers in different parts of the country to encourage the proper disposal of e-waste.

**5.2 China: policing illegal traffic - Operation Green Fence (OGF)**

China already banned imports of e-waste in 2000. The “Catalogue for Managing the Import of Wastes” included a list, regularly updated, of prohibited goods. China signed the Basel Convention and in 2012 the government announced actions to improve coordination between the customs and inspection departments. Finally, in 2007, the Ministry of Environmental Protection signed a cooperation agreement with the Environmental Protection Department of Hong Kong - the main entrance port for scrap to combat illegal movements of waste. However, due to inadequate enforcement and monitoring activities imports of e-waste did not diminish.

It was only in 2013 that the People’s Republic of China enforced the ban on imports of waste electric and electronic equipment through a major initiative: OGF. The ten-month operation aimed at preventing imports of bales with a percentage of contaminants higher than 1.5%. The Chinese customs and China Certification and Inspection Group (CCIC) controlled documentations and suspicious behaviors. These include low prices for shipments, freight and insurance; firms that had already shipped hazardous wastes in the past through fraud and other malpractices; or companies that use different entrance points for imports.

OGF prevented 7.600 tons of equipment from being imported and suspended 250 import licenses. Hence, the initiative boosted law enforcement and it contributed to reduce the level of contaminants in shipped bales. In the long term, according to some commentator from the scrap recycling industry, this operation will “streamline the type of material coming into China and will limit the environmental impact” of e-waste shipments. For instance, shipments of certain types of plastic scraps, which can be better recycled in Europe, are likely to diminish. In addition, the initiative will force the recycling industry in exporting countries to adopt better sorting techniques improving the overall quality of scraps.

The recycling industry in China and developing countries will also benefit from the operation. Recycling companies will be forced to recycle scrap materials domestically and properly. Finally, OGF will increase and improve pre-shipment inspections in exporting countries. The initiative has already proven fruitful. It has been reported that waste management companies in exporting countries have already started improving the quality of the bales to be shipped.

However, in order to bypass the ban, some traders have resorted to ship e-waste away from Chinese ports, through other countries ports. In China, entry points for illegal shipments have spread from the Guangdong Province to other regions and some of the rejected shipments have been discharged in landfills without undergoing processing. The operation limited shipments of hazardous substances, but it also reduced imports of plastic scrap and other materials, which are in high demand among local recyclers. Consequently, the lower supply caused a peak in prices which affected mostly recyclers, some of whom had to leave the market. In the Guandong province, approximately 30-40% of recycling facilities had to shut down.

Furthermore, it was argued that the operation affected disproportionately exporters in developing countries since creating bales with no more than 1.5% contaminants is possible only through “modern recycling equipment”. Coordination among enforcement agencies was not optimal either. In fact, the allocation of responsibility between CCIC was not clear. This uncertainty resulted in a duplication of controls and contrasting decisions. In 2009 Chinese government enacted a law on promoting the development of circular Economy. The main purpose of this law is to reduce, reuse and recycle the electronics products during the production, consumption and other processes. In 2011 a law regarding the Regulation on recycling and disposal of waste electrical and electronic equipment was passed and this made the recycling of WEEE mandatory. With the enacting of this legislation the producer’s responsibilities were increased and a special fund was established to assist the e-waste recycling. As a token for reward certain certification and awards were made to be given for the second hand appliances and recycling enterprises. To further facilitate the enactment of these regulations, a catalogue of WEEE for disposal regulations was issued by the national bodies in 2010. This catalogue was amended to incorporate additional categories of WEEE and published in 2015.

In 2012, the regulations were issued regarding the collection and management of WEEE disposal fund in a standardized manner. In this regard, the Chinese taxation department immediately started collecting WEEE disposal fund from the manufacturers of products listed in the catalogue of WEEE. In 2019-20, China revised its regulations on the management of e-waste, which includes a comprehensive framework for the collection, treatment, and disposal of e-waste. China also issued a national e-waste management plan, which aims to establish a comprehensive system for the treatment and disposal of e-waste by 2025.

In some regions of China, there have been pilot projects aimed at improving e-waste recycling. For example, in the city of Guiyu in Guangdong province, which is known for its e-waste recycling industry, the government has established a new e-waste recycling park that uses advanced technologies to recover valuable materials from e-waste in a more environmentally friendly way. China is also building new e-waste disposal facilities to better manage the growing amount of e-waste generated in the country. For example, a new e-waste disposal facility is currently being built in the city of Qingdao in Shandong province, which will be able to process 100,000 metric tons of e-waste per year.

**5.3 India: formal-informal collaboration in e-waste processing**

In India, the Extended Producer Responsibility (EPR) principle has been applied to e-waste in 2010. However, its implementation is far from being achieved. Only a few manufacturers have set up an e-waste management system or joined one. Among the electronics companies operating in India, only four have established take-back schemes for their own products, one of which only for B2B equipment.

The association of manufacturers (MAIT) is trying to organize a joint initiative to set up collection networks, but so far there is no nation-wide organized formal system. The formal sector manages only 3% of the total e-waste generated. Similarly to other developing countries, India can count on a small number of large recycling facilities that struggle to gain access to e-waste while the informal sector is constituted by numerous individual recyclers or organized enterprise. In such conditions it is unreasonable to expect that the informal sector will be formalized. At the same time, the status quo cannot be satisfied as the formal treatment facilities need to process an adequate amount of e-waste in order to cover their fixed costs.

In 2013, Attero, one of the largest waste management companies in India, launched a project - the Clean E-India Initiative - to integrate informal waste collectors in a formal management system. Attero has placed the organization of the informal sector at the core of its business strategy. In this view, the Clean E-India Initiative aims at, on one side, foster the collection of e-waste by establishing collection schemes in Delhi, Mumbai, Ahmedabad, and Hyderabad and take advantage of the company’s collection network that is already in place in over 22 States. On the other, it would provide training programs for informal recyclers, contracted or simply paid for collection and pre-processing operations. Investing in the training of informal recycling is fundamental in order to improve the environmental sustainability of e-waste management. To this aim, semi-skilled workers should be employed.

In order to maximize the economic value recovered and avoid the impact of improper practices on health and the environmental, WEEE is then transported to the only end-processing facility in the country (located in Roorke). By raising awareness and increasing the number of collection points, the initiative aims also at reducing the amount of EoL equipment stocked in households which, according to Kumar and Shah (2014) accounts for 40% of the e-waste generated. In addition, the project intends to increase the amount of e-waste which is treated properly. The project was co-funded by 15 major manufacturers operating in India and obtained USD 5mn from the International Finance Corporation (IFC, the World Bank group). It also received the endorsement from former Minister for Communications and Information Technology, Kapil Sibal.

The environmentally sound management of waste is a significant challenge for India. The Regulations / Rules and Acts for waste control are primarily listed as:

* The Environmental Protection Act 1986
* The Environmental Protection Rules 1986
* The Hazardous Waste (Management and Handling) Rules
* The Batteries (Management and Handling) Rules
* Bio-Medical Waste (Management and Handling) Rules, 1998
* The Water (Prevention and Control of Pollution) Act, 1974, amended 1988
* The Water (Prevention and Control of Pollution) Cess Act, 1971 amendment 2003 Air (Prevention and Control of Pollution) Act 1981, Amended 1987 and the Air (Prevention and Control of Pollution) Rules, 1982
* The Ozone Depleting Substances (Regulation and Control) Rules, 2000
* The Noise Pollution (Regulation and Control Rules) 2000
* The Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008
* The Plastics (Manufacture, Usage and Waste Management) Rules, 2009 The E-Waste (Management and Handling Rules) 2011

In all, one can say that the rule 2011is a comprehensive piece of regulation for dealing with the e waste that at least refers to all important issues which even the developed countries like EU , US , Japan , China , Thailand etc initiatives have not been able to address till now. The Rule is not been able to completely address the measures of monitoring and enforcement mechanisms, the role of informal recyclers in India or how the import ban can be enforced. Informal e-waste recycling dominates the industry, accounting for 90 to 95 per cent of all recycling. The formalization of collectors and dismantlers may be effective, but as long as informal recyclers are able to pay more for e-waste, an incentive exists for market participants to shirk compliance and illegally sell toxic material to informal recyclers. The regulation‘s effectiveness at reducing the role of informal recyclers will entirely rest on the ability of the respective bodies to present a credible threat of enforcement. The maintenance of the registry of authorised market participants and compliance with the regulation‘s requirements will pose financial constraints as these are likely to be expensive. Adding administrative costs to formal recyclers who are already struggling to survive will find it difficult to run organizations formally. By concentrating on actions related to e-waste sources and associated aspects, the auctions provide Indian regulators with the control and ability to target their enforcement to some extent.

In 2016 Government of India passed E-waste Management Rules, 2016 will a sole purpose of to decrease the E-waste and to recycle these products and include collection targets as well as a requirement that producers implement a deposit-refund system (DRS). A similar legislation was carried out in 2016 for the hazardous and other waste management. This legislation involves the prevention minimization, reuse, recycling, recovery, and safe disposal of these wastes. These rules proved to be ineffective in generating the desired response. Since then, these rules were amended twice. The amendments have introduced regulations which mandate the manufacturers to gradually increase the WEEE collection percentage. These amendments targets an over 70% collection by the year 2023. The steep collection targets would mandated by these amendments would push the producers to look towards WEEE that is informally managed.

In 2018, the Indian government amended the E-Waste (Management) Rules, 2016 to make the e-waste management system more effective. The amendment includes the revision of the e-waste collection targets and increased penalties for non-compliance. Furthermore, the government made it mandatory for producers to be responsible for the disposal of the e-waste generated by their products. This policy is known as Extended Producer Responsibility (EPR), and it aims to make producers more responsible for the entire lifecycle of their products.

In 2020, the Central Pollution Control Board (CPCB) launched an e-waste exchange platform to facilitate the collection and recycling of e-waste. The platform allows waste generators, recyclers, and producers to connect with each other and exchange information on e-waste management. In 2021, the government launched the National E-waste Management Programme (NeMP) to establish a formalized system for the management of e-waste in India. The programme aims to reduce the environmental impact of e-waste by promoting recycling and reducing the amount of e-waste sent to landfills. The Ministry of Environment, Forest and Climate Change also released a draft of the “E-waste Management Rules for Extended Producers”. The proposed rules will require producers to register with the government and meet specific e-waste management targets.

**5.4 Indonesia: e waste Management regulations**

Indonesia has been taking steps to address e-waste management in recent years. Here are some of the e-waste management regulations in Indonesia:

* In 2011, a regulation was passed which mandates producers of electronic goods to be responsible for the collection and management of their e-waste. It also mandates the establishment of collection points and recycling facilities for e-waste.
* In 2012, a regulation was passed on ministerial level which outlined the technical requirements for e-waste management, including the standards for e-waste collection, storage, and recycling. It also requires producers to submit annual reports on their e-waste management activities.
* In 2017, a regulation was passed on presidential level which outline the national strategy for e-waste management in Indonesia. It sets out the government's goals for reducing e-waste and improving e-waste management practices.
* In 2018, Indonesia’s Ministry of Environment and Forestry issued a decree, which requires producers of electronic goods to submit a waste management plan to the government. The plan must include details on how the producer will collect, transport, and recycle their e-waste. Furthermore, the ministry passed a regulation which establishes guidelines for the management of hazardous and toxic waste, including e-waste. It outlines the procedures for the handling, transport, and disposal of e-waste.

The country has also prepared a “Circular Economy Roadmap 2019-2024”whichoutlines Indonesia's goals for transitioning to a circular economy, and includes improving e-waste management. The roadmap sets out specific targets for e-waste collection, recycling, and disposal.

Overall, Indonesia has made significant progress in e-waste management regulations in recent years. The government has been taking steps to encourage producers to take responsibility for their e-waste, establish collection and recycling facilities, and set technical standards for e-waste management. However, there is still room for improvement, particularly in increasing e-waste collection rates and improving recycling infrastructure.

As the government polices started to focus on e-waste management, there have been several recent developments in Indonesia regarding e-waste management. In 2020, the Indonesian government passed a new regulation on e-waste management, which requires producers to take responsibility for their e-waste products and develop a waste management system. The regulation also includes guidelines for the recycling and disposal of e-waste.

Several companies and organizations have started to provide e-waste collection and recycling services in Indonesia, such as Tzu Chi Foundation and Daur Ulang Nusantara. These initiatives aim to reduce the amount of e-waste that ends up in landfills and promote responsible e-waste disposal. The Indonesian government and various organizations are also raising awareness about e-waste and the importance of proper disposal through education campaigns and workshops. For example, the Ministry of Environment and Forestry launched the "Eco-friendly E-waste" campaign to encourage people to recycle their e-waste.

Private companies are also getting involved in e-waste management. For example, electronics manufacturer Samsung has partnered with local organizations to set up e-waste collection points across Indonesia. Meanwhile, ride-hailing service Gojek has launched an e-waste collection service, where customers can request to have their e-waste picked up and properly disposed of.

These developments are important steps towards better e-waste management in Indonesia, but there is still much work to be done to ensure that e-waste is properly collected, recycled, and disposed of in an environmentally friendly manner.

**5.****5 Japan: the docket system**

The 2001 Act on Recycrying of Specified Kinds of Home Appliance introduced a manifest system for appropriate recyclying of air conditioners, refrigerators, freezers, CRT TV sets and washing machines. Whereas later on Flat screen television and clothes dryer are also included in 2009.

When deciding to discharge their home appliance, consumers get a five-part manifest (or docket) from a retail store (if they decide to return the equipment there) or from a Post Office (if they take it directly to a collection point), and use it for payment of recyclying fee.

Consumers retain one copy of the manifest and apply another, which includes a bar code, to the appliance’s package. The bar code is scanned when the equipment is entrusted to a collection facility, and a recycling facility.

Each of the operators involved retain a paper copy of the manifest as proof. The data in bar code of the copy is sent to the Home Appliance Recycling Law Ticket Centre, a private association for common good in Japan, which is also responsible for the administration of the manifest system including the Post Office system.

Waste management operators register information regarding the handling of the equipment in a database. Data is also uploaded to the Association for Electric Home Appliances (AEHA) website to enable consumers and retailers to trace the equipment. Tracking is made possible because each manifest is assigned a reference number. This is linked to the appliance, its characteristics, the issuance date, as well as the name and address of the producer and retailer.

The system allows consumers and authorities to make sure that WEEE is managed properly by authorized operators only.

In addition, the system facilitates the compliance, identifying applicable collection points and recycling plants for each brand and category of WEEE. It also allows treatment facilities to identify the producer and receive compensation for recycling the appliance. Finally, the system improves the quantity and quality of data collected.

The Japanese manifest system for e-waste works because consumers are required by law to return their EoL appliance, and because retailers are requested to take it back and entrust it to the manufacturer or importer responsible for its management. In addition, despite its costs, consumers are willing to pay for the manifest.

As an initiative of E waste management in 1998, Japan enacted the Act on Recycling of Specified Kinds of Home Appliance. The law requires recycling rates of between 50-60 per cent by weight, which could be addressed by reusing and recycling product and its components. The amended Act on Recycling of Specified Kinds of Home Appliance has ensured the proper treatment of waste home appliances.

Japan enacted the Revised Act on the Promotion of Effective Utilization of Resources, which requires manufacturers of e products including computers and similar items, large electrical home appliances, which were not covered under the Act on Recycling of Specified Kinds of Home Appliance to design for disassembly, recycling and waste reduction and longevity of use.

The main purpose of enacting this act was the encouragement of the voluntary efforts among the producer to reduce the waste, reuse the recycled material and enhance the recyclability by adopting DfE. In 2006 an amendment of Government Order for this act was made and the producer and the importer are required to label the material content of the EEE containing six substances. i.e. Lead, mercury, chromium, Cadmium, PBB and PBDE.

In 2013, Act on Promotion of Recycling of Small Waste Electrical and Electronic Equipment was enacted for the recycling of the small household electrical appliances (SHEA). The primary purpose of this law was the recovery of valuable material from the WEEE waste because SHEA is often easy to waste even though it includes valuable materials. It is pertinent to mention that prior to this law, there was no such law for the recycling of the rare earth metal, which are heavily used in small electronics equipment.

In a commendable effort to raise awareness, Japan’s Olympic organizing committee launched an initiative titled “Tokyo 2020 Medal Project” in 2016. The initiative aimed to fabricate the medals of 2020 Tokyo Olympics solely from recycled WEEE from within Japan. Under this initiative, WEEE collection centers were setup across the country helping the local authorities to collect 90% of the total waste. As a result, 32 kg of gold, 3.5 tonne of silver and 2.2 tonne of bronze was recycled. This project represent a mere fraction of the total WEEE generated every year in Japan. However, initiatives like these can be a blueprint for effecting a lasting change within the recycling industry.

In 2018, the Japanese government revised its Home Appliance Recycling Law to increase the number of appliances that manufacturers are required to recycle. The revised law added small appliances such as electric toothbrushes and shavers to the list of recyclable items. In 2019, the Ministry of the Environment launched a new initiative that aimed to promote collaboration between companies in the electronics industry to improve e-waste recycling. The initiative included workshops and training sessions for industry members. In 2020, the Japan Environmental Sanitation Center (JESC) started a pilot project to test a new e-waste recycling method. The project used a robot to dismantle discarded appliances and sort their parts for recycling. Furthermore, the Japanese government launched a public awareness campaign to encourage proper e-waste disposal. The campaign included a video that explained the importance of recycling e-waste and showed how it can be done. Japan has essentially established numerous e-waste collection centers and recycling facilities throughout the country. These centers and facilities play an essential role in properly managing e-waste in Japan.

**5.6 Republic of Korea**

Beneficial use practice of E-wastes in Korea was introduced to improve recycling activities including collection system and recovery center with facilities In order to improve the recycling of waste in Korea (Republic of). The act on the promotion of saving and recycling of resources was activated in 1992. Under the act, waste charges and waste deposit fee system were operated for several products from industries to promote recycling measurement. Due to the abolition of waste deposit system in 2002, the EPR system was introduced in 2003 by the amendment of recycling law Since early 2004, the Ministry of Environment of Korea has carried out a feasibility study to introduce an. “Eco-Assurance System (The ECOAS)” which would restrict the use of hazardous substances in electrical and electronic equipment and promote recycling of E-wastes by applying a systemic management for life cycle analysis from cradle to grave. On January 2008, the ECOAS in Korea has been implemented under the Act on the Resource. Circulation of Electrical and Electronic Equipment and Vehicles for resource circulation and environmental conservation in a joint legislation by the Ministry of Environment, the Ministry of Knowledge & Economy, and the Ministry of Land, Transport and Maritime Affairs According to the ECOAS in Korea, 5 product groups and 27 items of WEEE including refrigerator, personal computer, electric oven, audio, and mobile phone are controlled to intensify the recycling capacity in electronic industries. Beneficial use of practice of recycling E-Waste in Korea were examined to improve recycling activities including collection system, recovery center with facilities by the information of E-Waste generation and recycling, policy and regulations of E-Waste Even though total generation of E-wastes was almost constant recently, the generation trend of TV, refrigerator and washing machine was very increased because those products was used in household more than 2 times for past 10 years. Also, recycling rates of those E-wastes will be increased because recycling technologies have been improved and those E-wastes were readily decomposed by heavy parts.

Ministry of Environment of Korea has outlined a framework plan in 2002 in a comprehensive waste management plan and its goal was to establish a sustainable and resource circulating socio-economic foundation. Utilization of waste resources was one of the major aspect of this plan. It was able to reduce the amount of waste by 22% from 2002 to 2011 and increased recycling of these waste by 53%.

With aim to supplementation and extension of existing initiatives the ―Act on resource recycling of electric electronic equipment and vehicles came in 2008. The act have provisions for design and production considerations of recycling with aim to Elimination of hazardous substances, Design of product to easy to dismantle and use of easy-to-recycle substance in Environment friendly collection, treatment & recycling atmosphere. The act consists of precautionary and end-of-pipe regulation along with life cycle of the product.

Through the revision of the “Act on the Promotion of Saving and Recycling of Resources”, the legal concept was re-established and the basic principles regarding resource circulation were declared in March, 2008. Accordingly, “resource circulation” is defined as “environmentally using and managing the recycling process of resources, such as suppressing the generation of waste within the scope necessary to achieve the purpose of environmental policy, and recycling or disposing of the generated waste appropriately”. In line with this, the “Act on the Resource Circulation of Electrical/Electronic Products and Vehicles” was also enacted in 2007 for the full-fledged EPR system of electrical/electronic products and was implemented in January 2008. Among the various EPR target items, it was seen as a characteristic case in which separate management laws for electric/electronic products and automobiles came into effect, and it aimed to suppress the use of harmful substances and encourage the development of easy to recycle products.

In 2017, the government enacted the “Framework Act on Resource Circulation” to promote the transition to a resource recycling society and announced its enforcement in 2018. Through the “Framework Act on Resource Circulation”, the “Resource Circulation Performance Management System” was introduced, It aimed to minimize the generation and disposal of waste and promote recycling. In addition, by introducing the “recycling resource recognition system”, if a manufacturer meets certain requirements, it recognized the trade as a recycling resource. In connection with this, the “Circular Usability Evaluation” system is introduced to manage hazardous substances by manufacturers, and the waste disposal charge is introduced to strengthen management and supervision of final disposal companies.

The domestic WEEE recycling system applies and operates the EPR system based on the “Resource Saving and Recycling Promotion Act” and the “Electric/Electronic Products and Vehicle Resource Circulation Act”. The Ministry of Environment allocates a recycling target per citizen based on the “National Long-Term Recycling Target” policy and manages recycling performance by calculating the annual national recycling obligation based on the output and ratio of producers. Actual performance is managed through “EcoAS” operated by the “Korea Environment Corporation”.

In 2020, the Ministry of Environment announced the Enforcement Decree of the “Resource Circulation of Electric/Electronic Products and Vehicles Act”. The main contents of the 'Enforcement Decree of the Recycling of Electronic Products, etc. Act' are to facilitate the recycling of WEEE and to prevent harmful elements in the living environment in advance. 23 items, such as dehumidifiers and electric massagers, which are recently increasing in use, were added to the EEE products subject to restrictions on the use of hazardous substances, and the management target was expanded from to 49 items from a previous list of 26 items.

In 2021, the Ministry of Environment prepared a 'step-by-step roadmap' to ban and restrict imports of 10 items with large imports, such as coal ash and waste paper, with the goal of prohibiting imports of all wastes except for some items such as waste metals by 2030. Waste batteries, metals, and waste electrical and electronic products that are being imported for the recovery of valuable metals from electronic waste have high value as raw materials.

IN 2023 SK ecoplant Co. is taking over Singapore-based electronics waste management solution provider TES Envirocorp for $1 billion to enhance its sustainability identity. SK ecoplant entered the environmental services market in 2020 by taking over Korea’s leading waste management solution provider EMC Holdings for about 1 trillion won. The company acquired six more environmental service firms last year alone. In September 2022 Samsung Electronics announced its new environmental strategy, a comprehensive effort to join global efforts to tackle climate change. It includes commitments to achieve enterprise-wide net zero carbon emissions and plans to use more renewable energy, as well as to invest in and research new technologies to develop energy-efficient products, increase water reuse and develop carbon capture technology.

Samsung Electronics has also joined RE100, a global initiative dedicated to pursuing 100 percent renewable energy. As part of this commitment, the company plans to match electric power needs of all international markets where it operates, outside of Korea, with renewable energy within five years.

South Korea has been actively cooperating with other countries to tackle the global issue of e-waste. For example, in 2021, South Korea participated in the International E-Waste Day event, which aimed to raise awareness about the need for proper e-waste management.

**5.7 Malaysia: E-waste management**

The quantities of e-waste generated in Malaysia according to the Environment Quality Report by DOE is 1.1 million tonnes in 2008, 1.3 million tonnes in 2009, 1.6 million tonnes in 2010, and 1.5 million tonnes in 2011. The e-waste are slightly increases year by year. This is caused by the rapid increase in Electrical and Electronic Equipment (EEE) amount produced and imported into Malaysia as well as the increase of development of a growing its technology.

E-waste has been regulated in Malaysia since 2005. The Department of Environment (DOE) within the Ministry of Natural Resources and the Environment (NRE) is responsible for the planning and enforcement of regulatory requirements related to e-waste. Although there are no direct regulations to deal with e-waste, the management of e-waste is incorporated within the Environmental Quality (Scheduled Waste) Regulations 2005 and the Environmental Quality (Prescribed Premises) (Treatment, Disposal Facilities for Scheduled Waste) Regulations, 1989 (control on collection, treatment, recycling and disposal of scheduled waste including e-waste). In January 2008, the DOE issued the ‘Guidelines for Classification of Used Electrical and Electronic Equipment in Malaysia’ for assisting all stakeholders involved in e-waste management to identify and classify the used products according to the regulatory codes. The guideline provides a list of the types of electrical and electronic waste which may contain the hazardous compounds or materials. Currently the DOE is working on a draft regulation to manage e-waste, which will be known as the Environmental Quality (Recycling and Disposal of EoL Electrical and Electronic Equipment) Regulations. The purpose of this regulation is to make it a mandatory requirement for producers and manufacturers to design equipment to minimize hazardous components and facilitate ease of recycling including the requirement for producers and manufacturers to take back e-waste for recycling or disposal.

In Malaysia there are around 146 e-waste recovery facilities which are working with a total capacity of around 24000 metric ton to handle per month. 128 are the partial recovery small and medium sized operators who are engaged in the physical and manual segregation of e-waste for the further processing. There are around 18 recovery facilities which are useful for the processing of the e-waste to recover precious metals from the waste of electronics.

Currently, In Malaysia Solid Waste and Public Cleansing Management Act 2015 has been implemented and with its implementation the household e-waste is managed through the separation at source policy. As a part of the policy, it is compulsory for every household to separate their waste into recyclable and non-recyclable waste. This policy is monitored and administrator by Solid waste Corporation.

In 2017, the 'Environmental Rules on Designated Household Waste' were released. The rules cover all categories of designated waste generated by households in the future. In the early stages of implementation of the rules, six categories of household e-waste were focused: televisions, washing machines, refrigerators, air conditioners, computers, and mobile phones. Other categories of household waste, such as fluorescent lamps, batteries, and small electrical and electronic devices, are also planned to be regulated in stages with the following contents.

* All persons concerned with household e-waste (including retailers, collectors, carriers, recyclers, etc.) must be registered and authorized. Some stakeholders, such as recycling facilities, need to acquire new licenses.
* Proper collection, storage and transport, prohibition of dismantling operations, and a new system have been developed in which the collected electronic waste is transported only to licensed recycling facilities for proper recycling. Activities performed by installers or unregistered parties are illegal.
* In this new structure, manufacturers and importers need to pay a 'recycling fee' for all electrical and electronic devices that have become regulated products when they are put into the market. This fee is used for proper recycling of household e-waste when the product is disposed of.
* Under the new regulations, a new financial organization, tentatively named 'RFMB/Recycling Fund Management Board' (RFMB/Recycling Fund Management Board) was established by the Environment Agency to govern the new rules, manage and generate recycling charges collected from recycling, final It manages the entire system from disposal to disposal.

According to a recent estimate, Malaysia generated about 280 kt of e-waste in 2016. The budget for 2021 has been allocated to positively impact the environment under the 4th ‘Ensuring Resource Sustainability’, which is in line with the United Nations’ Sustainable Development Goals (SDGs).

The recent WTE project in Malaysia based on the PPP model has enabled waste management and green energy production in the area where the project has been carried out. This PPP model will lay the groundwork for a model that will lead the expansion of eco-friendly energy, smart city development, and sustainable projects in the future.

In 2021, the Malaysian government introduced new e-waste management regulations that require producers to implement take-back programs for their products. Under the regulations, manufacturers must collect and recycle their products at the end of their useful life. Malaysia has several e-waste recycling facilities that recover valuable materials from e-waste. These facilities use advanced technologies such as automated sorting, chemical treatment, and smelting to extract useful materials from e-waste.

The Malaysian government has launched several public awareness campaigns to educate citizens about the importance of proper e-waste management. For example, in 2019, the Ministry of Environment launched a campaign called "Recycle Your E-Waste Today" to encourage people to recycle their e-waste. Malaysia has established partnerships between the government and the private sector to promote e-waste management. For example, in 2018, the Malaysian Investment Development Authority (MIDA) launched an initiative to promote the recycling and reuse of e-waste by working with local and international companies.

Malaysia has established several e-waste collection points throughout the country. Consumers can dispose of their e-waste at these collection points or through designated collection events.

**5.8 Pakistan: E-waste management**

Using the information from StEP, the amount of e-waste in Pakistan is estimated for the year 2014, and is calculated as 316 kilotonnes approximately while UNU estimated it to be 266 kilotonnes with 1.4 kg per individual in 2014. These estimates, which are in fair agreement, are both higher than historical estimates; Breivik et al., (Robinson, 2009) estimated that Pakistan generated approximately 210 kilotonnes of e-waste in year 2005 which was estimated by distributing the global e-waste generated to individual countries using GDP as a surrogate. Assuming these estimates are reasonable, this implies that the e-waste generation in Pakistan may have increased by up to about 50% over the last decade. Although the data reflect domestic generation and do not include illegal imports, it indicates an increasing trend for domestic e-waste generation in Pakistan.

Pakistan has no regulations specifically targeting e-waste although the National Environment Policy has been active since 2005. The Ministry of Environment overseas the environmental protection and movement of chemicals and waste. There is no formal mechanism to manage e-waste at the national level. People use different methods to manage e-waste locally. The informal recycling sector is very active and a number of workers, including children, earn their living by dismantling the electronic scrap and extracting valuable metals. Open burning and open dumping of e-waste is very common in Pakistan. Therefore, the government of Pakistan first needs to enforce the rules that already exist, such as the Basel Convention, which restricts the import and transboundary movement of hazardous substances, becomes more effective. Apart from existing laws and regulations, government shall devise e-waste specific national level legislation. The legislation should be in line with the issues addressing recycling and disposal/management of e-waste in Pakistan.

The major Regulations / Legislations / Provisions are as follows:

Section 13 reads ―Prohibition of import of hazardous waste.—No person shall import hazardous waste into Pakistan and its territorial waters, Exclusive Economic Zone and historic waters.

Section 14 reads ―Handling of hazardous substances.— Subject to the provisions of this Act, no person shall generate, collect, consign, transport, treat, dispose of, store, handle or import any hazardous substance except

* under a license issued by the Federal Agency and in such manner as may be prescribed; or
* in accordance with the provisions of any other law for the time being in force, or of any international treaty, convention, protocol, code, standard, agreement or other instrument to which Pakistan is a party.

National Policy, Legislation and Regulatory System in Pakistan includes:

* National Environment Policy 2005,
* Import Policy Order 2009,
* Day to day orders of Ministry of Commerce and Federal Board of Revenue (FBR) controls imports and exports, The regulating powers of Ministry of Industries and Production oversees manufacturing addresses e waste, As and when needed steps initiated by Ministry of Environment oversees environmental protection and controls import/export of restricted chemicals and waste.

A German company is investing in the construction of Pakistan's first 100MW power plant that converts waste into energy. The Lahore Waste Management Company (LWMC) hopes to cooperate with foreign companies in this type of Waste-to-Energy project. According to LWM's own feasibility study, potentially 1035 tonnes of waste per day for the city of Lahore. It is estimated that it will be able to generate 550 MW of electricity.

There is a demand for cooperation with foreign companies in the field of resource-efficient clean production (RECP). The Punjab Provincial Government, in collaboration with the World Bank, is promoting the 'Punjab Green Development Program' worth $280 million over five years to improve environmental policies and stimulate private investment..

In 2018, as part of an effort to promote renewable indigenous resources for power generation, the National Electric Power Regulatory Authority (NEPRA) of Pakistan approved the construction of a 40 MW waste power plant. According to NEPRA, the project plans to apply state-of-the-art waste-to-energy technology that processes around 2,000 tons of municipal solid waste every day, and NEPRA said in a statement that the generation of electricity using municipal solid waste is a local waste treatment and energy demand The successful implementation of this project will be a cornerstone for other initiatives of a similar nature to promote cleaner cities and healthier lives by addressing pressing issues such as waste disposal, limited landfill space and gas emissions.

The National Hazardous Waste Management Policy, 2022 was introduced by ministry of climate change and it will be a milestone achievement in addressing the issue of hazardous waste management in Pakistan. The policy instrument will enable Pakistan to play a pivotal role in meeting the obligations under the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. In addition, it would also help Pakistan achieve the relevant Sustainable Development Goals and avail extension of the European Union’s GSP Plus status post - 2023.

The policy underscores the significance of a life cycle approach to manage hazardous waste from its generation to disposal in an environmentally sound manner. It provides measures for controlling transboundary movement of hazardous waste, managing contaminated sites, institutional capacity building, monitoring & reporting mechanisms, and sustainable financing options. In 2020, the government of Pakistan approved the country's first-ever E-waste Management Policy. The policy aims to establish a regulatory framework for the collection, transportation, storage, treatment, and disposal of e-waste in an environmentally sustainable way.

Pakistan has several e-waste recycling facilities that recover valuable materials from e-waste. These facilities use advanced technologies such as automated sorting, chemical treatment, and smelting to extract useful materials from e-waste. Pakistan has also established several e-waste collection points throughout the country. Consumers can dispose of their e-waste at these collection points or through designated collection events.

The Pakistani government has launched several public awareness campaigns to educate citizens about the importance of proper e-waste management. For example, in 2019, the Ministry of Climate Change launched a campaign called "Clean Green Pakistan" to promote environmental sustainability, including proper e-waste management. Pakistan has established partnerships between the government and the private sector to promote e-waste management. For example, in 2019, the Pakistani government signed a Memorandum of Understanding (MoU) with the World Economic Forum to collaborate on e-waste management and other environmental issues.

**5.9 Thailand: E-waste management**

Pollution Control Department (PCD) estimated that the amount of E-waste generated in 2014 is 376,801 tons and 384,233 tons in 2015. This forecast was done for only 8 types of household appliances. It is expected that the actual amount of E-waste generation is much higher than this number and is likely to increase each year.

To have environmentally friendly management of E-waste, PCD drafted the National Integrated Strategy for the Management of Waste Electrical and Electronic Equipment to cope with E-waste problems in the country which included an action plan and a development of specific law to establish a comprehensive E-waste management in order to have a proper treatment of E-waste and rising public awareness about E-waste issues. Draft Act on the Management of Waste electrical and electronic Equipment and Other End-of-Life Product was approved from the cabinet on May, 19 2015. This is specific law to control E-waste management in order to have effective E-waste management system by integrated all stakeholders participation with EPR that producers have responsibilities to pay for E-waste management and improve more environmentally friendly product design by reducing the use of hazardous substances and design easy recycleable product to promote sustainable production and consumption. Moreover, this law allows the informal sector to join take-back system by registering with local administrative organization and must operate under the regulation which is good choice for informal sector to operate with good management. However, after this law was sent to The Council of State (Krisdika), it was changed and removed many key topics that may result in lower effective of E-waste management. And now, this law is in a process of improvement and consideration to promulgate.

The Thai government is encouraging the e-waste import/disposal hub and WTE (Waste to Energy) industry. The Thai government judges that the economic benefit of the process of extracting minerals from e-waste is high, and is fostering related industries under the management of the Ministry of Industry. In this regard, about 53,000 tons of e-waste were imported just in the year of 2017.

The need for waste reduction and environmental protection is emerging from both the public and private sectors in Thailand, and the government plans to increase Thailand's waste disposal amount from only 35% to 75% by 2026. In commemoration of World Environment Day in June 2018, more than 20 companies and organizations launched the ‘Plastic Waste Killer’ campaign with the goal of reducing plastic waste by 50% by 2027.

Thailand, which suffered from an influx of waste from around the world since China banned the import of recycled waste in 2018, has decided to ban the import of waste. The Thai government held a joint meeting with related ministries and agreed to ban the import of hazardous waste to prevent environmental damage caused by electronic products and plastic waste. Thailand's Ministry of Resources and Environment has decided not to allow the import of 411 types of electronic waste and any kind of plastic waste. However, used communication devices and photocopiers for repair and recycling purposes are excluded from the import ban. According to Thai Customs, the amount of recycled and electronic waste imported from this year to May of this year was 212,000 tons, far exceeding the annual import volume of 145,000 tons last year.

In 2018, the Thai government passed the "Management of Hazardous Substance Act" to regulate the import, export, and disposal of e-waste in the country. The act sets out several measures for e-waste management, including:

* The act prohibits the import of e-waste into Thailand, except for e-waste that can be reused or recycled.
* The act requires e-waste to be labeled with information about its contents, including hazardous substances.
* The act requires manufacturers, importers, and distributors of e-waste to collect and dispose of their products in an environmentally sustainable way. They are also required to provide information on e-waste collection and disposal to consumers. The act encourages e-waste recycling and sets out rules for e-waste recycling facilities. These facilities must meet environmental standards and obtain licenses from the government.
* The act provides for penalties for non-compliance, including fines and imprisonment.

Since the passage of the act, the Thai government has taken several measures to implement its provisions, including establishing e-waste collection points, conducting public awareness campaigns, and strengthening enforcement. In 2021, the government also introduced a draft e-waste management strategy for the period of 2021-2030, which aims to further improve e-waste management in the country.

**6. Related international activities**

**6.1 Activities in SDOs**

**6.1.1 ITU (ITU-T & ITU-D)**

The ITU and their partners build the momentum of the agreement at WTSA-12 on a Resolution on e-waste, giving further impetus to ITU’s standardization work on the subject and mandating ITU’s standardization and development sectors, ITU-T and ITU-D, to assist Member States in instituting policy frameworks that limit e-waste’s negative environmental effects.

The ITU members represent a cross-section of the global ICT sector, from the world's largest manufacturers and telecom carriers to small, innovative players working with new and emerging technologies along with leading R&D institutions and academia (ITU, 2016). As the whole ICT/telecommunication sector is represented in ITU, collaboration towards meeting the e-waste reduction target is crucial. The ICT/telecommunication sector, including OEM, mobile and integrated network operators, internet service providers, content owners and infrastructure providers, among others; must actively participate in this process.

The e-waste target attainment and the implementation of the e-waste roadmap, must be addressed as a joint effort between ITU and its member states. This must be carried out in collaboration with the ITU sector members, in cooperation with existing platforms and organizations working on environmentally sound e-waste management worldwide.

The ITU-T activities can be understood by the aims to define the baseline of the ITU Connect 2020 agenda for e-waste target redundant e-waste by 50% by the year 2020 for the ICT/Telecommunication Sector. It covers the three main steps of the e-waste roadmap which sets the foundation for future accomplishment of the e-waste target under the Connect 2020 Agenda by the year 2020. ITU has established these e-waste targets based on the work carried out by ITU-T Study Group 5 (SG5) on “Environment and Climate Change”.

The ITU has been able to develop a meaningful e-waste target baseline and set the foundation for the implementation of the e-waste roadmap. This roadmap also allows to identify alternatives to develop future guidance and standardization mechanisms for the reporting of national ICT/telecommunication products life-cycle situations (import, products placed in the market, recycled, resold, disposed of, exported, etc.). The standardized assessment and baseline definition phase of the roadmap presented requires further adjustment of the numbers included in the assessment. This should be done on the basis of the public data provided and new calculation initiatives. This process should include the participation and engagement of data owners. A detailed statistical analysis of the different e-waste categories based on product categories have also been done on a country level. Standardization opportunities should be focused on the development of recommendation that includes a standardized definition of e-waste. Also, a framework to calculate e-waste generation flows; based on the work of ITU and other UN agencies, including the segregation of types of e-waste.

The work on Question 13 within ITU-T SG 5 “Environment and Climate Change” has generated a number of international technical standards including ITU-T L.1000, 1001 and 1100.

ITU-T L. 1000 (Universal power adapter and charger solution for mobile terminals and other hand-held ICT devices) specifies requirements for a universal power adapter for mobile devices. The requirements cover power adapter interface, energy efficiency, safety, EMC, resistibility, eco-environmental specifications. ITU-T L.1001 (External universal power adapter solutions for stationary information and communication technology devices) is a recommendation that defines the requirements and characteristics of universal power adapters (UPA) for stationary ICT devices, such as routers, modems, fixed telephones and facsimiles. It complements ITU-T L.1000 by specifying the same requirements as well as other items. ITU-T L.1100 (Procedure for recycling rare metals in information and communication technology goods) explains the necessity and importance of rare metal recycling and the recycling procedure for rare metals. It also describes a communication method for providing recycling information of rare metals contained in ICT goods. The main objective of this recommendation is to promote resource efficiency and environmental protection by facilitating the recovery and reuse of rare metals in ICT goods.

On the International E-Waste Day in 2020, ITU released a joint paper with the WEEE Forum on ‘Internet Waste’. The paper sheds light on EOL management of the ICT equipment calling for a collaborative effort for WEEE management. The ICTs have significant carbon footprint due to high energy expenditure, raw material mining and WEEE generation. The ITU is aiming to deal with the accumulating WEEE by policy making and standardization. In 2018, ITU policy makers set a target for increasing the global percentage of WEEE recycling to 30% by 2023. Furthermore, to raise global awareness regarding the seriousness of this issue, ITU aimed to achieve a target of raising the percentage of countries with WEEE related legislation to 50%.

In the year 2021, ITU made significant contribution towards enhancing the e-waste management system across the board. These activities include the following:

* ITU-T L.1470: In 2021, the ITU updated its standard on environmentally sound management of end-of-life ICT equipment (ITU-T L.1470) to include new guidelines for the refurbishment of ICT equipment. The updated standard provides guidance on how to refurbish ICT equipment in a way that maximizes its reuse potential and minimizes its environmental impact.
* E-waste data collection: The ITU collaborated with the United Nations University (UNU) and the International Solid Waste Association (ISWA) to develop a methodology for collecting data on e-waste. This methodology, known as the Global E-waste Statistics Partnership (GESP), aims to provide reliable and comprehensive data on e-waste generation, disposal, and recycling around the world.
* E-waste management training: The ITU launched a training program on e-waste management for policymakers and stakeholders in developing countries. The program provides participants with knowledge and skills to develop and implement effective e-waste management strategies in their countries.
* ITU-T L.1700: The ITU continued its work on developing its standard on the assessment of e-waste management systems (ITU-T L.1700). The standard provides guidelines for evaluating the performance of e-waste management systems and can help policymakers and stakeholders to identify areas for improvement in their e-waste management practices.

Overall, the ITU's contributions in 2021 have focused on developing new guidelines and methodologies for e-waste management, as well as providing training and capacity-building support to policymakers and stakeholders in developing countries. These efforts are helping to promote more sustainable and environmentally friendly practices in the ICT sector.

**6.1.2 ISO**

There are currently two standards for electronics recyclers, with certification programs attached. Recyclers can be certified to show their conformance to these standards. One is called the e-Stewards Standard for Responsible Recycling and Reuse known as e-Stewards, and the other is called Responsible Recycling (R2) Practices.

R2 stands for “responsible recycling,” but, it falls well short of “responsible”, when it comes to handling toxic materials. In fact, the standard is so weak in the key areas that only two participating environmental groups (the BAN and the ETBC) both withdrew in protest from the multi-stakeholder process in the final stages. This is the standard supported by the recycling industry association.

Many recyclers have been certified to ISO 14001. This is a standard for how to design a company’s environmental health and safety program. An ISO certification alone is no indication that a company is a responsible recycler, because it has no specific guidance for electronics recyclers.

This is why the e-Stewards standard incorporates ISO 14001 into the e-Stewards standard: the e-Stewards part sets the bar for WHAT responsible recyclers should be doing, and the ISO part speaks to HOW they should be doing it. Recyclers being audited to the e-Stewards standard get their ISO 14001 audit at the same time. This is why the cost of e-Stewards audits appears higher than R2 audits – it includes the ISO auditing costs. R2 does not, and R2 recyclers would pay for their ISO audit (if they are doing one) separately.

Meanwhile, in 2015, the ISO has created a rare earth division in the technical committee (TC) 298. The scope of the TC is standardization in the field of rare earth mining, concentration, extraction, separation, and conversion to useful rare earth related materials. Rare earth elements(REE) refers to seventeen elements including scandium(Sc), yttrium(Y) and 15 lanthanides defined by IUPAC(International Union of Pure and Applied Chemistry). REEs are used in a variety of electronic products. In particular, rare earth permanent magnets with neodymium(Nd), dysprosium(Dy) and praseodymium(Pr) are indispensable components for motors used in computer hard disk drives, audio speakers and electric vehicles. Systematic recycling of REE related components is essential because REEs are not only disposed of in some areas (more than 97% of REES are produced in china), which also cause serious environmental problems during mining and smelting process.

Recognizing the importance of rare earth recycling, in ISO TC 298, the second working group(WG) after the ‘Term and definition’(WG1) was confirmed as ‘element recycling’ at the second plenary meeting in 06.2017. Since it is a newly created TC and WG, a specific standard has not yet been proposed. However, Nd and Dy are key elements in REEs, it is expected that standardization will focus on the method of recycling rare earth magnets in e-wastes and extracting rare earths.

The TC 298 made significant progress in the recent years as it proposed and published multiple standard documents over the course of three years to aid recycling of key elements from EOL containing rare earth elements. These documents are as follows:

* ISO 22450:2020: Recycling of Rare Earth Elements—Requirements for Providing Information on Industrial Waste and End-of-Life Products
* ISO 22453: Exchange of Information on Rare Earth Elements in Industrial Wastes and End-of-Life Products;
* ISO TS 22451: Recycling of Rare Earth Elements—Methods for the Measurement of Rare Earth Elements in Industrial Waste and End-of-Life Products.

These standards aim to streamline the recycling process and promote recycling by aiding the recycling industry.

**6.1.3 IEC**

In consideration of global discussion on reducing e-waste and improving re-usability of power supplies, IEC continues to adopt USB-IF’s standards as international standards for USB technology.

The IEC 62680 series (Universal serial bus interfaces for data and power) of standards covers various aspects of USB. For example, IEC 62680-1-2(Part 1-2: Common components - USB Power Delivery specification) defines the standard for USB PD technology, which enables fast and flexible power delivery between devices. IEC 62680-1-3(Part 1-3: Common components - USB Type-C® cable and connector specification) defines the technical standard for USB Type-C, which is a reversible connector that supports multiple protocols and functions.

IEC 63002(Interoperability specifications and communication method for external power supplies used with computing and consumer electronics devices) The objective of this document is to enable common charging interoperability of external power supplies (EPSs) used with the increasing variety of computing and consumer electronics devices that implement IEC 62680-1-3 (USB Type-C®1 Cable and Connector Specification) and IEC 62680-1-2 (USB Power Delivery). Broad market adoption of this document is expected to make a significant contribution to the global goals of consumer convenience and re-usability of power supplies by expanding common charging interoperability across different product categories while preserving backwards compatibility with the installed base of billions of IEC 62680 compliant devices worldwide. This document specifies the minimum technical requirements for interoperability and includes recommendations for EPS functionality when used with computing and electronics devices. The approach taken by this document, focused on enabling common charging interoperability, can allow manufacturers to innovate in aspects such as technical design, system performance, and energy efficiency.

IEC 62680-1-3 adoption is well underway in global markets for a wide range of devices using as much as 100 W, including notebook computers, tablets, smartphones, small form-factor desktop computers, and other consumer electronics devices. This document enables the reporting of the identity and power characteristics of power sources (EPSs and other Sources) supported by IEC 62680-1-3 (USB Type-C) and specifies interoperability guidelines when using IEC 62680-1-2 (USB Power Delivery). This document also provides important information regarding consumer safety, system reliability as well as relevant global standards and regulatory compliance.

IEC Technical Specification 62700(DC power supply for notebook computers) addresses the common electro-mechanical characteristics for AC adapters used with a specified array of notebook computers.

In the current market, hundreds of millions of notebook computers are shipped every year with AC adapters which can typically be shared between generations of OEM notebook computers. The objective of a common DC power supply is to support global interoperability of adapters for a specific range of notebook computers. This Technical Specification describes design considerations for the common adapters and identifies technical areas that require further development for interoperability with existing notebook computer technologies.

In 2021, the IEC approved a new WEEE management related project led by Dworak under IEC TC 111. Under this standard, a blue print will be prepared for a sustainable management of WEEE. Additionally, measures will be introduced for increasing the amount of WEEE reuse by ensuring that the recyclers conform to guidelines of WEEE reuse and disposal under the new standards. The first IEC TC 111 meeting in this regard was held in September, 2021.

**6.2 The activities in the related international organizations**

**6.2.1 OECD**

OECD published “e-waste statistics Guidelines on classification, reporting and indicators” in 2015. These guidelines describe a measurement framework presented that captures the dynamics of e-waste, in which the parameters relate to each other. A minimum requirement of e-waste statistics is also proposed, which can be obtained via household surveys. The central classification to categorize the data is called the UNU-KEYS. Existing harmonized statistical data, such as production statistics, international trade statistics and IT statistics, can be linked to this classification. The memo also presents indicators that can be compiled from the framework, and serve as a resource for policymaking. Harmonizing the framework and indicators will be a substantial step towards reaching an integrated and comparable global measurement system for e-waste.

The OECD's Working Party on Resource Productivity and Waste (WPRPW) presented policy proposals to increase the metal recovery rate and recycling of used mobile devices through case studies. WPRPW emphasized the importance of mobile device recovery and recycling as mobile devices contain more important metals than other electrical and electronic products. Through this case study, WPRPW suggested that OECD member countries encourage the development of programs for recycling mobile devices and that developing countries can improve recycling capacity and quality. The WPRPW also suggested that Member States develop regional or industry-led programs to educate consumers on the importance of recycling electrical and electronic products and to encourage mobile device recall.

In 2016, the OECD published a Recommendation on E-waste, which provides guidance for member countries on how to develop and implement policies and regulations related to e-waste management. The recommendation includes guidelines on collection, recycling, and disposal of e-waste, as well as measures to prevent illegal dumping and promote resource efficiency.

In 2018, the OECD published a set of country profiles on e-waste management, which provide information on the regulatory frameworks, collection and recycling systems, and other aspects of e-waste management in different countries. These profiles can help countries to learn from each other's experiences and best practices and improve their own e-waste management systems.

**6.2.2 GeSIIn**

June 2012 the GeSI & StEP e-Waste Academy (EWA) 2012 took place in Accra, Ghana. The EWA changed its name to EWA-Managers Edition (EWAM) in January 2013. The second initiative, the EWA–Scientists Edition (EWAS) is a pioneering concept in the development of capacity on e-waste research and management to foster multi-stakeholder partnerships and establish opportunities for continued collaboration on e-waste research, policy and management. EWAS brings together young e-waste researchers from around the world, looking at solving the e-waste from different disciplinary perspectives. It aims to be the foremost forum available to young scientists to share their knowledge, interact with experts from academia, industry and policy and to develop collaborative partnerships. Three editions of the EWAS so far, between 2009 and 2011, have been extremely successful.

The E-Waste World Conference & Expo has hosted a two-day virtual conference and exhibition featuring intensive participation in all areas of WEEE (past, present, future and disruptive) in 2020.

E-WASTE World Conference & Expo discussed the latest recycling technologies, material recovery solutions, green electronics, sustainable materials, non-toxic alternatives and end-of-life. They also discussed lifestyle strategies, as well as regulatory and business models, to help reduce the environmental impact of all forms of consumer and industrial e-waste.

The International Telecommunication Union and the WEEE Forum have jointly organized the "Internet Waste Dialogue" in conjunction with the 2020 International E-waste Day. Sustainability efforts have become important throughout the supply chain, especially for energy efficiency, and more and more companies are focusing their efforts on circular economy goals for material reuse, such as the repair, upgrade and recycling of infrastructure equipment.

The overall impact and regulation of materials and components critical to the digital economy on individual consumers using personal ICT devices supported by data centers and telecommunication networks are difficult to assess as infrastructure and end-of-life management are less visible. GeSI has worked to raise awareness of these waste streams and generate ideas by exchanging knowledge to support the transition to a sustainable society and circular economy.

**6.2.3 UNEP**

UNEP published Sustainable Innovation and Technology Transfer Industrial Sector Studies “RECYCLING – FROM E-WASTE TO RESOURCES” in 2009. It summaries; Due to the early stage of awareness for e-waste recycling in emerging economies, innovation hubs and centres of excellence have not been established yet. However, some organizations are currently establishing their e-waste competence and have a great potential to develop into innovation hubs.

Multilateral institutions, mainly National Cleaner Production Centres and Basel Convention Regional Centres develop into knowledge hubs for e-waste management in some countries. The current situation in China, India and South Africa indicate that smaller and less complex economies such as South Africa’s improve faster in awareness and competence. Crucial instruments and framework conditions for the development of innovation hubs include the possibility to participate in international knowledge partnerships programs.

It also has been observed that without clear legal framework and active participation of the government, the development of innovative technologies is hampered. The future success of technological innovation in environments with strong informal participation strongly depends on alternative business models with financial incentives, which allow the informal sector to still participate with “safe” recycling processes, while hazardous operations are transferred to state-of-the-art formal recyclers. The development of innovation hubs also demand for a fair competitive environment with common rules, clearly favouring the development and application of innovative technologies.

The United Nations Environment Program (UNEP) announced “Recycling – from electrical and electronic waste to resources” at the Conference on the Basel, Rotterdam, and Stockholm Conventions (Super COP) held on February 22, 2010 in Bali, Indonesia. The report was published.

The report was prepared by an organization called United Nations University Solving the E-Waste Problem (UNU StEP). The group is a technical and multi-stakeholder group headquartered in Bonn, Germany as a think tank dealing with the global electrical and electronic waste problem. The report, presented at the Super-Cop, a gathering of environmental issues, raised the issue of electrical and electronic waste management to the level of the international environmental agenda.

The three main points of the report are:

* Market potential analysis of electrical and electronic waste recycling technology in selected developing countries
* Testing the application of the UNEP technology transfer activity system to support the achievement of global climate change goals
* Verification of electrical/electronic waste recycling technology related to economic growth

The report focuses on the current status of electrical and electronic waste generation and potential solutions and measures for current and future technologies to deal with the generation of electrical and electronic waste in developing countries. In addition, innovative electrical/electronic waste recycling technologies were investigated, and potential barriers such as political, legal, social, and economical barriers were analyzed in applying these technologies to developing countries.

An important part of the report is that potential job creation and economic growth related to electrical and electronic waste treatment are being considered, and that policy and legal approaches to the introduction of new electrical and electronic waste recycling technologies are analyzed and provided. In addition, a regional recycling hub was proposed as a way to solve social and economic barriers in developing countries. Allows informal recyclers to participate in safe recycling processes (e.g., collection and pre-treatment), while potentially hazardous operations (e.g. post-treatment) are handed over to qualified, skilled recyclers located at regional recycling hubs for safe electrical and electronic method of disposing of waste.

This approach will allow economies of scale to be applied when operating a state-of-the-art recycling facility, while maintaining growth opportunities for informal recyclers. The development of recycling hubs will also facilitate the creation of a fair and competitive international environment based on common laws and will encourage the development and application of innovative technologies in developing countries.

UNEP, together with the International Telecommunication Union (ITU), published the latest edition of the Global E-waste Monitor in 2020. The report provided updated data on e-waste generation and management in different regions of the world. It also highlighted the impacts of the COVID-19 pandemic on e-waste management, as well as the potential opportunities for a more sustainable recovery.

UNEP is one of the founding members of Partnership for Action on Computing Equipment (PACE), a multi-stakeholder initiative focused on promoting sustainable and responsible management of used and end-of-life computing equipment. In 2020, PACE expanded its scope to include other types of electronics, such as mobile phones and household appliances.

In 2021, UNEP announced the formation of the Global E-waste Coalition, a new partnership that brings together a diverse group of stakeholders to accelerate the transition to a circular economy for electronics. The coalition aims to promote sustainable e-waste management practices, increase resource efficiency, and reduce the environmental and health impacts of e-waste.

E-waste Academy for Policymakers: UNEP continues to offer its E-waste Academy for Policymakers, a training program designed to build the capacity of policymakers and other stakeholders to address e-waste management challenges. The program covers topics such as policy and regulatory frameworks, collection and recycling systems, and public awareness and education.

**7. Case study and best practices in APT members**

**7.1. Japan**

Cell phone and PHS companies started recycling activity since the 1990’s. However, in order to tighten up recycling activity, the industry actually started the MRN (mobile, recycle, network) in April, 2001. That gathered completely used terminals (body, battery, and charger) from 9,300 stores countrywide. All of the gathered terminals were recycled through thermal treatment.

The entrepreneurs delivered the returned cell phones to the recycling contractor. Then the recycling contractors took all the work after receiving the cell phones and PHS.

**7.2. Republic of Korea**

In March, 2002, the number of domestic subscribers of the mobile service had increased rapidly from 6.91million in 1997, to 30 million. However, Due to decrease of reuse and exportation of wasted cell phones, the treatment and processing of wasted cell phones had become an urgent problem.

In five years, from 1997 to 2001, the sales record of new mobile phones increased threefold, and the amount of wasted cell phones had increased nearly sixfold. There had been too many new cell phones with advanced technology from various competing companies. This is a reason why the numbers of wasted cell phones were growing. Wasted cell phones can be processed by several ways. This lead to decreased exportation of wasted cell phones. The cell phones were reused for testing and rental purpose, and some of them were recycled. In Korea, there are three enterprises of recycling the extraction of valuable metals from connecting terminals. But they are small-scale companies, and of weak performance. And also, there are no recycling companies to manage recycling batteries. There is no statistical data of the amount of recycling, but it is estimated at under the 10% of total amount of recovery. Lastly, the rest of uncounted wasted cell phones might be processed by incineration and landfill.

Valid disposal of the wasted cell phones was difficult due to industrial reasons. It need thorough state intervention. If neglecting the problem of wasted cell phones keep increasing, it could lead to a serious danger in the society. Therefore, it is necessary for the national plan about the recycling of wasted cell phones regarding the systemic management, collection and environmental friendly reuse systems.

It is necessary to make a solution for decreasing the amount of wasted cell phones. Tight regulation of subsidy and securing compatibility of charging system could reduce the amount of wasted cell phones, batteries and charger. Establishing a returning system of wasted cell phones would guarantee a profit from valuable metals in PCB and batteries. Therefore, it is urgent to make government policy or standards returning system for recycling the wasted cell phones and its industry. The technology level of recycling wasted cell phones is too low domestically.. The discarded PCB is emitted when a terminal is discarded, and almost all PCB are being exported to foreign countries at cheap price. It is necessary to prepare and develop more technologies focused on recycling and returning valuable metals, and to induce the industry. In addition, there is a need for a policy for a safe environment when the recycling companies treat a toxic substance such as Pb, and other substances from the part of cell phones.

Terminal: extraction of the valuable metals such as palladium, silver, and gold in the discarded PCB.

Battery: extraction technique of valuable metals such as lithium, and cobalt was developed in domestic, but not commercialize.

**7.3 India**

In August 2015, a private company, Namo Ewaste, was setup with a primary aim to reuse and recycle the e-waste. The company has setup waste collection centers across the country which provide access to the majority of the e-waste produced within India. With a successful execution of their recycling plan, the company has recycled nearly 70,000 tonnes of e-waste until 2022.

The company collects e-waste in various forms and categorizes them into repairable and non-repairable assets. The non-repairable is completely dismantled into metallic components and non-metallic components. The respective components are then sent relevant facilities for reprocessing into usable commodities.

Although it is a step in the right direction, there needs to be a concerted effort in incubating such business within the country for decreasing the huge gap that lies between the generated and recycled e-waste.

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