BASEL CONVENTION REGIONAL CENTRE
for SOUTH-EAST ASIA

Ref: 05 /BCRC-SEA/07/2018 Jakarta, 9 July 2018

To:
Rolph Payet
Executive Secretary of the Basel,
Rotterdam and Stockholm Conventions

Subject: Call for information on the prevention of illegal traffic in hazardous chemicals and wastes for consideration by the 2019 meetings of the conference of the parties to the Basel, Rotterdam and Stockholm Conventions

Responding to your letter dated 28 May 2018 on the above-mentioned subject may I provide information on the activities taken by BCRC-SEA/SCRC Indonesia as follows:

a. BCRC-SEA/SCRC Indonesia over the years has been directly involved with the Secretariat of the Asian Network (ANT) for the Prevention of Illegal Transboundary Movement of Hazardous Wastes under the Ministry of the Environment Japan mainly in supporting their annual workshops held nearing the end of each year. Support is provided on organizational and logistic matters as well as participation on its substantive matters. At present BCRC-SEA/SCRC Indonesia is in preparation with the Secretariat on the upcoming annual workshop to be held in Odate City, Japan on 6-8 November 2018. The reason for choosing the location is due to its nearby location with the Kosaka refining and smelting plant relevant to the issue of the workshop, i.e. recycling e-waste. The plant has the technology for the separation and refining of various precious metals that are complexly intermingled. The workshop is expected to be funded by MOEJ through a combination of MOEJ's Trust Fund with the BRS Secretariat and its own funds at MOEJ;

b. BCRC-SEA/SCRC Indonesia has successfully concluded its study e-waste management in ASEAN countries in September 2016 with funding provided by UNEP-IETC (document attached, **Attachment 1**). The study was an attempt to analyze the current trends, management and gaps for e-waste and drive recommendations for an ASEAN -wide strategy to improve e-waste management based on good practices, polices and -waste technologies. Under the study the issue on illegal traffic of e-waste and take back experiences were also elaborated. The study was presented to ASEAN through AWGCW (ASEAN Working Group on Chemical and Wastes), the unit within ASEAN entrusted to address the chemicals and wastes issue under the conventions, during its 2nd Meeting in Vientiane, Lao PDR, 7-8 June 2017. It was concluded that further action and exchange of information among ASEAN member states be fostered following the study;

c. The ASEAN e-waste study was also presented during the first meeting of the experts working group on Technical Guidelines on Transboundary Movements of Electrical and Electronic Waste and Used Electrical and Electronic Equipment in Particular Regarding the Distinction between

Waste and Non-waste under the BRS Secretariat in Beijing 24-25 January 2018. The meeting's task was to accelerate the work on developing technical guidelines on electrical and electronic waste (EEW). Alongside to the presentation on the ASEAN e-waste study, the presentation provided by Basel Action Network (BAN) raised the concern of e-waste being diverted to southeast Asian countries after China put a ban to its illegal import. BAN also demonstrated a device to trace e-waste from originating countries by planting a tracker in the equipment which could later be used to detect the e-waste at its destination countries such as China and Taiwan. The device has been informed to Indonesian Customs officers for their knowledge and future interest;

d. With respect to the ASEAN e-waste study and the profiling of each individual ASEAN member states on its e-waste management issue, updates are carried out as new information becomes available, hence would serve as an active document which could be presented at the upcoming November ANT Workshop 2018 in Japan;

e. During the attendance of the 3rd AWGCW ASEAN meeting in Kuala Lumpur, 2-3 May 2018, whereby BCRC-SEA/SCRC Indonesia is now represented as a dialogue partner, the issue was raised by Malaysia on the concern of flow of e-waste to southeast Asian countries after China's ban on e-waste. China's effective ban on waste import would affect international trade of recyclables worldwide and many Asian countries, including ASEAN, would become new destinations for various types of hazardous (such as e-waste) and non-hazardous wastes (e.g. plastics, paper and textiles). The meeting welcomed Malaysia as the lead country for the implementation of the activity on Transboundary Movements on Hazardous Waste. Malaysia will develop a proposal in line with the activity and submit to AWGCW through the ASEAN Secretariat.

The meeting also welcomed Indonesia as the lead country for the implementation of the activity on Hazardous Waste Management and Other Waste Defined under the Basel Convention. The meeting noted that Indonesia will develop a proposal in line with the activity and submit it to AWGCW for consideration. The Meeting noted the potential collaboration with BCRC-SEA/SCRC Indonesia for the implementation of the activity. BCRC-SEA/SCRC Indonesia is considering putting on issue the illegal transboundary movement of wastes and non-wastes for ASEAN, subject to approval of Indonesia. BCRC-SEA is acknowledged in assisting with the implementation of the study through its recognition on its relevance and significant role as stated in the *ASEAN Joint Declaration on Hazardous Chemicals and Wastes* (as attached, **Attachment 2**) announced during the High-Level Segment of the BRS COP Conventions last May 2017.

The meeting also noted the proposed potential activities that could be implemented in collaboration with BCRC-SEA, among others:

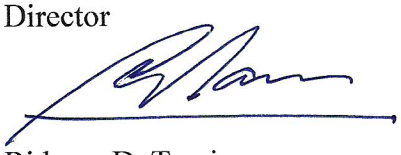
i. trainings on guidelines on hazardous waste management and consultation, i.e. regulations, e-waste, inputs to Basel COPs;
ii. Improvement of database on e-waste i.e. regulations, import export policies, Best
iii. Available Techniques (BAT) & Best Environmental Practice (BEP) of 3R (Reduce, Reuse, Recycle) facilities, criteria to distinguish Used Electric and Electronic Equipment (UEEE) and e-waste, facilities that can receive e-waste and UEEE;
iv. BCRC-SEA/SCRC Indonesia as clearing-house for information on illegal traffic of hazardous chemicals and waste in ASEAN region;

v. Facilitation for ASEAN countries in national reporting under the Basel and Stockholm Conventions;

The meeting welcomed further discussion and/or submission of joint development of proposals with BCRC-SEA on the potential joint activities in line with AWGCW Action Plan.

Thank you for your attention.

Director



Ridwan D. Tamin

Cc:

1. Director General of Solid Wastes, Hazardous Wastes and Hazardous Substances Management, MOEF
2. Permanent Mission of the Republic of Indonesia to the UN, WTO and other International Organizations in Geneva, Switzerland

ASEAN JOINT DECLARATION
ON HAZARDOUS CHEMICALS AND WASTES MANAGEMENT

WE, the Ministers Responsible for Environment of Brunei Darussalam, the Kingdom of Cambodia, the Republic of Indonesia, the Lao People's Democratic Republic, Malaysia, the Republic of the Union of Myanmar, the Republic of the Philippines, the Republic of Singapore, the Kingdom of Thailand and the Socialist Republic of Viet Nam, Member States of the Association of Southeast Asian Nations (ASEAN).

RECALLING the ASEAN Vision of 2020 that envision a clean and green ASEAN with fully established mechanisms for sustainable development to ensure the protection of the region's environment, the sustainability of its natural resources, and the high quality of life of its people.

RECALLING ASEAN Community Vision 2025 that envisions the Socio-cultural Community (ASCC) by 2025 shall be one that engages and benefits the peoples, and is inclusive, sustainable, resilient and dynamic.

ACKNOWLEDGING the global commitment and targets of the 2030 Agenda for Sustainable Development particularly on Goal 12 Ensuring Sustainable Consumption and Production Pattern.

ADHERING the purposes of ASEAN enshrined in Article 1 of the ASEAN Charter, that is to promote sustainable development so as to ensure the protection of the region’s environment, the sustainability of its natural resources, the preservation of its cultural heritage and the high quality of life of its people.

URGENTLY HIGHLIGHTING the need to implement environmentally sound management of hazardous chemicals and wastes particularly the recycling, recovery, and treatment of hazardous wastes, more effectively through governance, capacity building and exchange of information.

RECOGNIZING the environmental and health concerns, especially in developing countries and among the vulnerable populations including women, children, and future generations, resulting from exposure to hazardous chemicals and wastes.

ENSURING the transboundary movement of hazardous chemicals and wastes are managed in an environmentally sound manner through technical cooperation, capacity building and information exchange so as to combat illegal traffic of hazardous chemicals and wastes more effectively.

RECALLING ASEAN Ministers Responsible for Environment Joint Statement on the Implementation of Sustainable Consumption and Production in ASEAN by the ASEAN Ministers Responsible for Environment in 2013 that articulated ASEAN commitment to strengthen the cooperation within ASEAN, and between ASEAN and dialogue/ development partners towards the implementation of sustainable consumption and production.

REAFFIRMING the importance of the Basel Convention, the Rotterdam Convention, the Stockholm Convention, and the Minamata Convention, including the Strategic Approach to International Chemicals Management (SAICM), as milestones in the international sound management of hazardous chemicals and wastes.

RECOGNIZING the significant role of the Basel Convention Regional Centre for South-East Asia/Stockholm Convention Regional Centre (BCRC-SEA/SCRC) in providing training, technology transfer, technical assistance, and capacity building for the implementation of the Basel Convention, the Rotterdam Convention and the Stockholm Convention in ASEAN region.

EXPRESSING the importance of BCRC-SEA and the interim secretariat of Minamata Convention in facilitating the ratification and effective implementation of the Minamata Convention to protect human health and the environment from the adverse effects of mercury, and accelerating entry into force of the Ban Amendment of the Basel Convention to prevent importation of hazardous waste.

EMPHASIZING desire to strengthen regional cooperation to ensure the protection of the environment, the sustainablity of natural resources and the high quality of life of our people.

HEREBY:

CALL UPON ASEAN Member States to continue working closely and strengthen cooperation in good faith, and further mobilize the capacity building, exchange of relevant information, including transfer of technology, hence explore new additional financial resources towards the establishment of environmentally sound hazardous substances and waste management and achieving the 2020 Goal of SAICM and the 2030 Sustainable Development Agenda;

CONTINUE to implement an environmentally sound management of hazardous chemicals and wastes throughout their life cycle and substantial reduction of waste through prevention, reduction, reuse recycle and recovery;

CONTINUE our efforts, in accordance with agreed international frameworks and agreements, to significantly minimize the adverse impacts on human health and the environment caused by the release of hazardous chemicals and wastes to air, water and soil, in the ASEAN region;

IMPLEMENT decisions by the ASEAN Summit and the ASEAN Ministerial Meeting on Environment to ensure the coherence, transparency, continuity and effectiveness of the representation of ASEAN Member States where a common position exists in hazardous chemicals and wastes-related international conventions, including the

Basel Convention, the Rotterdam Convention, the Stockholm Convention and the Minamata Convention, subject to where applicable those which have been ratified by ASEAN Member States, as well as in internationally agreed-upon arrangement such as the SAICM thereto;

ENHANCE the coordination and collaboration between ASEAN Member States and partner organizations in providing continuous support for capacity building, and creating opportunities to share and exchange information and knowledge, and transfer of technologies including financial resources among the ASEAN Member States in the implementation of the Basel Convention, Rotterdam Convention, and Stockholm Convention;

ENDORSE the establishment of networks between ASEAN Member States in the management of hazardous chemicals and wastes to improve the supervision of trade in such substances , thus enhance coordination in information exchange on preventing the illegal traffic of chemicals and wastes in ASEAN territory;

OPTIMIZE the functions of BCRC-SEA/SCRC in providing capacity building and assisting ASEAN Member States in exploring new or additional financial resources to strengthen the implementation of the Basel Convention, the Rotterdam Convention, and the Stockholm Convention in ASEAN region;

ENCOURAGE each ASEAN Member State that has not yet ratified the Minamata Convention and the Ban Amendment of the Basel Convention to do so expeditiously to accelerate their effective implementation;

CALL UPON non-ASEAN Member State Parties particularly developed Parties to the Basel Convention, Rotterdam Convention, and Stockholm Convention to strengthen and deepen the cooperation with ASEAN towards the full implementation of the conventions;

DONE by the ASEAN Ministers responsible for the Environment, on this Twenty Six Day of April in the Year Two Thousand and Seventeen.

United Nations Environment Programme
International Environmental Technology Centre

STUDY ON E-WASTE MANAGEMENT IN ASEAN COUNTRIES

September 2016





BASEL CONVENTION REGIONAL CENTRE
for SOUTH-EAST ASIA

Prepared by:
Basel Convention Regional Centre for
South-East Asia (BCRC-SEA)

UN environment

asean

one vision
one identity
one community

EXECUTIVE SUMMARY

As the problem of waste of electrical and electronic equipment (WEEE/E-waste) increases exponentially, action is required to tackle and solve critical issues and prevent the generation from harmful effect of E-waste. E-waste is composed of various substances or materials both hazardous and non hazardous which can be recycled and reused as resources. Precious metal such as gold, copper, silver, zinc, etc contained in E-waste can be extracted which makes the E-waste recovery attractive economically.

The objective of the study is to analyze the current trends, management and gaps for E-waste and to drive recommendations for an ASEAN-wide strategy to improve E-waste management based on good practices, policies and technologies. The study will include collection and analysis of available data and information on E-waste and identify the gaps and barriers for the sound management of E-waste. This study will recommend for an ASEAN-wide framework for policy harmonization and guidance for national and city level. The methodology of the study is through collect information through desk study, questionnaire and direct visit to ASEAN countries. Assessment of the collected information was carried out to determine future projection of E-waste generation and identify gaps in E-waste management and propose recommendations for an environmentally sound management on E-waste.

Based on the baseline data information, 6 (six) countries have data on E-waste generation but most of the data do not present the total amount of E-waste generated. Only Thailand has detailed data on domestic consumption of EEE (2012-2016). Singapore had data on common household electrical and electronic products sold per year by retailers.

7 (seven) countries have data on import of UEEE and E-waste. Origin countries of E-waste import within ASEAN are Thailand, Malaysia, Vietnam, Indonesia, Singapore, Lao PDR. Within countries outside ASEAN the import originated from Japan, Korea, Hong Kong, China, India, Sri Lanka, Qatar, Israel, Australia, New Zealand, Italy, Belgium, Germany, Costa Rica, USA, Canada, Brazil, Trinidad and Tobago.

Destination countries of export of E-waste within ASEAN countries are Thailand, Malaysia and Singapore. Within countries outside ASEAN are to Japan, Korea, Hong Kong, Sweden, Italy, Finland, Netherlands, Belgium, Germany, Denmark, US and Canada.

Only 4 (four) countries have data on future projection of E-waste from inventory activities. On specific regulation on E-waste, 1 (one) country has enacted a Sub-decree on E-waste Management and 3 (three) other countries are drafting specific regulation on E-waste.

At present there are a few full recycling and disposal facilities with environmental sound management. Even in Indonesia, licensing of E-waste is only issued to 1 (one) recycling facility while others are for collection and dismantling. There are many activities on E-waste on illegal refurbishment. Malaysia has 97 partial recovery and 32 full recovery facilities. Singapore has 100 licensed facilities and Thailand has 1 (one) regional e-waste facility. Brunei Darussalam has 1 (one) formal facility and does not have informal facility.

Full recovery facility with BAT and BEP is very expensive. It was mentioned by recyclers in Singapore, Malaysia, Thailand and Vietnam that if the illegal facilities are not controlled by government it will be difficult for them to compete with the illegal facilities. As in Indonesia, the junkman pay for the household E-waste with a much higher price. They are aware that facilities without BEP and BAT will result in lower cost of production.

5 (five) ASEAN countries have definition of E-waste and 3 (three) countries have definition of UEEE. At present, 4 (four) countries have criteria to differentiate UEEE and E-waste. Malaysia has a detailed criteria reflected in a specific published DOE guideline which is The Guidelines for the Classification of Used Electrical and Electronic Equipment in Malaysia, 2010. Most of the countries within ASEAN allow the importation and exportation of UEEE except Lao PDR. For E-waste, most of the countries in ASEAN allow exportation of E-waste and prohibit importation of E-waste.

7 (seven) countries provided information on number of E-waste recycling facility (partial/full facilities) and 3 (three) countries provided website link on company profiles in their countries. This will inform stakeholders where to send their waste to these facilities within their own boundaries or abroad.depending on the types of waste.

3 (three) countries have provided guidelines on E-waste management. Malaysia developed a specific technical guideline on E-waste to assist all stakeholders (i.e. generators, transporters, importers, exporters, treatment facilities, relevant authorities involved in the management of E-wastes) in identifying and classifying UEEE or component, whether it is categorized as an e-waste.

3 (three) countries applied EPR on a voluntary basis and 1 (one) country has a mandatory EPR regulation in 2016 but not yet applied.

6 (six) countries reported data on illegal traffic, to control the illegal traffic all countries have good cooperation between environmental agencies and customs. To re-export illegal import of e-wastes, some countries took more time to re-export to obtain the response from the competent authority of the exporting country.

Some of the components in the Basel Convention Technical Guidelines on transboundary movements of electrical and electronic waste and used electrical and electronic equipment have been covered under national regulation/technical guidelines in 3 (three) countries.

3 (three) countries in ASEAN have ratified the Ban Amendment.

Based on the baseline data information on E-waste generation and flow as well as the current E-waste management system practiced within ASEAN countries and outside ASEAN countries, gaps and barriers were identified:

1. Data on EEE production, import-export, domestic consumption (EEE/person) and lifetime of EEE are not available in most countries within ASEAN. These data are essential for conducting a proper inventory on EEE and E-waste in predicting future E-waste generation in each individual ASEAN country. To carry out the sound management of E-waste and UEEE, data on E-waste generation and export and import of UEEE is also very important.
2. In general, there is no clear classification made towards E-waste such as those available in other developed countries. In Japan the main type of E-waste originates from home appliances, namely television, air conditioners, washing machines and refrigerators as well as computer monitors and cell phones. The EU classified E-waste into large and small household appliances, equipments on information and telecommunication,

consumers, lighting, tools, toys, leisure, sports, medical, monitoring instruments and dispensers. With these set categories, in their management they could start setting targets for E-waste to be collected, recycled/recovery or treated to reduce the harmful effect to human health and the environment.

3. Activities involving 3R and treatment facilities in ASEAN countries are practiced by the informal as well as formal sector except for Brunei Darussalam which does not have an informal facility. Usually informal facilities in conducting 3R activities and treatment do not apply BAT or BEP and will have detrimental impact on human health and environment. With the amount of benefit gained through urban mining from E-waste recycling/recovery activities, provides an alternative source for workers economically but at the same time these informal activities are not environmental friendly.

   Formal facilities in Indonesia, Malaysia, Singapore, Thailand and Vietnam apply good practices and best available technology which comply with environmental standards. Integrated hazardous waste treatment facility in Indonesia, Malaysia, Singapore and Thailand is similar with the facility in developed countries.
4. In reducing illegal activities it is very important to develop an environmentally sound management for collection of E-waste from household, industry and office. In improving the E-waste collection system, several countries have implemented the extended producer responsibility (EPR). Within ASEAN countries only Vietnam is implementing mandatory EPR. Singapore and Malaysia are implementing it voluntarily. In Indonesia even though the Solid Waste Management Law 2008 stipulates that packaging using non degradable material should be collected by producers for recycling and treatment/landfill or the producers should find alternative degradable material for packaging. But the producers have not yet complied with the law, and the industrial association proposed to the government a roadmap for various types of wastes for 10 years ahead since 2008. Learning from the developed countries in implementing the EPR it is clear that a specific regulation on waste and EPR for E-waste is a necessity.
5. Based from the experiences, illegal traffic of E-waste happened because of different waste classification in different countries and lack of human resources as well as technical capacity to control illegal traffic.

Based on the identification of gaps and barriers, 8 (eight) recommendations are proposed to improve the e-waste management system within ASEAN countries.

1. In conducting an inventory from all sources (household, industry, business entities, etc.), it is proposed to use harmonized guidelines for ASEAN countries. This will result in better development of E-waste management and the development of a regional strategy for E-waste management in ASEAN. Some references are made available in conducting a national inventory of E-waste, among others:

a. BCRC-SEA Technical Guidelines on E-waste Inventory

The guideline explains the methodology for inventory development and E-waste generation estimation methods. The guideline also focus on the methods that are used to optimize available secondary data on an E-waste inventory

b. Southeast Asia Countries Inventory Project

This project focuses on survey methods and provides technical details. Countries within the ASEAN member states that conducted the E-waste inventory were: Malaysia in 2008, Cambodia in 2007, Vietnam in 2007 and Thailand in 2007 and 2012.

For the E-waste inventory carried out in Thailand, the E-waste generation was estimated using a Weibull Distribution Model together with Logistic Model. Market saturation, lifetime of product and consumption of EEE were considered in the estimation process.

In accordance with the recommendation to use a harmonized guidelines for ASEAN countries, E-waste classification is also proposed for ASEAN countries and can refer to the classification developed by United Nations University (UNU) : temperature exchange equipment, screens, monitors, lamps, large equipments, small equipment, small IT and telecommunication equipment.

With this classification the Harmonized System Number (HS number) can be developed further through mutual agreement amongst ASEAN countries. If countries have different classifications on E-waste and UEEE, it will become more difficult to control the transboundary movement of UEEE and E-waste. Classification of e-waste is also very useful for each country to set their target priority on ESM of e-waste.

2. There is a general lack of legislation or enforcement in most ASEAN countries. To improve the E-waste management system, the development of specific policy and regulation for E-waste management from household and industry is proposed. Specific regulations for E-waste management from household and industry may include a clear definition of UEEE and E-waste, classification of E-waste, E-waste management system

(collection, transportation, storage, segregation, dismantling/separation, crushing, refurbishment/reconditioning, recycling, recovery, waste treatment facility and disposal), Environmental impact assessment (EIA) and licensing/permit for facilities, emergency response, environmental standards, criteria to distinguish UEEE and E-waste, import and export requirement, policy and control, EPR system, responsibility of all stakeholders, consumers, retailers, transporters, collectors, 3R facilities, producers, central and local government, collection, transportation and 3Rs fees, public awareness, monitoring and reporting, administrative sanction e.g. penalties and criminal sanctions.

3. For good practices and technology that can be applied within the ASEAN countries can refer to the good practices and technology applied in Indonesia, Malaysia, Singapore, Thailand and Vietnam.

4. Potential source of E-waste from household is large. E-waste from household will be difficult without the proper collection system in place. This will require obligation from household consumers to deliver their e-waste to designated collection point. Nevertheless, this would be difficult due to the lack of the obligation and knowledge of the harmful effect of e-waste towards human health and environment. Hence while developing the regulation, a large public awareness program is very essential and should be carried out. With cooperation between 3R companies, producers and also government, programs for increasing the public awareness can be created. The Malaysian program on public awareness can be used as reference for other countries.

Proposed programs on public awareness are as follows:

a. Public awareness through partnership between government, recycling/recovery facilities, EEE manufacturer, community, and civil society and media.
b. Develop guidelines for public awareness
c. Training of trainers
d. Incentives and disincentives.

5. In setting up a regional E-waste management facility, considerations below are proposed:

a. Only can be established in countries that allow import of E-waste
b. Refer to regional facility in Thailand and Singapore

c. BAT/BEP criteria for regional facilities refer to facilities in Indonesia, Malaysia, Singapore, Thailand and Vietnam

6. In controlling the illegal transboundary movement of hazardous wastes, several actions should be taken as follows: source interception, intelligence sharing between competent authorities, joint operations to tackle transboundary movement, guideline for checking the container by Custom and environmental agency officers, if possible using electronic exchange of information as implemented by Singapore, Malaysia and South Korea. It could also be carried out by having environmental agency officers establishing an office in the harbor. Re-export of E-waste to the country of origin could be carried out faster after detection of E-waste in containers by environment and custom officers and inform the focal point of the Basel Convention or Ministry of Environment in the country of origin as soon as possible.

   Regulation should also be applied obligating shipping companies to ship back the illegal E-waste to the country of export. Hence it will overcome the difficulties in handling shipment cost for the re-export (take back) procedure.

7. Malaysia explained the re-export of E-waste within the border areas of Singapore and Malaysia. Once information is obtained action is immediately taken. This is achieved since each country has introduced their regulation and policies on E-waste export and import. It is very important between ASEAN countries to exchange information on their E-waste management. For these activities, BCRC-SEA can use their website to inform ASEAN countries on the regulation, policies of export-import, BAT & BEP of 3R facilities, criteria to distinguish UEEE and E-waste, facilities that can receive E-waste and UEEE, etc.

8. In conducting the ESM of e-waste, EPR is a necessary to reduce illegal management of e-waste. Hence regulation on EPR should be developed. Component of the EPR regulation could provide provisions as follows: obligation of consumer to drop their E-waste in the collection bin designated by municipality, fee for collection, transportation from dropping point appointed by local municipalities to 3R companies, responsibilities of retailers to take back for the large E-waste and pay for the transportation to 3R facilities, producer's responsibility for 3R and treatment and pay for the 3R fee, using the

manifest system for transportation, set target of certain E-waste type in implementing the EPR. The EPR system can refer to the system being implemented in Japan, South Korea or EU. Public awareness plays an important role in the implementation of the EPR system.

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GLOSSARY

3R	Reduce, Reuse, Recycle
AEE	Association of Electronic Environment
B2B	Business to Business
BAT	Best Available Technology
BCRC	Basel Convention Regional Centre
BCRC-SEA	Basel Convention Regional Centre for South East Asia
BEP	Best Environmental Practices
CA	Competent Authority
CCTV	Closed Circuit Television
CD	Compact Disk
CPU	Central Processing Unit
CTR	Cathode Ray Tube
DAO	DENR Administrative Order
DENR	Department of Environment and Natural Resources
DOE	Department of Environment
DOER	Department of Environment, Parks and Recreation
DONRE	Department of Natural Resources and Environment
DVD	Digital Versatile Disk
EEE	Electrical and Electronic Equipment
EIA	Environmental Impact Assessment
EMB	Environmental Management Bureau
ENVICO	Environment and Resources Corporation (Korea)
EOL	End of Life
EPA	Environment Protection Administration
EPD	Environmental Protection Department
EPR	Extended Producer Responsibility
EU	European Union
E-waste	Waste of Electrical and Electronic Equipment
GEF	Global Environment Facility

GD	General Directorate
GIS	Geographic Information System
HW	Hazardous Waste
HWA	Hazardous Waste Act
HWM	Hazardous Waste Management
ICC	International Coordinating Committee
ICT	Information and Communication Technology
IPP	Investment Priorities Plan
JICA	Japan International Cooperation Agency
KORECO	Korea Recycling Corporation
KT	Kilo tons
LCD	Liquid-Crystal Display
MAFF	Ministry of Agriculture Forestry and fishery
MEF	Ministry of Economic and Financial
MEP	Ministry of Environmental Protection
MIIT	Ministry of Industry and Information Technology
MIME	Ministry of Industry Mines and Energy
MOC	Ministry of Commerce
MOE	Ministry of Environment
MOEF	Ministry of Environment and Forestry
MOFA	Ministry of Foreign affair and International Cooperation
MOH	Ministry of Health
MOI	Ministry of Industry
MOLVT	Ministry of Labor and Vocational Training
MONRE	Ministry of National Resources and Environment
MOP	Ministry of Planning
MOPH	Ministry of Public Health
MOT	Ministry of Trade
MOTrans	Ministry of Transportation
MOW	Ministry of Women Affair
MOWT	Ministry of Public Work and Transportation

MPP	Municipality of Phnom Penh
MT	Metric tons
NDRC	National Development and Reform Commission
NEA	National Environment Agency
NPC	National People's Congress
NVMP	The Dutch Association for the Disposal of Metal and Electrical Product
ODS	Ozone Depleting Substances
PBDE	Polybrominated Diphenyl Ethers
PBB	Polybrominated Biphenyl
PC	Personal computer
PCD	Pollution Control Department
PDR	Producer Deposit Refund
PIC	Prior Informed Consent
PPM	Phnom Penh Municipality
PR	Producer Recycling
PRO	Producer Responsibility Organization
RA	Republic Act
RFMC	Recycling Fund Management Committee
ROI	Return on Investment
RUPP	Royal University of Phnom Penh
SAR	Special Administrative Region
SBC	Secretariat of the Basel Convention
SGD	Singapore dollar
SOP	Standard Operation Procedures
StEP	Solving the E-waste Problem
TSD	Treatment, Storage and Disposal
UEEE	Used Electrical and Electronic Equipment
UNIDO	United Nations Industrial Development Organization
UNU	United Nations University
VCD	Video Compact Disk
VCR	Video Cassette Recorder

VEA	Vietnam Environment Administration
WB	World Bank
WEEE	Waste of Electrical and Electronic Equipment
WRMD	Waste Resources and Management Department
WWTP	Waste Water Treatment Plant

CHAPTER 1
Introduction

1.1. Background

ASEAN member countries include Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam. Member countries have a combined population of approximately 625 million people, 8.85% of the world's population. It indicates that the region's population is projected to rise to 650 million by 2020 with more than half living in urban areas. In 2005 around 49% of the population resides in urban areas. Indonesia and the Philippines have the biggest of increase in urban population.

E-waste is an urgent global issue. Everyone needs to work collectively to manage the situation. As the problem of waste of electrical and electronic equipment (WEEE/E-waste) increases exponentially, our world needs to take action to develop answers that address, tackle and solve critical issues and prevent the generation from harmful effect of E-waste.

Electrical and electronic waste (E-waste) is one of the biggest wastes produced globally. The world generated nearly 41,8 million metric tons (MT) of E-waste in 2014 [UNU, 2014]. The quantity of E-waste generation in the 10 (ten) ASEAN countries in 2014 was around 1,809 KT or 4,3% of the global quantity [UNU, 2014]. United Nation organizations, governments, non-government as well as science organizations formed in a partnership known as the "Solving the E-waste Problem (StEP) Initiative" forecasted that by 2017 the world will produce about 33% more E-waste equivalent to around 72 million tons (65 million metric tons).

E-waste is one of the hazardous waste covered by the Basel Convention. All ten countries within the South-east Asia region (all ASEAN member states) are parties to the Convention. E-wastes is characterized as hazardous under Article 1, paragraph 1 (a) and listed in Annex VIII, list A (A1180) of the Convention. However, E-waste is also not to be considered as waste as stipulated in Article 1, paragraph 1 (a), of the Convention as listed in Annex IX, List B (B1110).

E-waste is composed of various substances or materials both hazardous and non hazardous which can be recycled and reused as resources. Precious metal such as gold, copper, silver, zinc, etc contained in E-waste can be extracted and makes the E-waste recovery attractive economically.

The intrinsic material value of global E-waste is estimated to be 48 billion Euros (equivalent to USD 54.24 billion) in 2014. The annual supply of toxins from E-waste is comprised of 2.2 MT of lead glass, 0.3 MT of batteries and 4 kilo tons (KT) of ozone depleting substances (ODS).

Data included in the impact assessment carried out by the Commission in 2008 shows that 65% of the EEE placed on the market was already separately collected than, but more than half of this was potentially the object of improper treatment and illegal exports, and, even when properly treated, this was not reported [Official Journal of the European Union, 2012]. ASEAN countries is one of the destination areas of illegal export of E-waste due to the take back notification data from Japan as mentioned in the presentation of MOE-Japan during the Asian Network Workshop on 6-8 September 2016 in Semarang, Indonesia. In 2012 there were 2 take back notice from Malaysia and in 2013 there were 2 from Malaysia and 1 from Indonesia. In 2014 there was 1 take back notice from Thailand. Besides from Japan, Hong Kong also exports their office equipments, batteries, metal ash and mercury to Singapore, Thailand, Italy, Japan, South Korea and Switzerland.

In practice however, low collection rates, improper collection, inadequate transport, storage and treatment, incineration and landfill of E-waste, as well as illegal exports are common. Even in the European Union (EU) despite comprehensive E-waste legislation, only around one-third of E-waste is reported as being treated according to the state-of the-art. In other regions of the developed world, legislation is unavailable, or limited to only a few categories of E-waste. This situation results in the disposal and incineration of E-waste or inadequate treatment or export to developing countries.

Finally, in developing countries and in countries with market economies in transition, effective E-waste legislation may not be available or may not be enforced. This will result in not only in the loss of valuable resources, but in severe environmental pollution and health problems, particularly in developing countries.

In Japan, E-waste are reused, recovered, recycled and it will produce precious metal such as gold, silver, palladium, platinum and plastic, etc. It is commonly called as the "urban mining." E-waste is a resource and has economic value but if not managed in environmentally sound manner during the process of 3Rs, it will impact human health and environment pollution. This is because E-waste contains many components that are made of hazardous material and can therefore severely harm a dismantler and/or the environment if malpractice takes place.

Common hazardous materials in E-waste can be seen in table below.

Table 1.1 Common hazardous materials in E-waste

Hazardous substances	Lead
Where to be found	solders
How are they released	heating up solder
Why dangerous	heavy metal accumulates in the body tissues through unprotected contact, kidney damage
Hazardous substances	Cadmium
Where to be found	contacts, colouring of plastic casing
How are they released	burning/heat treatment
Why dangerous	brain damage, even death
Hazardous substances	Mercury
Where to be found	Switches, sensors, contact
How are they released	heat treatment, shredding
Why dangerous	nerve toxin, deathly in small dose, severe polluter of water, soil, air
Hazardous substances	Hexavalent Chromium
Where to be found	plating, anti corrosive agent, pigment in plastic
How are they released	melting, burning plastic
Why dangerous	carcinogenic
Hazardous substances	Flame retardants polychlorinated biphenyls, polychlorinated diphenyl ether
Where to be found	plastic casing and housing, plastic wiring and cables, printed wire boards
How are they released	melting, burning plastic, shredding
Why dangerous	carcinogenic

Source: Best Practice Guidebook for Small South African E-waste Businesses, 2013

If improperly managed throughout its life cycle, E-waste can result in the adverse effects to human health and create environmental problems due to the potentially hazardous waste

component contain in it. An environmentally sound management (ESM) of E-waste is strictly required to protect human health and the environment.

1.2 Definition of E-waste in Global Terms

E-waste is a term used to cover items of all types of electrical and electronic equipment (EEE) and its parts that have been discarded by the owner as waste without the intention of re-use [StEP, 2014]. It is also referred to as WEEE (Waste Electrical and Electronic Equipment), electronic waste or E-scrap in different regions. E-waste includes a wide range of products, almost any household or business item with circuitry or electrical components with power or battery supply.

1.3 E-waste Management Flow

E-waste management involves actors, original E-products and E-waste types and follow through certain flow patterns. Various actors identified in the E-waste flow can be referred to as potential source of information, whether directly or indirectly, on the amount of E-waste generated. E-waste flow patterns, in general, can be mapped based on similarity of certain E-waste type. Figure 1.1 provides an example of flow pattern of E-waste and E-product in Japan.

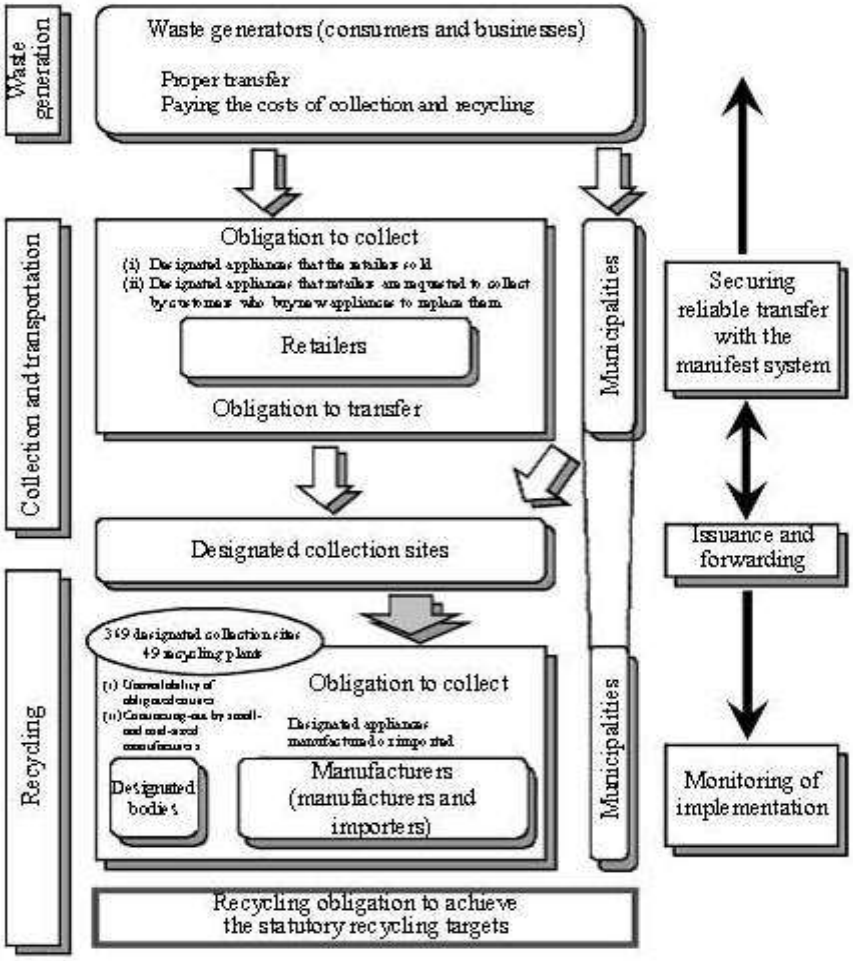


Figure 1.1 Waste flow and stakeholder roles under the Home Appliance Recycling Act from Japan

1.4 Objective of Study

To analyze the current trends, management and gaps for E-waste and to drive recommendations for an ASEAN-wide strategy to improve E-waste management based on good practices, policies and technologies.

1.5 Scope and Coverage of the E-waste Study

An ASEAN-wide study will include: definition and classification of E-waste and Used electrically and electronics equipment (UEEE), collection of available data and information on E-waste; and analysis of the current situation and future projection within ASEAN countries and identify the gaps and barriers for the sound management of E-waste. The study will also collect information on the informal E-waste sector and focus on the private sector participation in E-waste management, highlighting the best available technologies (BAT) and best environmental practices (BEP) and to propose an ASEAN-wide framework for policy harmonization and guidance for national and city level E-waste strategy and action plans as

well as for setting up regional E-waste management facilities for specific E-waste streams or end of life products through a support mechanism from multi-lateral environmental agreements.

1.6 Methodology of the Study

Methodology of the study is as follows:

1. Collect information through desk study, questionnaire and visit to ASEAN countries to collect information on:
    a. E-waste generation and flow
    b. Current E-waste management system
    c. Good practices, policies, environmental standard and technologies within and outside ASEAN countries.

    Responses from questionnaires were verified to the ASEAN member countries during direct visit to certain ASEAN countries or during the ASEAN review meeting on the E-waste study on 23-24 August 2016 in Bangkok, Thailand and Asian Network Workshop on 6-8 September 2016 in Semarang, Indonesia.
2. Assessment of the collected information to determine:
    a. Future projection of E-waste generation
    b. Gaps in E-waste management
3. Development of a draft framework for E-waste management based on all of the above information

CHAPTER 2

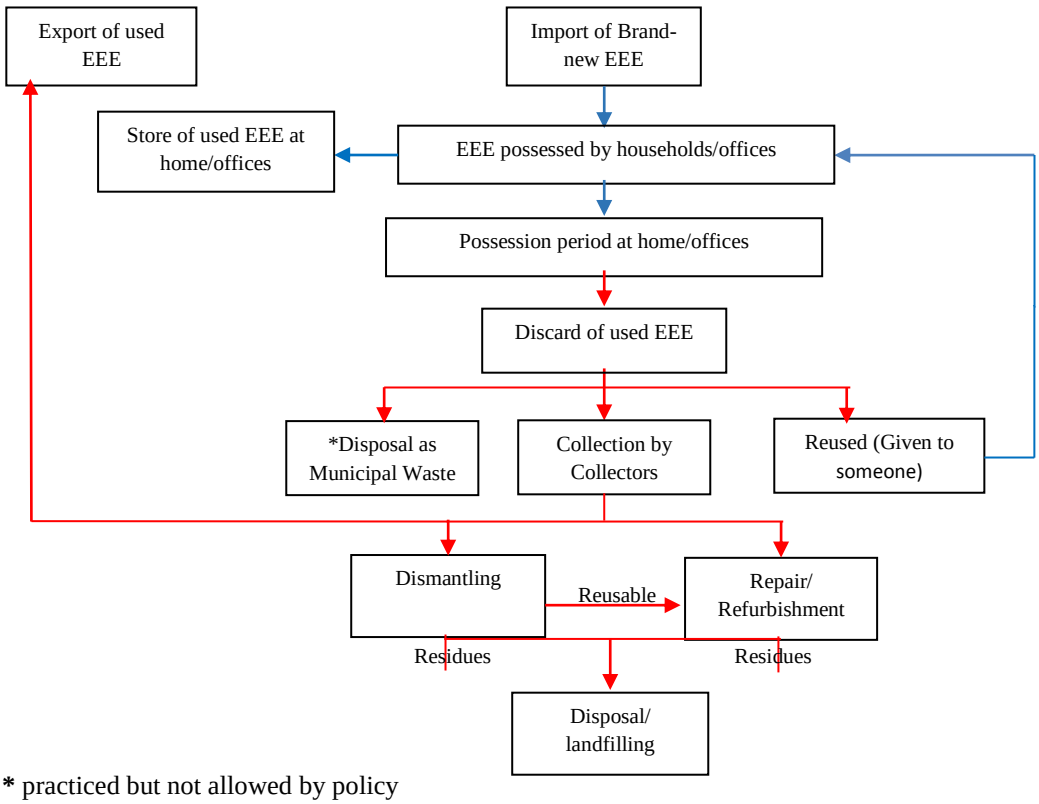
Data Collection through Desk Study, Questionnaire and Field Visit

2.1 ASEAN Countries

2.1.1 Brunei Darussalam

2.1.1.1 E-waste generation and flow

No available data were obtained and no inventory carried out on types of electrical and electronic equipment. The E-waste flow applicable in Brunei Darussalam is illustrated in Figure 2.1.



***** practiced but not allowed by policy

Figure 2.1. E-waste flow in Brunei Darussalam

Brunei is not a producer of electrical and electronic equipment (EEE), hence no data was available on the amount and type of EEE consumed. Based on a waste composition survey made in 2005, E-waste contributed to around 1% of the total waste generated. The waste composition including E-waste as illustrated in Figure 2.2.

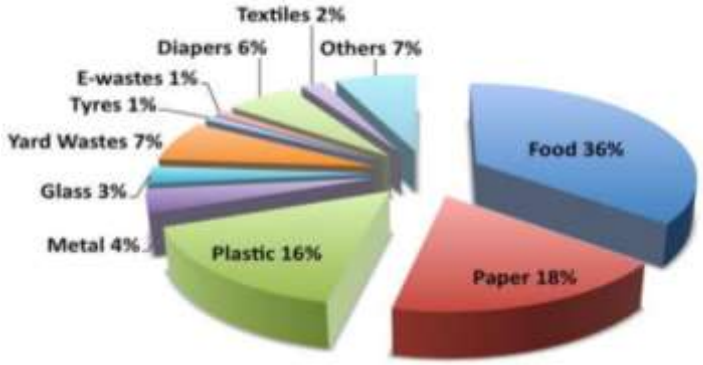


Figure 2.2 Waste composition including E-waste in Brunei Darussalam

Importation of E-waste is prohibited. During 2009-2014, there was no exportation of E-waste. In 2015, however, about 6.45 MT of electronic board scrap was exported to Japan. Also no illegal trade was detected during 2009-2014. No information on the lifetime of EEE can be found and no information on the number of unit EEE per thousand persons. Hence no available data on future projection of E-waste could be sought.

2.1.1.2 E-waste management

E-waste regulation

The Department of Environment, Parks and Recreation (DOEPR), Ministry of Development is responsible for the management of E-wastes in Brunei Darussalam. The Director of DOEPR is the national focal point of Brunei Darussalam to the Basel Convention. DEPR is also the competent authority of Brunei Darussalam to the Basel Convention.

No specific regulation for E-waste exists in Brunei Darussalam. E-waste is covered under the Hazardous Waste (Control of Export, Import and Transit) Order 2013, see the following link: www.agc.gov.bn. The Order covers definition and import/export/transit of hazardous waste. E-waste is categorized as hazardous wastes following the characteristics of Annex III to the Basel Convention.

The regulation covering hazardous waste management are as follows:

- Hazardous Waste (Control of Export, Import and Transit) Order 2013. The Order contains the following:
  - Procedures on export, import and transit of hazardous wastes in accordance with the requirement of Basel Convention

- Basel permits are issued for the arrangement of export, import and transit of hazardous waste
- Specify the kinds of import, export and transit proposals within the scope of the Basel Convention.

The Order has been gazetted but has not entered into force. At present, all measures to control transboundary movement of hazardous wastes and implement the Basel Convention are carried out administratively.

Other environmental guidelines and standards are available, such as the following:

- Environmental Impact Assessment (EIA) – Prior to commencement of development projects and activities that poses significant environmental impacts, the project proponents are required to submit an Environmental Impacts Assessment to the Department of Environment, Parks and Recreation, Ministry of Development for approval. Through this process, necessary measures to prevent, monitor and mitigate environmental degradation and pollution are developed as an integral part of development project planning and implementation.
- Pollution Control Guidelines for Industrial Developments in Brunei Darussalam - The guidelines provide standards and limits for emissions and discharges for industrial development to prevent pollution and ensure a good quality environment.

Other relevant laws and regulations include:

- Custom Order, 2006
- Excise Order, 2006
- Ports Act, 1984

No standards (or criteria) are specified to distinguish UEEEs from E-waste for the purpose of import/export control. Provisions under the Basel Convention are used to:

- ✓ regulate the import/export of UEEEs that are intended for reuse by application approval from government, and
- ✓ regulate the import/export of UEEEs which are intended for repair or refurbishment through an approved application by the government and through a Prior Informed Consent (PIC).

No definition is formulated for used EEE. E-waste is defined as any discarded electrical and electronic devices, hence all kinds of E-waste are categorized as E-waste. No classification for E-waste is formulated. Regarding policy on export and import, export activity of UEEE is not banned. Import activity of UEEE is not banned providing the UEEE falls under Annex IX of the Basel Convention (i.e. B1110). Export activity of E-waste is not banned whereas import activity of E-waste is banned. Brunei signed the Basel Convention Ban Amendment.

Within the government there are a limited number of technical officers and enforcement officials especially from the competent authority. Collection and manual dismantling could not be carried out due to the unavailability of recycling, refurbishment and disposal facilities. Also there is a lack of technical expertise to provide basic and intermediate knowledge.
Institutions related to E-waste are:

a) Government agencies: Department of Environment, Parks and Recreation (Brunei Darussalam's National Focal Point and Competent Authority to the Basel Convention

b) Royal Custom and Excise Department

c) Private sectors (for collection, transportation, manual dismantling and packaging)

Local government regulations are based on internationally accepted and good practices since no written guidelines or regulations for E-waste management/disposal are available. Institutional arrangement on E-waste management can be seen in Table 2.1.

Table 2.1. Institutional arrangement on E-waste management in Brunei Darussalam.

No	Issue	Institution
1	EEE production and import-export	Custom
2	UEEE and E-waste import-export	Custom, DoEPR
3	Collector of E-waste	DoEPR
4	Transporter of E-waste	DoEPR
5	Recycling Facilities of E-waste	DoEPR
6	Treatment/recovery of E-waste	DoEPR
7	Residue from treatment/recovery of E-waste	DoEPR

Three institutions are involved in E-waste management as follows:

1. Department of Environment, Parks and Recreation
2. The Royal Custom and Excise Department
3. Private sectors

Authority in charge for preventing illegal traffics is the central office of the competent authority in close coordination with the Royal Custom and Excise Department.

To strengthen border control and combat illegal traffic, measures that have been taken are:

- strengthening the cooperation amongst enforcement officials such as officials from the Competent Authority and the Royal Custom and Excise Department through joint inspections when suspicious items are detected.
- collection and diffusion of information of import/export regulation of other countries and good practices of E-waste management
- training of enforcement officers
- awareness raising for importers/exporters and other stakeholders through briefings, talks and mass and social media

Currently, there is no official E-waste management mechanism from the government for E-waste from household and industry. The field executor for E-waste is by registered private sectors. No incentive mechanism for E-waste management is available.

Private sectors (formal sectors) are involved in the following activities for television, computer and mobile phone:

1. collection
2. transportation
3. segregation
4. separation/dismantling

There is only one company for collection, segregation and dismantling.
There is no available data on best available technology (BAT)/good practices/BEP and environmental standards from each activity in E-waste management. Extended Producer Responsibility (EPR) program has not been applied for E-waste management. The reference used in E-waste management is from the Basel Convention's website.

Type of operations in existing facilities is by manual dismantling. No specific national definition, rule or guideline to evaluate mixed metal scraps for metal recovery falling under

non-hazardous or hazardous wastes. Definition, rule or guideline is in accordance with the Basel Convention.

Disposal practices in Brunei Darussalam are as follows:

- direct disposal/no treatment/improper disposal
- co-disposal with domestic waste
- burying
- recycling
- out of country disposal

E-waste is prohibited from being disposed at landfills but at present, no E-waste recycling facilities are available throughout the country. The only method of disposal is through collection by recycling companies who then will send the E-waste out of the country for recycling purposes. The exporter is required to obtain approval from the Competent Authority prior to shipment.

Current plan of action on E-wastes management:

- develop guidelines for handling and managing E-waste
- developing an E-waste inventory
- enforce environmental impact assessment (EIA) for development projects related to hazardous waste
- encourage more private sectors involvement in E-waste recycling
- disseminate information on E-waste management and its procedures under the Basel Convention to relevant stakeholders including government agencies and importers/ exporters
- raise public awareness on E-waste

2.1.1.3 Technical Guidelines on transboundary movements of electrical and electronic waste and used electrical and electronic equipment, in particular regarding the distinction between waste and non-waste under the Basel Convention as adopted, on interim basis, by the twelfth meeting of the Conference of the Parties to the Basel Convention and Ban Amendment

No component of the guidelines or part of it is covered under regulation in Brunei Darussalam. Brunei however has accepted the Ban Amendment.

2.1.2. Cambodia

2.1.2.1 E-waste generation and flow

Cambodia conducted a national inventory of used of EEE in 2007. The type of E-waste which is covered under the inventory is as follows [CEA, 2007]:

1. televisions (TV)
2. computers
3. mobile phone
4. air conditioners
5. refrigerator

The E-waste flow in Cambodia is as illustrated in Figure 2.3.

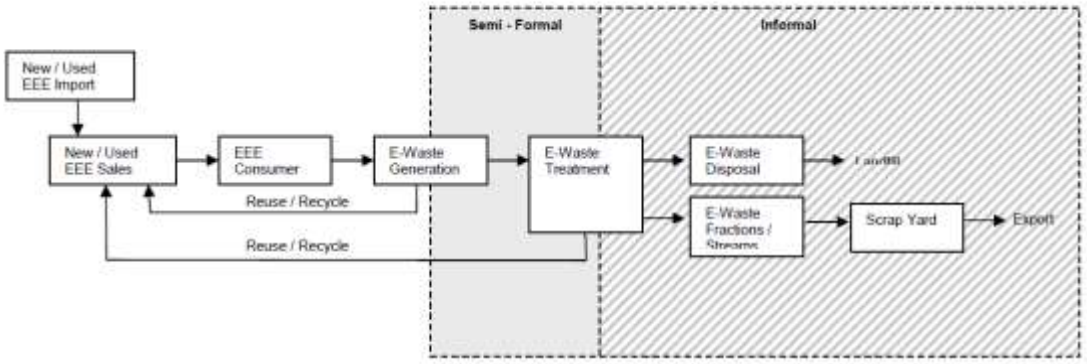


Figure 2.3 Cambodia E-waste flow (1)

Stakeholders involved are divided into two sectors organized as formal and informal sectors. The E-waste generated initially from the formal/organized markets such as manufacturers, importers, offices and semi-organized markets, whereas E-waste from domestic consumers originated either in exchange schemes or as discarded items. The recyclable parts of computers, mobile phones, AC, TV, refrigerators and washing machine are sold to waste pickers and dismantlers while other parts which cannot be repaired are disposed in dustbins as domestic wastes. The waste pickers generally sell their collected E-waste residues both from dustbins as well as from formal/organized sector to scrap yard owners for export.

Another E-waste flowchart is shown in the Figure 2.4.

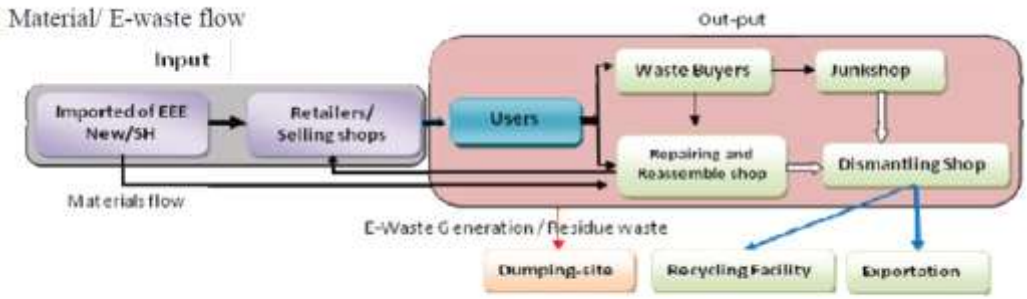


Figure 2.4 Cambodia E-waste flow (2)

Brand new EEE and UEEE imported into Cambodia for consumption use have noticeably increased yearly since government policy permits their entry based on existing national regulations. However, the quality and the level of function (end of life) of the imported UEEE has not been determined. Some UEEE have been found to be of low quality and improper functioning. Imported EEE in 2000-2012 have been recorded without any distinction between new and second-hand items as seen in Table 2.2.

Table 2.2 Imported EEE between 2000 –2012 without separation of new and second-hand items in Cambodia

No	Year	**TV (CRT screen), unit**	**Computer (CRT Monitor), unit**	**Amount (Unit)**
1.	2000★	157,096	26,342	183,438
2.	2001★	109,915	1,863	111,778
3.	2002★	163,663	1,990	165,653
4.	2003★	114,390	1,852	116,242
5.	2004★	126,755	1,467	128,222
6.	2005★	95,269	9,381	104,650
7.	2006★	86,438	3,115	89,553
8.	2007★★	10,464	4,428	14,892
9.	2008★★	48,373	4,709	53,082
10	2009★★	138,774	5,452	144,226
11	2010★★★	12,965	867	13,832
12	2011★★★	3,713	130	3,843
13.	2012★★★	10,495	2,153	12,648
	Total	1,078,310	63,749	1,142,059

Source: Pichhara and Sothun, 2014

Cambodia is not a country that produces EEE products and neither exports to other countries. Brand new electric and electronic equipment (EEE) and used electric and electronic equipment (UEEE) are imported into Cambodia for domestic consumption.

Due to its rapid economic development, Cambodia has developed an enormous demand for EEE. Due to the lack in its own domestic EEE industry, it heavily depends on the import of brand new and second hand EEE from abroad. While Cambodia does not produce EEE at all, the country possesses a large second hand market and cheap second hand products play a dominant role in satisfying the domestic demand. According to UNEP in 2007, second-hand appliances are imported from China, Finland, France, Hong Kong, Japan, Malaysia, the Republic of Korea, Singapore, Thailand and the USA. No data is available on the domestic production and consumption of EEE [Ibitz, 2012].

Based on a 2007 National Inventory of UEEE carried out in Cambodia, the estimation of E-waste discarded can be seen in Table 2.3.

Table 2.3 Estimated E-waste discard between 2004-2010 in Cambodia

Year	Waste EEE Discard (sets)				
	TV	Air-con	Refrigerator	Computer	Mobile Phone
2004	157,096	28,408	15,172	26,342	
2005	162,557	26,450	9,640	1,863	7,356
2006	163,663	44,920	14,645	1,990	12,222
2007	111,538	36,698	9,895	1,852	142,990
2008	126,773	15,070	16,606	1,514	113,605
2009	95,269	19,331	13,464	9,381	86,438
2010	86,438	23,114	12,513	3,115	
Total	**903,334**	**193,391**	**91,935**	**46,057**	**362,611**

On the illegal trade of E-waste recorded in 2013, 42 ton of scrap E-waste (3 containers) was intercepted through the Trapeng Thlong international check point, Province of Kampong Cham near the Cambodia -Vietnam border [Pichhara and Sothun, 2014].

Future projection of E-waste

Future projection of E-waste generated potentially ranges from 6,792 metric tons initially calculated in 2008 to 22,443 metric tons in 2019. The volume of E-waste item to be collected and transported until 2020 based on an E-waste inventory estimate in Phnom Penh ranges from 4,490 m3 to 32,923 m3 for washing machine, 5,140 m3 to 6,925 m3 for personal computers, 9 m3 to 46 m3 for mobile phones, 2,918 m3 to 9,573 m3 for refrigerator, 1,458

m3 to 5,976 m3 for air conditioners and 1,557 m3 to 2,618 m3 for washing machine [MOE Cambodia, 2009].

The estimated amount of reusable part, recyclable materials and residues generated in 2009 and 2019 has been carried out based on the inventory estimates, outcome of the field work carried out during 2009 and CEA estimates for the year 2006-2007. The generation of E-waste fractions in metric tons has been projected and estimated by considering that the existing repair/refurbishment and dismantling activities will continue in informal and semi-formal sector in Phnom Penh Municipality (PPM) without any intervention. The existing and projected E-waste fraction in metric tons from 2009 to 2019 has been described in Table 2.4 [Sothun, 2012].

Table 2.4 Existing and projected E-waste fraction (metric tons) in Cambodia

E-waste Items/ E-waste fractions	2009			2019		
	Reusable	Recyclable	Residues	Reusable	Recyclable	Residues
TV	980.54	792.05	131.37	5517.54	4456.88	739.24
PC	1706.69	964.62	59.39	2247.85	1270.48	78.23
MP	26.17	14.22	2.69	90.38	49.09	9.30
Refrigerator	548.70	387.79	62.97	1716.15	1212.87	196.94
Air conditioner	490.83	377.56	19.99	1908.53	1468.10	77.72
Washing machine	525.39	175.13	175.13	842.30	280.77	280.77

Source: Sothun, 2012

2.1.2.2 E-waste management

E-waste regulation and policy (national definition, classification, collection, transportation, recycling and disposal system, EPR, import, export, environmental standard)

Cambodia has specific legislation on E-waste management. A sub-decree on E-waste management had been enacted on 1 February 2016.

Article 18: Importation of UEEE will have to apply with the condition below:

- Import permit from MOE;
- Kept in its original form and workable;
- Lifetime less than 5 years from production year;
- Material is not dismantled, recycled or for disposal;

- Having a certificate identifying the date of product and quality from the exporting country.

Article 19: Export of UEEE abroad must require permit letter from MOE and document application as procedure to imported country.

Article 20: Some kind of UEEE has to be prohibited import into Kingdom of Cambodia and this needs to be identified by inter-ministries circular for MOE and MOEF.

Article 21: All importation of E-waste from abroad into Kingdom of Cambodia is prohibited.

Article 22: Exportation of E-waste to abroad have permit letter from MOE and carry out to Basel Convention on the control of TBM of HWs and their disposal.

Article 23: Transition of E-waste implement to Basel Convention on the control of TBM of HWs and their disposal.

Draft on the Guideline on the Environmental Sound Management of E-waste in Cambodia will become the implementation tool to achieve the target of the Sub-Decree based on environmental requirements. The draft guideline is in the process of preparation as well as the draft on the Directive on Hazardous Waste Management and the draft on the Guideline on Hazardous Waste Management.

National regulation and implementation of hazardous wastes including E-waste are as follows:

1. Draft Law on Environmental Pollution management

Charter 7 and 9, provides clear text to hazardous waste management (HWM). It provides specific on the cycle of HWs handling. For example Part 3 of Charter 7 refer to import and export of HWs in which article 40 and 41 stipulates the following:

- Importation of garbage, solid waste and hazardous waste into the Kingdom of Cambodia is prohibited.
- Exportation of garbage, solid waste, hazardous waste and used equipment abroad will require a permit from the Ministry of Environment.
- Exportation or Transit of HWs will follow procedure under the Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their disposal.

2. Draft law on hazardous chemicals management

It is an important law on the management that mentions all aspect related to chemicals and waste in particular [Pichhara and Sothun, 2014]

Other regulations related to E-waste are as follows:

1. Law on Environmental Protection and National Resource Management

   Laws on Environmental protection and National Resource Management adopted by National Assembly on 24 December 1996 stipulated that "the prevention, reduction, control of airspace, water and land pollution, noise and vibration disturbances as well as waste, toxic substances and hazardous substances, shall be determined by sub-decree following a proposal of the ministry of Environment in Article 13, chapter 5 of this law.

2. Sub-decree on Solid Waste Management

   The Sub-decree No. 36 on Solid Waste Management issued dated 27 April 1999 by the Royal Government of Cambodia, covered all activities related to disposal, storage, collection, transport, recycling, dumping of garbage and hazardous waste. In Article 3 paragraph c of the sub-decree, hazardous waste is referred to as "radioactive substances, explosive corrosive substances, oxidizing substances, or other chemical substances which may cause danger to human health and animal or damage plants, public property and environment.

3. Sub-decree on Water Pollution Control

   This Sub-decree stipulated that "The disposal of solid waste or any garbage or hazardous substances into public water areas or into public drainage system shall be strictly prohibited. The storage or disposal of solid waste or any garbage and hazardous substances that leads to the pollution of water of the public water areas shall be strictly prohibited." This Article strictly prohibits all activities disposing hazardous wastes and other residues into water sources in order to protect and maintain public health and the environment (Article 8, Chapter 2).

4. Sub-decree on Air Pollution Control and Noise Disturbance

   This Sub-decree strictly control/monitor emission from UEEE recycling and/or WEEE burning. But this Sub-Decree seems unnecessary since recycling process of UEEE does not exist in Cambodia at present.

5. Sub-decree on Ozone Depleting Substances

   This Sub-decree applies to import, export, handling, production and the use of ozone depleting substances.

6. Sub-decree on Business Facilitation by Risk Management 2006

   This sub-decree aims to: (i) improve the importation/exportation processes of goods and other facilities in complying with the national laws/regulations and international agreements/protocols; (ii) effective management and monitoring; (iii) lower cost in

service compared to other adjacent countries; (iv) authorize functions/duties of line institutions at check-points; and (v) facilitate a rapid and easier way to importers/exporters.

7. Directive's Custom and Excise General Department

   This directive has been announced on the ban of importation of old computers and spare-parts for occupation purpose, except, for self-consumption and/or charity in minor amount (12/03/02).

8. Guideline on the Environmentally Sound Management of Waste Electrical and Electronic Equipment (WEEE) in Cambodia

   Currently, Cambodia has no specific regulation for management of E-waste yet, although, recently, the Ministry of Environment of Cambodia has developed the guideline on the Environmentally Sound Management of Waste Electrical and Electronic Equipment (WEEE) in Cambodia. The guideline was developed under a project proposal, namely "The preparation of guideline to manage waste electrical and electronic equipment in Cambodia" supported by the Ministry of Environment Korea. The guideline aims to maintain and protect the environment and human health which may be harmful by unsound management and disposal of WEEE as well as to achieve the initiative of resources recovery that is a crucial part of an integrated waste management or sustainable solid waste management. The principles of the guideline aimed at managing electronic and electric equipments and related waste (E-waste) should be governed by the following:

   1. Reuse E-waste as possible prior to disposal;
   2. Reduce E-wastes and the like at various generating sources, e.g. households, selling shops, repairing and dismantling shops, etc.;
   3. Recycle E-wastes as much as possible prior to disposal based on the viewpoint that "Waste is the Money";
   4. Repair electronic and electric equipments for reusing purpose rather than keeping or throwing it away;
   5. Manage E-waste at its cycle, e.g. generating process, storage, transportation, treatment and disposal based on the environmentally sound, identify, establish and operate a safe-dumpsite for hazardous wastes, including E-wastes at selected urban and town areas;
   6. Implement in complying with national and international law, regulations, conventions, protocols, and so on.

Used EEE and E-waste definition

E-waste is defined as all electronic and electrical equipment not used anymore but still in the whole figure or broken (not function) or separating/recycling of EEE (source: Sub-Decree on E-waste).

Used electronic and electric equipment (UEEE) means a second hand electronic and electric equipment (as refer to above captioned items), requiring to classify as reusable equipment or may be continued to use. (Source: Draft of Technical Guideline Management of Waste Electrical and Electronic Equipment (WEEE) in Cambodia).

Classification for E-waste

The Sub-decree No. 36 on Solid Waste Management dated 27 April 1999 by the Royal Government of Cambodia, covers all activities related to disposal, storage, collection, transport, recycling, dumping of garbage and hazardous waste. In the annex of the Sub-decree hazardous waste also includes the following types of WEEE:

1. PCB waste from use of PCB contained in discarded air-conditioners,
2. TV,
3. microwaves,
4. metal waste and their compounds: Zinc (Zn), Selenium (Se,) Tin (Sn), Vanadium (V), Copper (Cu), Arsenic (As), Barium (Ba), Cobalt (Co), Nickel (Ni), Antimony (Sb), Berillium (Be), Tullurium(Te), Lead (Pb), Titanium (Ti), Uranium (U), Silver (Ag);
5. wastes from used or discarded electricity lamps; and
6. wastes from the production or use of batteries.

Policy on import and export

For importation and exportation of hazardous waste stipulated in Article 20 and 21 of the Sub-decree No. 36 on Solid Waste Management dated 27 April 1999 by the Royal Government of Cambodia. Article 20 stated that export of hazardous waste from the Kingdom of Cambodia abroad could be conducted if there is an agreement from the Ministry of Environment, export license from the Ministry of Trade and permit from the import country. Export of hazardous waste shall be consistent with the provisions and principles of the Basel Convention in 1989 which comes into force on May 05, 1992. Article 21 states that the import of hazardous waste is strictly prohibited [Sothun, 2012].

Import of UEEE have not been regulated yet whether by quality standards, its level of functioning, level of hazardous chemicals or article containing in products and take back policy, etc. [Pichhara and Sothun, 2012]. There is no regulation on import/export of used electrical and electronic equipment (UEEE) that are intended for re-use and repair or refurbishment. There is also no standard or criteria to distinguish UEEEs from E-wastes for the purpose of import/export control based on summary of questionnaire [Session 1, Asian Network Workshop Singapore, 2015].

Available resources (human resources, financial, technology, knowledge, institution, etc.)

The Ministry of Environment (MOE) is responsible for the the prevention, protection as well as in minimizing/reduction of activities that impacts human health and the environment from all pollution sources. It develop projects, conduct research, consultation workshop, training workshop and dissemination to stakeholders related to E-waste generation and its impact to human health and environment. Project as well as technical expert is provided by the Basel Convention especially the Secretariat of Basel Convention (SBC) in coordination with the Basel Convention Regional Center for South-East Asia (BCRC-SEA) and Basel Convention Regional Center China (BCRC-China), Other international support are from the Ministry of Environment, Japan, Ministry of Environment, Korea and UNEP IETC [Sothun, 2014].

Key ministries involved directly in controlling import at the border are: General Directorate of Custom and Excise, MEF and General Department of Camcontrol, MOC [Pichhara and Sothun, 2014]. The role of GD of Custom and Excise (MEF) is to control and monitor import and export of HWs include E-waste and confiscates illegally smuggled and harmful substances that may pose threats to the environment and pubic health.

The role of GD of Camcontrol (MOC) are as follows:

- To make a decision in providing import-export permission to private and/or industrial sectors based on national and international laws or agreement;
- To control quality and quantity of imported and exported products and carry out the repression of fraud related to product quality.

Institutional mechanism to deal with illegal movement of E-waste

The Ministry of Commerce is one of the institution responsible on import-export of goods quality inspection. All importers should be registered at the Ministry of Commerce. The Ministry of Economic and Financial (General Department of Custom and Excise), is the inspector institution on transboundary movement of trade, evaluation for Custom tariff and banned cross-border goods smuggling activities.

On 2 March 2001, the Royal Government of Cambodia signed to being a party of the Basel Convention whereas the Department of Environmental Pollution Control, MOE is the competent authority and focal point. The Ministry of Environment set-up a working group/steering committee for applicants of Basel Convention such as below [Bol and Chanpunnara, 2012]:

- MOE (Ministry of Environment)
- MOI (Ministry of Interior)
- MOEF, General Department of Custom and Excise
- MOC, CAMCONTROL "Cambodia Import Export Inspection Fraud Repression Directorate General")
- MOP (Ministry of Planning)
- MOH (Ministry of Health)
- MAFF (Ministry of Agriculture Forestry and fishery)
- MOFA (Ministry of Foreign affair and International Cooperation)
- MOWT (Ministry of Public Work and Transportation)
- MIME (Ministry of Industry Mines and Energy)
- MOW(Ministry of Women Affair)
- MOLVT(Ministry of Labor and Vocational Training)
- MPP (Municipality of Phnom Penh)
- RUPP (Royal University of Phnom Penh)

Institutional arrangement on E-waste management can be seen in Table 2.5.

Table 2.5 Institutional arrangement on E-waste management in Cambodia

No	Issue	Institution
1	EEE production and import-export	Custom, MOC
2	UEEE and E-waste import-export	MOE, Custom, MOC

3	Collector of E-waste	MOE
4	Transporter of E-waste	MOE
5	Recycling Facilities of E-waste	MOE
6	Treatment/recovery of E-waste	MOE
7	Residue from treatment/recovery of E-waste	MOE, Local Municipality

Several activities contribute to E-waste minimization in Cambodia as follows [Pichhara and Sothun, 2014]:

- 3R concept application for environmentally sound management of E-waste,
- Project on creating employment opportunities and ensuring effective E-waste management in Cambodia,
- Comprehensive assessment report of E-waste
- Training of trainer for " installation and repair services in electronics industry."

No infrastructures have been authorized or licensed by the Government to recycle E-wastes based on summary of questionnaire [Session 1, Asian Network Workshop Singapore, 2015].

Current E-waste management system

Cambodia does not have the technology and capability to conduct an EEE/E-waste recycle and does not have a formal E-waste collection system. Lack of specific capacity/capability in EEW management and recycling as well as take back policy, makes the WEEE being improperly disposed at dumpsites and opened areas as well [Sothun, 2010]. There are no EEE "take back" schemes in place in Phnom Penh. Therefore, E-waste collection and transportation mechanism in PPM is diverse in nature [MOE Cambodia, 2009].

The increasing amount of E-waste and existing practice on the collection and transportation, repairing, reassemble, dismantling including junkshop and recycling facility uses simple technology for practice and unsound management. Cambodia will be faced to deal with main issues such as:

- Cambodia does not have a sound management of WEEE.
- Existing legislation lacks in policy and mechanism related to WEEE management and compliance measures.

System Collection and Transportation

Currently, E-waste collection, transportation, treatment and disposal in PPM are inadequate both in terms of capacity and environmentally sound management. Since the existing toxic footprint covers areas, which are commercial along the main streets of PPM, its expansion is likely to further impact air, water and soil conditions in its area of influence. Cambodia has no modern technology to carry out repair/ dismantling /refurbishing [MOE Cambodia, 2009].

There are two types of E-waste collection system in PPM. Type 1 involves the intervention of waste picker and type 2, involves the intervention of dismantler. Both the mechanism collect and transport mixed type of E-waste and its fractions. Both the mechanism use significant manual handling of E-waste. No occupational health and safety practices are visible during E-waste collection and transportation. E-waste collection and transportation system appear to be market driven without regulatory controls. There is no company/enterprise in formal sector in PPM that collects/purchases E-waste from households and offices in Cambodia [MOE Cambodia, 2009].

In the municipal system, dustbins are utilized for E-waste disposal while waste pickers use hand carts for transportation of E-waste. Furthermore vehicles from municipal solid waste transportation company pick E-waste residues from the bins for disposal at waste dump site. Dismantler's in the informal sector use vehicles to transport E-waste from the point of generation to the junkshop or for the place of dismantling [Bol and Chanpunnara, 2012].

Repair or Refurbishment

Repairing and dismantling process to few items of UEEE is simply done, due to insufficiency of modern technology, and sectoral awareness. First, testing to identify problems as well as other useable parts. Connecting or replacing a spare-part from dismantled items to get a new one with appropriate functioning, although it has lower quality. Secondly, retesting will be done in order to emphasize the function of repaired EEE. If this repaired EEE does not function and/or improperly function, the repairing will be done once more [Sothun, 2010].

Beside the use of simple method of repairing, some broken/un-functioning EEE, e.g. laptop computer was sent to overseas for repairing in according to the negotiation between shop owner/manager and customer. Same as a repairing process, there is no technology has been presented and used for dismantling and recycling [Sothun, 2010].

These informal sectors play an important role in repairing for reuse, reassemble of a new one by using reusable part materials from dismantling for example reassemble of TV set. Beside this, scavengers/middle-man collected E-waste from local/official use, and then sent to repairing or junkshop. WEEE/E-waste which is un-function and/or could not repair has been collected from selling shop, repairing shop and refurbishment activities and then sent to dismantling site [Sothun, 2012].

Dismantling and Recycling

Dismantling is usually applied to non-functioning/broken UEEE which needs careful repair by using sophisticated techniques. Reusable parts recovered from dismantling process are kept separately (by types) for selling to repair shops on demand basis. Besides reusable parts, recyclable materials are bought by collectors. Waste collectors sell these recyclable parts/wastes to scrap yard owners for export while the remaining E-waste fractions are disposed as municipal waste [MOE Cambodia, 2009].

The dismantling site and activities practice are in the simple manual, meanwhile, they did not use equipment and high technology for dismantle, shredding, and sort by item, in particular, did not use protection equipment during working [Sothun, 2012].

Most E-waste residues generated from repairing and/or dismantling shops are disposed in dustbin and later at urban dumpsite by domestic waste collection service. Some areas where waste-collection trucks are not available, such kind of E-wastes are disposed improperly at sites close to/behind the repairing/dismantling shops, and are finally burnt [MOE Cambodia, 2009].

Disposal Methods

The residue of E-waste focus on the kinds of waste/E-waste could not reusable and recyclable, which are generated from various sources such as household, commercial sector, repairing shop, junk shop, reassemble shop and dismantling site. These residue wastes are being disposed with household dustbin and/or illegal disposal at public road, land- lot/free land, and forest. For the E-waste disposed in household dustbin, it was mixed with household waste without separation and then collected and transported directly to dumping site of the cities [Sothun, 2012].

There are two ways of disposal found in Cambodia [Sothun, 2010]: :

1. The residues from dismantling and repairing operation, which disposed directly to municipal trash-bin; and
2. Some residue sell to waste-picker (and finally to scrap yards).

Until now, Cambodia has no secure landfill for hazardous waste [Serey, 2014].

2.1.2.3. Technical Guidelines on transboundary movements of electrical and electronic waste and used electrical and electronic equipment, in particular regarding the distinction between waste and non-waste under the Basel Convention as adopted, on interim basis, by the twelfth meeting of the Conference of the Parties to the Basel Convention and Ban Amendment

Part of the Technical Guidelines on transboundary movements of electrical and electronic waste and used electrical and electronic equipment is not covered under Cambodia national legislation.

2.1.3 Indonesia

2.1.3.1 E-waste generation and flow

No data was made available on the various types of electrical and electronic equipment or was an inventory carried out. Likewise no information was made available on domestic production, export, import and domestic consumption of EEE.

Amount of each type of UEEE/E-waste (domestic generation, export & import and illegal trade

The quantity of E-waste generated from 2010-2014 was 212,782 MT. This data source was made available from one treatment company alone. Control of domestic E-waste generation is carried out by local government authorities.

Import of E-waste is prohibited. For UEEE only computers and monitors are allowed based on criteria set out by the Ministry of Trade. The quantity of UEEE import data is available at the Ministry of Trade.

In 2015 E-waste amounting to 1687, 4 MT was exported from Indonesia in 2015 and 706.7 MT in 2016. No information on data on illegal transboundary trade of used EEE and E-waste is available.

At present no information on future projection of E-waste, lifetime of EEE and number of unit EEE/person in Indonesia can be found.

2.1.3.2 E-waste management

E-waste regulation

A specific regulation on E-waste is being prepared by the Ministry of Environment and Forestry which would be in the form of a ministerial decree on the management of a municipal electronic waste. The draft regulation will cover definition, existing collection system, transportation, treatment and waste disposal among others.

Regulations on E-waste are also covered by other waste management regulation as follows:

a. For E-waste from industry: Government Regulation No. 101 Year 2014 on Hazardous Waste Management

b. On household and municipal waste, Act No. 18 Year 2008 on Solid Waste Management which categorize E-waste as a specific type municipal/solid waste
c. Presidential Decree No. 61 Year 1993 on the Ratification of the Basel Convention

These regulations are published on website: http://menlhk.go.id

E-waste is categorized as hazardous waste based on Government Regulation No. 101 Year 2014:

- Annex I, Table 1 Code Number B107d (E-waste includes CTR, TL lamp, PCB, wire rubber) and A111d (used refrigerants from electronic equipment)
- Annex I, Table 3 Code Number of activity 28 (electronic component/electronic equipment): source of waste from manufacturing and assembly of electronic components and equipment and from wastewater treatment plant treating process effluent.

The Ministry of Environment and Forestry is the institution mandated to manage E-waste in Indonesia. Based on another regulation, the Ministry of Trade Decree No. 127 Year 2015 concerning The Importation of Second Hand Product, UEEE limited only to computer and monitor are defined as electronic goods in which should fulfill certain requirements as follows:

1. Still in good condition including components packaged in one complete set
2. Still functioning
3. Lifetime not more than 5 years since production
4. The latest specification and type i.e. CPU minimum Core 2 Duo or equivalent including accessories and using LCD or LED type monitor

E-waste is defined as an electronic good that is not functioning and/or not used anymore which originates from household, office, commercial activity, etc (still in draft form). The kinds of electrical and electronic equipment categorized as E-waste are listed as follows:

1. Based on Government Regulation No. 101/2014, Annex I, Table 1 Code number B107d (E-waste including CTR, TL lamp, PCB, wire rubber) and A111d (used refrigerants from electronic equipment)
2. Based on E-waste Ministerial Decree (in draft form):

a. television
b. refrigerant
c. washing machine
d. air conditioner
e. computer
f. rice cooker/magic jar and/or hair dryer
g. photocopy machine
h. electronic projector
i. printer
j. telephone, mobile phone and/or other portable electronic communication devices
k. adaptor and/or charger
l. lamp switch
m. wire (containing metal)
n. battery
o. wire rubber
p. TL lamp

On policy on transboundary movement of UEEE can be elaborated as follows:

- Export activity of UEEE is allowed.
- Import of UEEE is prohibited but limited only to computer and monitor fulfilling criteria requirements of the Ministry of Trade as previously mentioned.

Available resources (human resources, financial, technology, knowledge, institution, etc)

Available resources for E-waste management can be seen in Table 2.6.

Table 2.6 Available resources for E-waste management in Indonesia

Resources	Description Details	Constraints (if any)
Human Resources	Government, university, industry, E-waste association	Unskilled labor in 3R facility
Financial	Bank, government especially for compliance monitoring and capacity building	Regulation for E-waste have not been finalized for budget allocation
Technology		Insufficient investments for advanced and environmentally sound technologies

Resources	Description Details	Constraints (if any)
Knowledge		1. Disparity of knowledge between central government and regional government personnel 2. Different perception regarding policies between government agencies 3. Insufficient socialization to related agencies and other stakeholders on new policies
Institution		Communications between related government agencies are not robust enough
Local government regulation		Local government's role is weakly defined as HW management policies are generally centralized

Institutional arrangement on E-waste management can be seen in Table 2.7.

Table 2.7 Institutional arrangement on E-waste management in Indonesia

No	Issue	Institution
1	EEE production and import-export	MOI, MOT, Custom
2	UEEE and E-waste import-export	MOT, MOEF, Custom
3	Collector of E-waste	MOEF, Local Government
4	Transporter of E-waste	MOEF, MOTrans
5	Recycling Facilities of E-waste	MOEF
6	Treatment/recovery of E-waste	MOEF
7	Residue from treatment/recovery of E-waste	MOEF

Current E-waste Management System

There is an official E-waste management mechanism for household and industry.

- For E-waste from industry, covered by Government Regulation No. 101/2014, the mechanism follows the mechanism of hazardous waste management
- For household and municipal waste Act No. 18/2008 on Solid Waste Management E-waste is categorized as Specific Municipal Solid Waste
- Under preparation is the Municipal Electronic Waste Management Decree from the Ministry of Environment and Forestry Regulation.

Scope of official mechanism are: collection, storage, transportation and treatment (3R/disposal).

The official mechanism is based on regulations:

- Government Regulation No. 101/2014
- Ministry of Trade Regulation No. 127/2015
- Presidential Decree No. 61/1993 regarding Basel Convention Ratification

Field executors are:

- Formal institutions: the Ministry of Environment and Forestry and the Ministry of Trade (on import and export of UEEE computer and monitor only
- Informal sector
- Registered private sector

No incentive mechanism for E-waste management is developed. At present 6 companies are involved in the collection of E-waste and 2 companies on recycling activity. EPR has not been applied in Indonesia although it is reflected in the Municipal Act.

2.1.3.3 Technical guidelines on transboundary movements of electrical and electronic waste and used electrical and electronic equipment, in particular regarding the distinction between waste and non-waste under the Basel Convention as adopted, on interim basis, by the twelfth meeting of the Conference of the Parties to the Basel Convention

Information on the components of the guidelines or part of it will be covered under a national regulation on E-waste which at present is under preparation. No information on components of the above mentioned guideline or partly is covered under any Indonesia regulation. However Indonesia has ratified the Ban Amendment.

2.1.3.4 Identification of Good Practices in Indonesia

Best Available Technology (BAT)/Best Environmental Practice (BEP) characteristics of E-waste processing in Indonesia vary based on their E-waste type. E-waste processing technology in Indonesia outlined in this study is the processing technology on several types of E-waste as follow:

a. Central Processing Units (CPUs) of Personal Computer
b. CRT (Cathode Ray Tube) of Personal Computer Monitors dan Television

a. Central Processing Units (CPUs) of Personal Computer

The following E-waste processing information was acquired through a survey of 3 (three) E-waste treatment facilities in Indonesia. The processing of CPU consists of several phase as follow:

1. Manual CPU dismantling on top of working table with drill and screwdriver.
2. First dismantling phase is casing segregation, followed by segregation of cable, voltage regulator, and other portable hardware such as hard disk, CD room, and floppy disc.
3. This process segregate cable, voltage regulator, hard disk, CD room, floppy disc, PCB, plastic, iron scrap dan steel.
4. Cable goes into extruder to separate copper and rubber.
5. PCB is dismantled further to separate the board from its electronic components. Cleaned PCB then goes to the crusher.

b. CRT processing of personal computer monitors and television

Computer monitor or television monitor outlined in this study are Cathode Ray Tube (CRT) monitor. The following E-waste processing information acquired through survey of 2 (two) E-waste treatment facilities in Indonesia. The processing of CRT consists of several phase as follow:

1. CRT are put manually on top of working table to start the dismantling process.
2. First dismantling phase is casing segregation followed by segregation of cable, voltage regulators, transformers, switches, and deflection yoke, other plastic body, glass funnel, panel and metal.
3. Plastic casing is chopped using crushing machine and processed to obtain pellet using pellet machine that consist of extruder, cooler, and cutting machine
4. Cable goes into extruder machine to separate copper and rubber.
5. PCB is then dismantled further to separate the board from its electronic components (capacitor, transistor, IC, etc.). Cleaned PCB then goes to the crushing machine. Electronic components are then separated by types.
6. Cleaned PCB then goes into crushing machine.
7. Metal components such as chassis, rings, and bolt are gathered as different category.

8. Panel and funnel are processed using CRT cutting machine in different working space.
9. Acquired glass then goes into crushing machine.

Types of process of EEE waste includes the processing of:

a. Printed Circuit Board (PCB)
b. Plastic (especially casing)
c. Landfill

a. Printed Circuit Board (PCB)

The following E-waste processing information acquired through survey of 3 (three) E-waste treatment facilities in Indonesia. The processing of PCB consists of several phase as follows:

1. PCB separated manually from its components in the cabinet equipped with solder. Melted lead then collected.
2. Separated components are sorted according to its type.
3. Cleaned PCB goes to crusher to be process further or disposed by third party.

Information on the processing of cleaned PCB acquired from a recycler company as follow:

1. Clean PCB goes into hopper then to crusher through belt conveyor.
2. From first crusher, crushed PCB goes into second crusher through belt conveyor to get smaller particle.
3. Between first and second crusher, crushed material are separated using magnetic separator to segregate metal material. Collected metal goes into collector bin.
4. Material that goes into second crushing machine are metal free material.
5. Using screw conveyor, material from second crusher goes into two set of hammer mills to get even smaller material fractions.
6. This material from hammer mills is then moved to drag screener that consists of three different sized screens.
7. Bigger material goes back into hammer mills while smaller particle goes into packaging system. The material mostly consists of copper. While other particles that mostly consist of fiber goes into different packaging system.
8. All process done in closed machine, where dust vacuumed into air filter equipped with fabric filter.

9. PCB process results in 3 main product which is iron, copper, and fiber.

b. Plastic Casing Processing

The following E-waste processing information acquired through survey from 3 (three) E-waste treatment facilities in Indonesia. The processing of plastic casing consists of several phase as follow:

1. Plastic casing is plastic from the process of dismantling E-waste.
2. Plastic are sorted according to its types.
3. Non-valuable plastic are disposed to third party.
4. Sorted recyclable plastics goes into crusher to acquired plastic flakes.
5. Plastic flakes are cleaned in cleaning container and then sun dried.
6. After cleaning and drying process, some plastic flakes are sold directly and some will be used as pellets.
7. Flakes that will be used as pellets goes into extruder machine equipped with heating element to make the flakes melt and molten to be thread shaped.
8. The thread shaped plastic material than goes into cooling container to make it harden.
9. The material then goes into chopper to make it into plastic pellets.

c. Landfill Technology

Landfill is a process of piling end-of-line waste on designated location carefully planned to prevent leak of hazardous waste substance. On waste management context, landfill is end-of-line of waste management. In Indonesia, hazardous waste landfill can be separated into 3 (three) categories. First category is double liner landfill, second is single liner landfill and last category is clay liner landfill. The categorization is regulated under Decision No. 04/Bapedal/09/1995.

The following landfill system information acquired was through survey to one landfill facility. The landfill system consists of several phases as follow:

1. Several types of E-waste are stacked and crushed using excavator
2. Stabilization using cement, absorbent clay, water and reagent with particular composition. Stabilization done following US-EPA standard.
3. Piling process.
4. Landfill technology used is a secure landfill Class 1 based on US-EPA Standard.

2.1.4. Lao PDR

2.1.4.1. E-waste generation and flow

At present Lao PDR has not conducted an inventory on E-waste yet. The E-waste flow in Lao PDR can be seen in Figure 2.5.

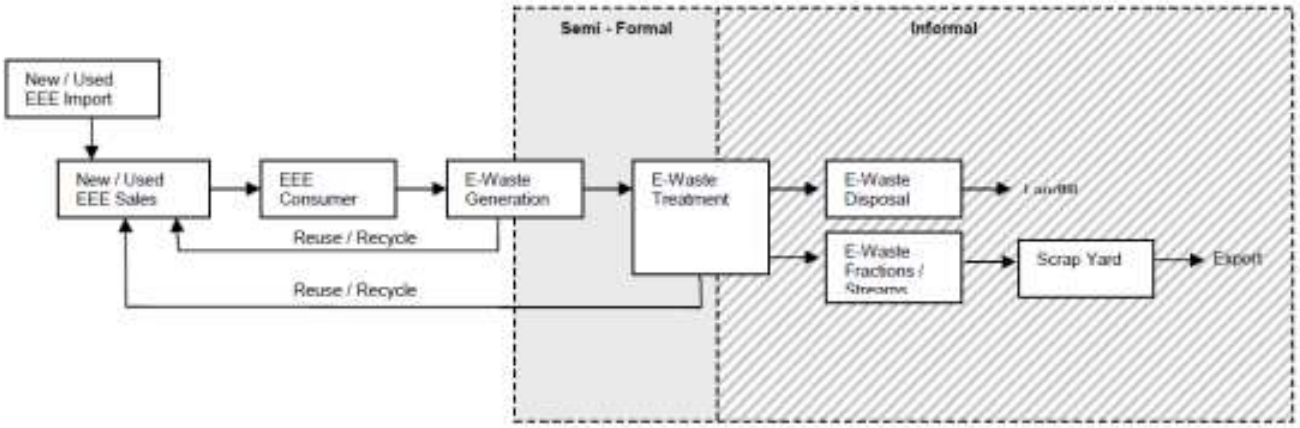


Figure 2.5 E-waste flow in Lao PDR

There is no available data on domestic production, export, import, domestic consumption of EEE from 2009-2014. Data on the number of EEE/thousand person in Lao PDR can be seen in Table 2.8.

Table 2.8 Number of EEE/thousand person in Lao PDR

No	EEE	Unit/thousand persons
1	Television (CRT)	136
2	Television (LCD)	59
3	Video/DVD player	92
4.	Hi-fi system	75
5.	Computer	71
6.	Mobile phone	264*
7.	Electric cooking stove	147
8.	Rice cooker	170
9.	Microwave oven	11
10.	Washing machine	75
11.	Vacuum cleaner	2
12.	Air conditioner	17
13.	Refrigerator	187
14.	Electric fan	174
15.	Electric kettle	130
16.	Electric water heater	17
17.	Water pump	38
18.	Electric iron	164

There is no available data on domestic generation, export, import and illegal trade of UEEE and E-waste from 2009-2014. Also no available data is available on the future projection of E-waste.

2.1.4.2 E-waste management

E-waste regulation

No specific regulation exists on E-waste. It is covered by other regulations as follows:

1. Law on Environment Protection No. 29/NA, 18 December 2012. Article 38, 39 and 40.
2. Ministerial Instruction on Hazardous Waste Management No. 0744/MONRE, 11 February 2015.
3. Ministerial Agreement on Waste Management from Processing Industry and Handicraft No. 0555/IC, dated 20 March 2012.

Electrical and electronic equipments that cannot be used anymore are categorized as hazardous waste. No specific legislation regulation is available for the control the import of second hand electrical and the other electronic equipment. The regulation on import does not include the risk of E-waste entering the country as second hand equipment. The Environmental Protection Law does not mention this type of waste.

Definition for used EEE is not specified but used EEE is considered as second hand electrical and electronic equipment. The types of electrical and electronic equipment categorized as used EEE which are regulated are as follows:

- Cooking appliances - electric cooking stove, rice cooker and microwave oven;
- Cleaning - washing machine and vacuum cleaner;
- Cooling appliances - air conditioner, refrigerator and electric fan;
- Heating - electric kettle, electric water heater and electric heater;
- Entertainment - TV CRT, TV LCD, video/DVD player, computer, hi-fi system and mobile phone;
- Others appliances - electric iron and water pump.

No definition exists for E-waste. The kinds of electrical and electronic equipment categorized as E-waste which are regulated are as follows:

- Fluorescent lamp and bulb, incandescent lamp and bulb, compact fluorescent lamp and bulb, and LED;
- Electric cooking stove, rice cooker and microwave oven;
- Washing machine and vacuum cleaner;
- Air conditioner, refrigerator and electric fan;
- Electric kettle, electric water heater and electric heater;
- TV CRT, TV LCD, video/DVD player, computer, Hi-fi system and mobile phone;
- Electric iron and water pump.

In distinguishing between used EEE and E-waste, used EEE is looked upon as second hand electrical and electronic equipment that can be used while E-waste is electrical and electronic equipment that cannot be used anymore. However there is no classification for E-waste.

Regarding policy on import and export, used EEE is banned in Lao. Import and export of E-waste is banned in Lao based on the Prime Minister's Office Notice No. 829/PMO, dated 13 June 2016.

Available resources (human resources, financial, technology, knowledge, institution, etc.)

Institutions responsible in managing E-wastes in Lao PDR are as follows:

1. Department of Pollution Control, Ministry of Natural Resources and Environment.
2. Department of Industry and handicraft, Ministry of Industry and Commerce.
3. Department of Custom, Ministry of Finance.
4. Department of Environmental Police, Ministry of Public Security.

Details on resources are identified as well as their constraints as illustrated in Table 2.9.

Table 2.9 Available resources (human resources, financial, technology, knowledge, institution, etc.) in Lao PDR

Resources	Description Details	Constraints (if any)
Human Resources	e.g. stakeholders involved, etc Need to strengthen technical knowledge and cooperation among stakeholders	

Financial	e.g. financial source, etc	Government financial support very limited
Technology	e.g. infrastructure, etc	No Best Available technology (BAT) utilization and transfer
Knowledge	e.g. level of knowledge, etc	Technical knowledge transfer
Institution	Need to have leading institution	
Local government regulation	Need to develop specific E-waste regulations	
Other (if any)	Capacity building for E-waste management for government officials than for collectors, small shop traders, recyclers etc.	

With respect to E-waste management, institutional arrangement on E-waste management is described in Table 2.10.

Table 2.10 Institutional arrangement on E-waste management in Lao PDR

No	Issue	Institution
1	EEE production and import-export	-
2	UEEE and E-waste import-export	MOE
3	Collector of E-waste	MOE
4	Transporter of E-waste	MOE
5	Recycling Facilities of E-waste	MOE
6	Treatment/recovery of E-waste	MOE
7	Residue from treatment/recovery of E-waste	MOE

E-waste management is not ranked highly in its capacity-building priority in Lao PDR. The lack of demand for E-waste management is reflected by the lack of legislation in regulating E-waste disposal. Institutions often cannot monitor E-waste and do not have access to confidential information regarding the composition of various electronic products. Stakeholders in the country will require training, education and awareness raising on the potential hazards of mismanaged E-waste. Responsible institutions need to gain increased access to information and funding to prevent E-waste from becoming a major concern to Lao PDR. No infrastructures are authorized or licensed by the Government to recycle E-wastes.

Current E-waste Management System

A list of the types of companies involved in E-waste management is as shown in Table 2.11.

Table 2.11 List of types of company involved in E-waste management in Lao PDR

No	Name of the company	Type of activities (e.g. collecting, transportation, refurbishment, repair, dismantling, recycling, recovery, disposal, etc)	Environmental standard applied
1.	Private small traders	Buying, recycling, transportation, exporting	No
2	Private small repair shops	Buying, repair, selling as second hand equipment	No

The challenges on E-waste management issues in Lao PDR are as follows:

- Lack of capacity in planning and management;
- Insufficient technical knowledge and resources;
- Low awareness of public on impacts of solid waste;
- E-waste generation rapidly increasing;
- No specific legislation to control the import of used EEE;
- Laws exist to control the movement of hazardous waste across the border and within the country;
- Hazardous Chemical Strategy in year 2020 and Action Plan for 2006-2010;
- Signatory to number of international conventions;
- The lack of national legislation governing E-waste management and disposal, capacity for policy and regulation enforcement and compliance monitoring.
- Lack of training and education capacity for understanding of technical equipment/technical guidelines needed;
- Lack of financial assistance, and the need for technology transfer to support final disposal, capacity to raise/secure funds needed;
- Lack of access to confidential information concerning E-waste, products and mixtures, capacity for awareness raising and community involvement needed;
- Lack of capacities and information for E-waste management and disposal, capacity for strengthening of institutions and public information among the responsible institute needed
- All E-waste management activities are conducted by informal sector (collection, transportation, refurbishment/repair, separation/dismantling, recycling and disposal).

Detailed information on formal and informal sector participation on existing management and future plan is provided by Lao PDR in response to the questionnaire.

Disposal Methods

According to surveys carried out in 57 urban areas, only Vientiane City and four secondary towns of Luangprabang, Thakhek, Savannakhet and Pakse use landfills for solid waste disposal. However, the disposal areas are small and have no leachate collection and monitoring wells. Elsewhere, open dumping and burning are common practices for waste disposal in Lao PDR. Hazardous and infectious wastes are often disposed in the same areas and manner as municipal waste. There is inadequate solid waste management in the secondary cities of Lao PDR. It is clear that the landfills were not monitored leading to groundwater quality problems since the leachate contains a wide variety of contaminants and hazardous chemicals. During the raining season, surface water run-off from the landfills could cause waste sediment loads in receiving water bodies (rivers, lakes).

2.1.4.3 Technical guidelines on transboundary movements of electrical and electronic waste and used electrical and electronic equipment, in particular regarding the distinction between waste and non-waste under the Basel Convention as adopted, on interim basis, by the twelfth meeting of the Conference of the Parties to the Basel Convention and Ban Amendment

Information on the components of the guidelines or part of it is covered in national regulation on E-waste. Part of the Technical Guidelines is covered under the hazardous waste management instruction. At present, the Lao Government strictly does not allow any person to import E-waste for recycling in the country as well as export of recycled metals since 13 June 2016.

2.1.5 Malaysia

2.1.5.1 E-waste Generation and Flow

Data on EEE is unable to be provided since the Project for Development of Mechanism for Household E-waste Management in Malaysia under cooperation with Japan International Cooperation Agency (JICA) Technical Expert is still on-going. The time frame for the project is from August 2015 to January 2018. Items covered under the projects are as follows:

1) television sets
2) personal computers
3) mobile phones
4) refrigerators
5) air conditioners
6) washing machines

The E-waste flow in Malaysia is illustrated in Figure 2.6

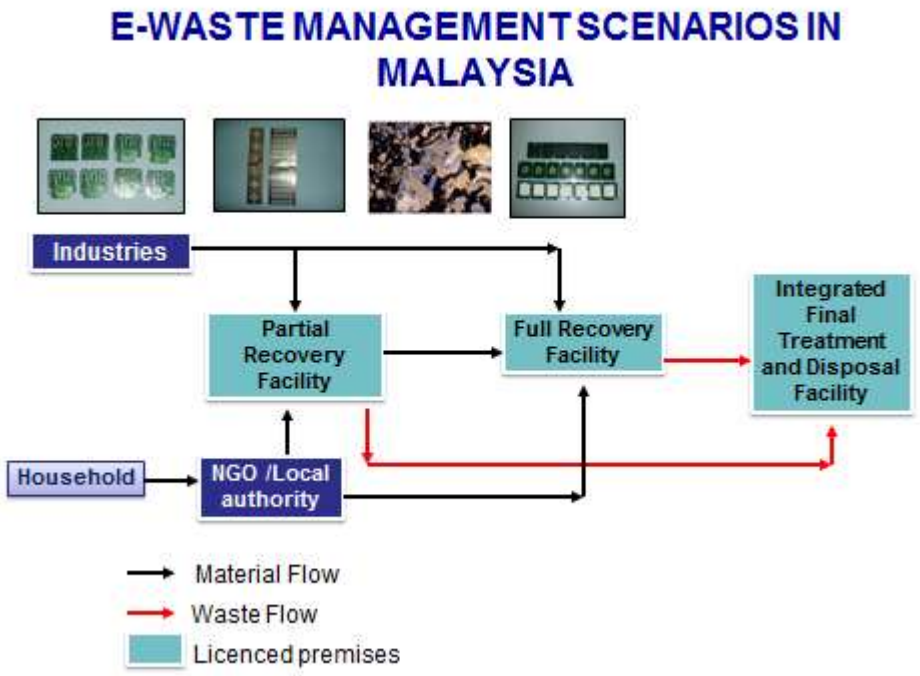


Figure 2.6 E-waste flow in Malaysia

No specific data on the generation of domestic EEE production and consumption is available. No specific data on domestic E-waste generation is available too. The domestic EEE in Malaysia originates from two sources which are household and industry.

i. Household E-waste data: The data survey has been carried out. However, the data is still under internal review as the project with the JICA expert team is still on going.

ii. Industry E-waste data: The quantity of E-waste generated by industries in Malaysia:

- 2009 : 134,035.70 metric tons
- 2010 : 163,339.80 metric tons
- 2011 : 152,722.04 metric tons
- 2012 : 78,278.05 metric tons
- 2013 : 52,978.13 metric tons
- 2014 : 57,103.40 metric tons

No data is available on the life time of EEE and the number of unit EEE/thousand persons. The quantity of E-waste exported from Malaysia (year 2012-2014) is recorded at:

1. 5,454.9 MT to Asian countries (Japan, Thailand, Korea, Hong Kong and Singapore)
2. 240.8 MT to Europe (Sweden, Italy, Finland, Netherland, Belgium, Germany and Denmark)
3. 1,761 MT to American (US and Canada)

Transboundary movement of hazardous waste (export) from Malaysia can be seen in Figure 2.7.



Figure 2.7 Export of E-waste from Malaysia (2012-2014)

No data was obtained on import E-waste into Malaysia (year 2012-2014).

Used EEEs was imported to Malaysia from USA and Singapore. Used computer/laptop was imported to Malaysia from Australia and New Zealand. It can be seen in Figure 2.8.



Figure 2.8 UEEE imported to Malaysia

Illegal shipment of E-waste (2009-2014) was from USA, Australia, China, Hong Kong, India, Indonesia, Japan, Korea, Latvia, Lithuania, New Zealand, Pakistan, France, Philippines, Singapore, Sweden and Taiwan (see Figure 2.9).

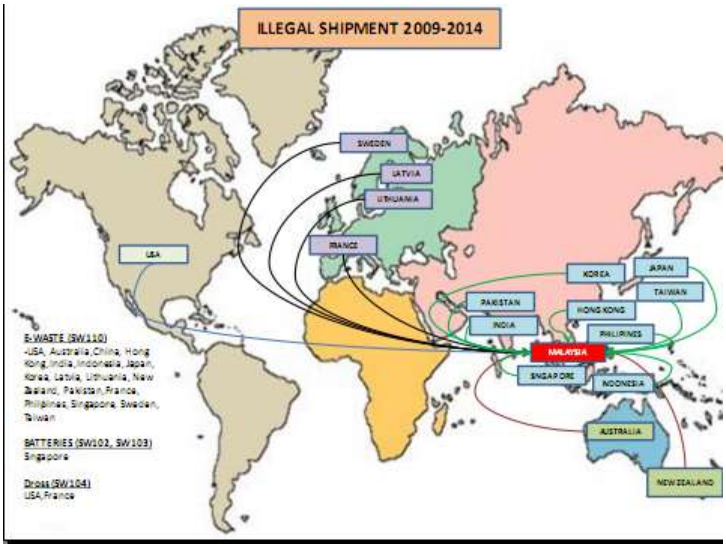


Figure 2.9 Illegal shipment of E-waste (2009-2014) to Malaysia

Data of illegal traffic relevant to Paragraphs 2, 3 and 4 of Article 9 since Year 2008 - August 2015: 53 cases

Data of illegal import according to country:

- U.S.A: 8
- Japan: 6
- Singapore: 6

- Republic of Korea: 5
- Canada: 4
- Hong Kong: 5
- Republic of China: 4
- Latvia: 3
- Indonesia: 2
- Australia: 2
- New Zealand: 1
- India: 1
- Taiwan: 1
- Pakistan: 1
- Sweden: 1
- Philippines: 1
- France: 1
- Lithuania: 1

No data was made available on future projection of E-waste since the Project for Development of Mechanism for Household E-waste Management in Malaysia under cooperation with JICA is still on-going. The time frame for the project was from August 2015 to January 2018. Items covered under the project are as follows:

1) television sets
2) personal computers
3) mobile phones
4) refrigerators
5) air conditioners
6) washing machine

The project also covered the development of draft regulations and guidelines as follows:

1) Draft for Environmental Quality (Household Scheduled Waste) Regulations
2) Guidelines/Guiding Document will be developed to assist in the implementation and management of household E-waste in Malaysia

Based on information from an E-waste recycling facility in Malaysia, estimation shows that Malaysia generates 53 million pieces of E-waste in 2020, 3.5 times higher than 1995. The figure is based on 6 selected items: TVs, PCs, mobile phones, refrigerators, air conditioners and washing machines.

2.1.5.2. E-waste Management

E-waste regulation

The management of E-waste in Malaysia is regulated under the Environmental Quality (Scheduled Wastes) Regulations 2005 of the Department of Environment (DOE), Malaysia.
At present Malaysia does not have a specific regulation on E-waste however is covered by other hazardous waste regulation, as follows:

1. Environmental Quality (Scheduled Wastes) Regulations 2005.
2. Guidelines for the Classification of Used Electrical and Electronic Equipment in Malaysia, 2nd Revision, 2010 to assist in identifying and classifying Used EEE and E-waste as prescribed under the First Schedule Environmental Quality (Scheduled Wastes) Regulations 2005

The regulation is published on website. It can be seen on the following link :
http://www.doe.gov.my/portalv1/en/tentang-jas/perundangan/akta-kaedah-peraturan-arahan-2/peraturan
http://www.doe.gov.my/portalv1/en/info-untuk-industri/garis-panduan-buangan-terjadual/guidelines-for-the-classification-of-used-electrical-and-electronic-equipment-in-malaysia/311750
Information that contains regulation on the Environmental Quality (Scheduled Wastes) Regulations 2005 and Environmental Quality (Prescribed Premises) (Scheduled Wastes) (Treatment and Disposal) Order and Regulations 1989 are available in the website:
http://www.doe.gov.my/portalv1/en/tentang-jas/perundangan/akta-kaedah-peraturan-arahan-2/peraturan

E-waste is categorized as scheduled wastes under code SW 110, First Schedule Environmental Quality (Scheduled Wastes) Regulations 2005. The SW 110 wastes are defined as waste from electrical and electronic assemblies containing components such as accumulators, mercury-switches, glass from cathode-ray tubes and other activated glass or polychlorinated biphenyl-capacitors, or contaminated with cadmium, mercury, lead, nickel, chromium, copper, lithium, silver, manganese or polychlorinated biphenyl.

Used EEE and E-waste definition

On used EEE, no specific definition was found. However DOE Malaysia has published a guidance document to differentiate whether used EEE is categorized as an E-waste or non-waste, referring to the Guidelines for the Classification of Used Electrical and Electronic Equipment in Malaysia, 2010

On kinds of electrical and electronic equipment categorized as used EEE can refer to the Guidelines for the Classification of Used Electrical and Electronic Equipment in Malaysia, 2010. It is to assist in identifying and classifying used EEE and E-waste as prescribed under the First Schedule Environmental Quality (Scheduled Wastes) Regulations 2005.

Website Link:

http://www.doe.gov.my/portalv1/en/tentang-jas/perundangan/akta-kaedah-peraturan-arahan-2/peraturan
http://www.doe.gov.my/portalv1/en/info-untuk-industri/garis-panduan-buangan-terjadual/guidelines-for-the-classification-of-used-electrical-and-electronic-equipment-in-malaysia/311750

E-waste is categorized as scheduled wastes under the code SW110. The SW 110 wastes are defined as wastes from the electrical and electronic assemblies containing components such as accumulators, mercury-switches, glass from cathode-ray tubes and other activated glass or polychlorinated biphenyl-capacitors, or contaminated with cadmium, mercury, lead, nickel, chromium, copper, lithium, silver, manganese or polychlorinated biphenyls.

Criteria to distinguish UEEEs from E-waste can refer to the Guidelines For The Classification of Used Electrical and Electronic Equipment in Malaysia, 2010:

a. Electrical and electronic components which are not contaminated or non-dispersible form such as metal or plastic casing of computer
b. Electrical and electronic assemblies (including printed circuit boards, electronic components and wires) which are less than three (3) years from the date of manufactured that are functioning and destined for direct re-use, and not for recycling or recovery or final disposal
c. New and unused electrical and electronic equipment or components made in Malaysia that are returned by the importing countries as defectives items

d. New electrical and electronic equipment or components made in Malaysia that are returned as defective units for repair to the manufacturer (under warranty) with the intention of re-export
e. Blank wafers or non-patterned wafers or test wafers
f. Off-cut lead or copper frames not contaminated with heavy metals such as cadmium, mercury, lead, nickel, chromium, copper, lithium, silver and manganese or polychlorinated biphenyl.

The Environmental Quality (Scheduled Wastes) Regulations 2005 and the Guidelines for the Classification of Used Electrical and Electronic Equipment in Malaysia, 2010 can assist in identifying and classifying used EEE and E-waste as prescribed under the First Schedule Environmental Quality (Scheduled Wastes) Regulations 2005.

Policy on export/import

On policy on export and import of second-hand/used EEE, second-hand/used EEE is not banned for export and import in Malaysia but are restricted and exporter or importers will be required to obtain a written approval from the Director General prior to any movement/shipment. Likewise on export and import of E-waste, the activities are not banned however are restricted and subject to the written approval of the Director General prior to any movement/shipment. Additional information pertaining to the illegal transboundary movement of E-waste (policies, difficulties, best practice, etc) can refer to the policy document on Standard Operating Procedures (SOP) Enforcement of Illegal Importation / Exportation of Scheduled Wastes).

However certain difficuties are faced such as:

a. Lack of access to adequate information about possible cases of transboundary movements of hazardous wastes or other wastes deemed to be illegal traffic as the result of conduct on the part of the importer or disposer.
b. Lack of awareness of relevant entities that should be involved in combating illegal traffic.
c. Lack of awareness by importers or disposers about the requirements of the Basel Convention.
d. Difficulties to define whether the waste concerned is hazardous waste (HW)/non-hazardous waste.
e. Lack of awareness by exporter and Competent Authority (CA) of export country to ensure the waste concerned is classified as HW under Article 1, 1(b) in import

country.

f. Most of the importation cases were conducted by forwarding agent/traders who are not the actual end user.
g. Most of the importation cases happened due to false declaration e.g. HS code. Article 9 1(c) & 1(d).
h. Difficulties in communicating and cooperating with other States concerned by the case of illegal traffic (state of transit, state of export).
i. A burden to authority to seek financial allocation due to clean up/treatment/disposal of the wastes ESM.
j. Insufficient information related to illegal importation cases under the Basel Secretariat database system.
k. Lack advisory services on the understanding and executing the Protocol of Liability for damage resulting from TBM HW and their disposal.
l. Involved exorbitant cost for storage, clean up, transportation, treatment and disposal of such wastes.
m. The liability in handling the residue from the recovery/treatment process that needs to be disposed.
n. The investigation conducted required special expertise and time consumed that effect the routine operation and enforcement.

Some of these difficulties are being resolved through the following actions:

a. Outreach program for Forwarders Association.
b. Training among the environment officer and Custom officer.
c. International cooperation need to be strengthened through International Coordinating Committee (ICC) or regional meeting.

Available resources (human resources, financial, technology, knowledge, institution, etc.)

Collaboration exists between The Royal Custom Department, Competent Authority of Basel Convention and other related agencies for the transboundary movement of hazardous waste. Cooperation are carried out between private and public sectors for household E-waste management in Malaysia and will enable government policies to be greatly enhanced through technical cooperation.

With numerous approaches to deal with E-waste and various aspects to consider, DOE is cooperating with the Japan International Cooperation Agency (JICA) Technical Expert to carry out the Project for Development of Mechanism for Household E-waste Management in Malaysia. The time frame for the project is from August 2015 to January 2018.

The project also covered the development of draft regulations and guidelines as follows:

1) Draft for Environmental Quality (Household Scheduled Waste) Regulations 20xx.
2) Guidelines/ Guiding Document will be developed to assist the implementation and management of household E-waste in Malaysia.

At present Malaysia is drafting the regulation and promotion of household E-waste, refer to the link http://www.doe.gov.my/household-ewaste/

Type of operation of the existing E-waste facilities in Malaysia:

- i.e: Manual dismantling, shredding and fragmentation, material separation (e.g., electromagnetic or gravity separation, etc.), plastic recycling and metal recovery and refinery through hydrometallurgical process/pyrometallurgy process.
- The E-waste will be sent to a facility licensed by DOE. Two types of facility are licensed by DOE:
    a. partial recovery – physical process (i.e. segregation and dismantling)
    b. full recovery – physical process and followed metal recovery and refinery process through the hydrometallurgical / pyrometallurgy process.
- Household E-waste will be sent to collection centre and engaged with facility licensed by DOE.

Based on Environmental Quality (Scheduled Wastes) Regulations 2005. Guidelines for the Classification of Used Electrical and Electronic Equipment in Malaysia, 2010 is to assist in identifying and classifying Used EEE and E-waste as prescribed under the First Schedule Environmental Quality (Scheduled Wastes) Regulations 2005, refer to the link:
http://www.doe.gov.my/portalv1/en/tentang-jas/perundangan/akta-kaedah-peraturan-arahan-2/peraturan
http://www.doe.gov.my/portalv1/en/info-untuk-industri/garis-panduan-buangan-terjadual/guidelines-for-the-classification-of-used-electrical-and-electronic-equipment-in-malaysia/311750
There is no incentive mechanism for E-waste management.

No specific data available for formal and informal sector participation in E-waste management. The data is not ready at the moment due to DOE has cooperation with the Japan International Co-operation Agency (JICA) Technical Expert to carry out The Project for Development of Mechanism for Household E-waste Management in Malaysia is still on-going. Currently, Malaysia collaborates the data by using code SW 110.

From questionnaire response there is no available data for the Best Available Technology (BAT), good practices and environmental standard for each type of E-waste and type of process, however good practices were identified during site visit to a full recovery E-waste recycling facility in Malaysia.

As of July 2016, currently there are a total of 129 E-waste facilities in Malaysia consisting of 97 partial recovery E-waste facilities (physical or manual segregation of E-wastes for further processing) and 32 full recovery E-waste facilities which can process the E-wastes to recover the precious metals. Information on the list of companies involved in E-waste management can refer to the link: http://eswis.doe.gov.my/facilityList.aspx

EPR is applied in several areas and on a voluntary basis.

2.1.5.3. Technical guidelines on transboundary movements of electrical and electronic waste and used electrical and electronic equipment, in particular regarding the distinction between waste and non-waste under the Basel Convention as adopted, on interim basis, by the twelfth meeting of the Conference of the Parties to the Basel Convention and Ban Amendment

Information on the components of the guidelines or part of it has been covered in national regulation on E-waste. Some of the components in the technical guidelines on transboundary movements of electrical and electronic waste and used electrical and electronic equipment had been covered in “Guidelines for The Classification of Used Electrical and Electronic Equipment in Malaysia, 2010”. The subject area that has been covered is as follows:

Technical Guidelines on transboundary movements of electrical and electronic waste and used electrical and electronic equipment	Guidelines for The Classification of Used Electrical and Electronic Equipment in Malaysia, 2010

Guidance on the distinction between waste and non-waste	Identifying and classifying used EEE whether it is categorized as an E-waste
Guidance on transboundary movements of E-waste	Criteria for the import and export of used EEE or components that is not categorized as E-waste

Malaysia ratified The Ban Amendment on 26 October 2001 and Malaysia has fully enforced the obligation stated under the Ban Amendment.

2.1.5.4 Identification of good practices in Malaysia

Malaysia has full recovery facilities of E-waste. Country visit was conducted during this study to Malaysia. Good practices and technology which are applied in a full recovery facility that was visited are as follows:

a. Have different area for loading, storage, dismantling (combination manual and machine), crushing, stripping/extraction using cyanide, electrolysis process, dissolution process, melting process (1200-1600°C)
b. The product 99% gold and silver
c. Platinum, Palladium and Rhodium product
d. All workers using personal protective equipment, in Malaysia especially for laser cutting the workers using mercury mask
e. Each activity having dust collector and transported to air pollution control (Electrostatic precipitator and scrubber)
f. Concrete floor, lighting, ventilation, water collection that will send to waste water treatment plant (WWTP)
g. Good practice storage for each type of E-waste
h. Truck having Geographic Information System (GIS) and monitor by closed-circuit television (CCTV) in every area
i. There are also different room for lithium cutting in air vacuum room (Singapore)
j. Residues from scrubber/EP and sludge from WWTP sent to licensed hazardous waste facility
k. ODS is sent to licensed incinerator
l. Scrap metal or plastic sent to licensed recyclers
m. Effluent and emission should comply with industrial standard
n. Cyanide was stored in locked storage room with proper label and symbol, every usage is recorded in logbook (date, name, amount)

o. Having emergency response equipment e.g. fire extinguisher, hand washer, shower room, first aid box

Raw material is obtained from industry, government office and household in Malacca.



Figure 2.10 Pictures of a full recovery facility in Malaysia

2.1.6 Myanmar

2.1.6.1 E-waste generation and flow

No available data on type of EEE covered in inventory. The E-waste flow in Myanmar can be seen in Figure 2.11 and Figure 2.12.

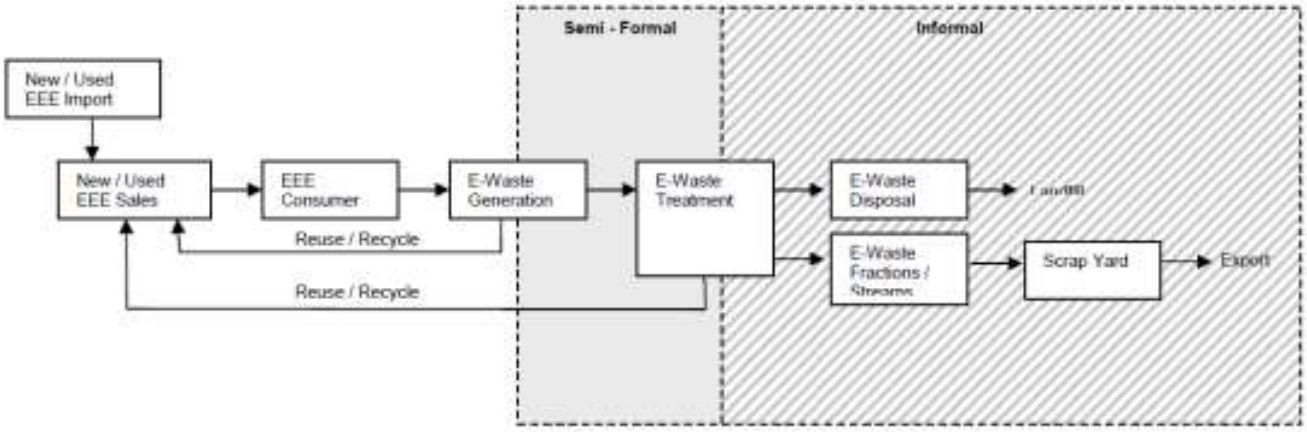


Figure 2.11 E-waste flow in Myanmar (1)

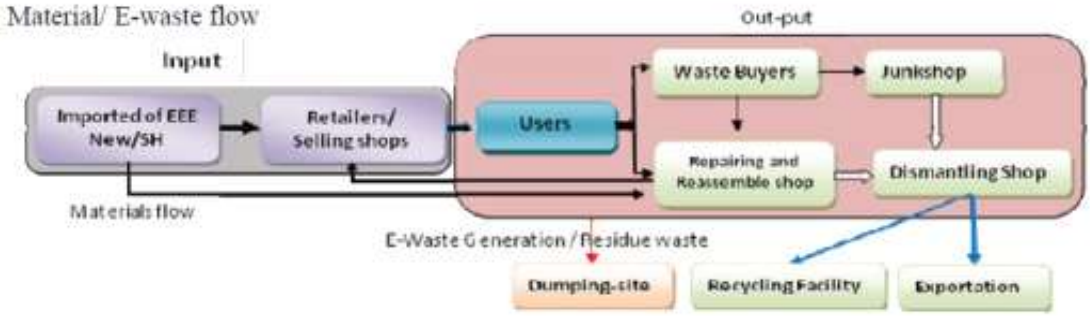


Figure 2.12 E-waste flow in Myanmar (2)

No available data on domestic production, export, import, domestic consumption of EEE from 2009-2014. No available data on domestic generation, export, import and illegal trade of UEEE and E-waste. No available data on future projection of E-waste.

2.1.6.2 E-waste management

E-waste regulation

Myanmar does not have an institution to manage E-wastes. Myanmar does not have regulation for E-wastes. E-waste has not been categorized as hazardous waste. There is no

definition for used Electrical and Electronic Equipment (EEE) and E-waste. There is no classification for E-waste.

Policy on import and export

There is no export and import activity of second hand/used EEE banned in Myanmar.

The export and import activity of E-waste is not banned in Myanmar. There are no formal data on the illegal transboundary trade of used EEE/E-waste. Responsible institutions are the Ministry of Commerce, Custom Department under Ministry of Finance and Ministry of Environmental Conservation and Forestry. Myanmar does not have the formulation for procedure of notification for hazardous Waste.

A law banning the dumping of E-wastes inside the country and law to ban the import and export of E-wastes to other countries do not exist yet. There is an issue on notification that inhibits the importation of used electrical goods. This notification helps in monitoring prevention and detection of illegal traffic of electronic wastes

Available resources (human resources, financial, technology, knowledge, institution, etc.)

Available resources in Myanmar can be seen in Table 2.12.

Table 2.12 Available resources in Myanmar

Resources	Description Details	Constraints (if any)
Human Resources	Stakeholders and private sectors should be involved in E-waste management.	Technicians, public participation
Financial	Financial source	Financial support
Technology	Infrastructure	Best available technology
Knowledge	Assessment of level of knowledge need to be carried out.	Public awareness
Institution	-	Capacity building, institutional strengthening
Local government regulation	The Yangon Water-Work Act (1885) The City of Yangon Municipal Act (1922) The Water Power Act (1927) The Underground Water Act (1930) The City of Yangon Development Law (1990) The Development Committees Law (1993) The City of Mandalay Development Law (2002) The Nay Pyi Taw Development Law (2009)	Formulation new regulations needed to cover e- waste management

Institutional arrangement in Myanmar can be seen in Table 2.13.

Table 2.13. Institutional arrangement in Myanmar

No	Issue	Institution
1	EEE production and import-export	
2	UEEE and E-waste import-export	Custom, MOC, MOECF
3	Collector of E-waste	CDC, MOECF
4	Transporter of E-waste	CDC, MOECF
5	Recycling facilities of E-waste	CDC, MOECF
6	Treatment/recovery of E-waste	CDC, MOECF
7	Residue from treatment/recovery of E-waste	

Current E-waste management system

Yangon City Development Committee is cooperating with private industries for recycling of solid waste (household waste).

Formal and informal sector participation in E-waste management

Detailed information on formal and informal sector participation in existing E-waste management and future plan is provided by Myanmar in response to the questionnaire.

There is no incentive mechanism for E-waste management. Myanmar does not apply the EPR mechanism for E-waste management.

Myanmar being a developing country there are almost no unusable part concerning electronic parts (wastes). Retail shops always keep the damage waste (parts) carefully aside to be used again. Consumers also tried to repair equipment devices at the repair services if something went wrong with the appliances. When this equipment becomes totally hopeless to repair they sold them back to the second hand brokers or to repair service shops. The repair services will sort out the good parts and reassembled them as second hand appliances as necessary. 28th street market (retail market) has an electronic waste dump where all unusable electronic parts are being traded.

People who are expert in reassembling buy goods there, resorting, re-smelting of the plastic parts, some iron parts etc. Even very small iron parts are used in mosquito stands.

People who cannot reach this market can dispose very small amount of their appliances in nearby waste dumps. Such items include small copper wires, used batteries, fluoresce lights, bulbs, old radios. Garbage hunters will collect electronic waste and sold them again at 28th street market or the garbage retailers. Therefore, it is hard to tell in Myanmar if there is electronic waste. All these facts lead to the concept that in Myanmar electronic waste is not regarded as waste. If a household disposes an EEE there will always be someone ready to collect it.

Disposal Treatment

The wholesome dumping of such items in urban dump sites is prohibited. They must call a municipal waste collecting truck to the house for dumping and pay the price for such services or dispose to the latest landfill sites of TharKeTa Bridge. However authorities say that no such disposal concerning electronic appliances happened yet.

Used computers and VCRs are reused or recycled by small private industries. Some used computers and other electrical appliances are donated to areas where there is insufficient EEE. Some parts of old and used digital equipment are recycled by private small industries.

There is a practice of repairing or upgrading used electronic equipment so that it can be continued to be used. By adding memory to a computer or upgrading the software, many users improve the unit's performance and extend its usefulness to reduce the E-waste in Myanmar.

2.1.6.3. Technical guidelines on transboundary movements of electrical and electronic waste and used electrical and electronic equipment, in particular regarding the distinction between waste and non-waste under the Basel Convention as adopted, on interim basis, by the twelfth meeting of the Conference of the Parties to the Basel Convention and Ban Amendment

No available data on information of component of the above guidelines or part of it is covered in Myanmar regulation on E-waste.

2.1.7 Philippines

2.1.7.1. E-waste generation and flow

No available data on types of EEE is covered in an inventory. Also no available data on domestic production, consumption, export and import of EEE. The amount of domestic E-waste generation can be seen in Table 2.14.

Table 2.14 Domestic E-waste generation in the Philippines

	2014	2013	2012
M506 (WEEE)	69.86 MT		
D401-D499 (Waste with inorganic chemicals)		269,816 MT	29,082 MT

Details on the data on import of used EEE and E-waste from 2009 to 2014 is provided by EMB-DENR in response to the questionnaire. A summary of the data can be seen in Table 2.15.

Table 2.15 Data on import of used EEE and E-waste (2009-2014) in the Philippines

Year	Origin countries	Quantity(MT)	Origin countries	Quantity (pcs/boxes/units/sets/pkgs)
2009	Thailand	1,100	USA	9,000
			Korea	62,456
			Hongkong	350,000
			Japan	22
2010			Korea	18,000
			Japan	765
2011	United Kingdom	1,460	Japan	1,534
	New Zealand	2,000		
	Thailand	500		
2012	Thailand	500	Japan	1,071 units
	Korea	14,34	Korea	69,000 units
2013	Costa Rica	1,000	Japan	176,555 units
	Thailand	2,500	Japan	1,016 pkgs
	Korea	90	Korea	352,694 units
	New Zealand	2,000	Korea	4,160 pkgs
	Japan	10.81	Korea	10 sets

Year	Origin countries	Quantity(MT)	Origin countries	Quantity (pcs/boxes/units/sets/pkgs)
			USA	5,356 units
			USA	107 pkgs
			Singapore	208 units
			Laos	6,429 units
			Canada	3 units
			Australia	510 units
			Germany	126 units
2014	Thailand	500	Korea	73,095 units
			Korea	6,410 pkgs
			Japan	7,840 units
			Israel	700 units
			Italy	148 units
			Belgium	96 units
			Germany	370 units
			USA	756 units
			Singapore	15 units

Details on the data on export of used EEE and E-waste from 2009 to 2014 is provided by EMB-DENR in response to the questionnaire. A summary of the data can be seen in Table 2.16.

Table 2.16 Data on export of used EEE and E-waste (2009-2014) in the Philippines

Destination countries	Year					
	2009 (MT)	2010 (MT)	2011 (MT)	2012 (MT)	2013 (MT)	2014 (MT)
Japan	3,000	1,000	2,000	2,000	1,780	8,760
Korea	-	230	250	3,320	-	-
Thailand	134	170	170	170	-	90
Singapore	800	1,250	300	1,320	300	300
Belgium	10.5	-	-	-	-	-
TOTAL	3,944.5	2,650	2,720	6,810	2,080	9,150

Data on illegal transboundary trade of used EEE and E-waste is not yet available. No information on life time of EEE and number of unit EEE/thousand persons in Philippines. No data is available on the future projection of E-waste.

2.1.7.2 E-waste management

E-waste regulation

Environmental Management Bureau of the Department of Environment and Natural Resources (EMB-DENR) is mandated to implement the different environmental laws, which include among others, Republic Act (RA) 6969 or Toxic Substances and Hazardous and Nuclear Waste Control Act. Regulation that control E-waste is under DENR Administrative Order (DAO) 2013-22 or the Revised Procedures and Standards for the Management of Hazardous Wastes http://www.emb.gov.ph/portal/Portals/25/dao-2013-22.pdf. DAO 2013-22 provides for the definition and classification of hazardous wastes (including E-wastes); standards, procedures, and requirements for generators, transporters, recyclers or treatment, storage and disposal (TSD) facilities. It also covers importation of recyclable materials containing hazardous substances such as electronic assemblies and scraps intended for re-sale and recycling subject to certain conditions and permitting requirements from EMB. It also provides for the requirements for the export of hazardous wastes subject to compliance to the Basel Convention notification procedure and permitting requirements from EMB.

Waste Electrical and Electronic Equipment (WEEE) is classified as hazardous wastes under Table 2.1 of DAO 2013-22, assigned with waste number M506. Special wastes including E-waste from households are also classified as hazardous wastes, assigned with waste number M507.

Used EEE and E-waste definition

Waste electrical and electronic equipment (WEEE):

Include all waste electrical and electronic equipment that contain hazardous components such as lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls (PBBs) and polybrominated diphenyl ethers (PBDEs) that includes its peripherals i.e., ink cartridges, toners, etc. All waste electrical and electronic equipment which meet the definition indicated above, such as computers, televisions, laptops, photocopiers, mobile phones, etc. are categorized as E-waste. At present there is no distinction between used EEE and E-waste.

Used EEE is classified as E-waste. All waste electrical and electronic equipment which meet the definition of E-waste, indicated above, such as computers, televisions, laptops, photocopiers, mobile phones, etc is categorized as E-waste. There is no classification for E-waste.

Policy on export/import

Policy on import:

- Import activity of UEEE is not banned, however it is regulated and subject to compliance with the requirements of DAO 2013-22
- Import activity of E-waste intended for disposal is strictly prohibited. However, import of E-waste intended for recycling is allowed subject to the requirements of DAO 2013-22 and the Basel Convention.

The Philippines allows the export of UEEE and E-waste.

Available resources (human resources, financial, technology, knowledge, institution, etc)

Available resources for E-waste management can be seen in Table 2.17.

Table 2.17 Available resources for E-waste management in the Philippines

Resources	Description Details	Constraints (if any)
Human Resources	EMB, generators/transporters/TSD facilities for E-waste (industry), academia, civil, society	
Financial	Private banks, GEF-WB/UNIDO projects (POPs in E-waste)	
Institution	EMB-DENR	
Local government regulation	RA 6969, DAO 2013-22	

Institutional arrangement on E-waste management can be seen in Table 2.18.

Table 2.18 Institutional arrangement on E-waste management in the Philippines

No	Issue	Institution
1	EEE production and import-export	-
2	UEEE and E-waste import-export	CustomEMB-DENR

3	Collector of E-waste	EMB-DENR
4	Transporter of E-waste	EMB-DENR
5	Recycling Facilities of E-waste	EMB-DENR
6	Treatment/recovery of E-waste	EMB-DENR
7	Residue from treatment/recovery of E-waste	EMB-DENR

Current E-waste management system

There is an official E-waste mechanism for household or industry based on DAO 2013-22. Incentive mechanism for E-waste management has been applied by establishment of Treatment, Storage and Disposal (TSD) Facility for hazardous wastes is included in the Philippines' Investment Priorities Plan (IPP). Formal and informal sectors are participated in E-waste management from collection to disposal activities. In the existing condition, EMB is the formal sector that conducts the activities of E-waste management (EMB-registered transporters of HW (for collection and transportation activities) and EMB-registered TSD facilities (for refurbishment, repair, segregation, separation/dismantling, recycling, recovery and disposal of E-waste). Junkshops as informal sector conduct E-waste management from collection to disposal (except refurbishment/repair). The environmental standards of those activities from collection to disposal must comply with DA0 2013-22. For future plan, the collection activities will also be conducted by formal sector (collection points as defined in the proposed policy on ESM of E-waste) and informal sectors (junkshops, proposed policy on the ESM of E-waste aims to apply the EPR). The proposed policy on the ESM of WEEE aims to apply the EPR. More detailed information is provided by EMB-DENR in response to the questionnaire.

Environmental standard that has applied for each process of E-waste management for TV and computers can be seen in Table 2.19.

Table 2.19 Environmental standard for each process of E-waste management for TV and computers in the Philippines

Type of process (e.g. dismantling, shredding, recovery, recycling process, etc)	Environmental standard applied
Collecting	WEEE must comply with the labeling and packaging requirements of

	DAO 2013-22 and must only be undertaken by EMB-registered transporters.
Transportation	Transporters must be registered with EMB and shall comply with the requirements of DAO 2013-22. Movements of the wastes shall be covered by a Permit-to-Transport (PTT) and accompanied by the manifest or chain-of-custody document.
Refurbishment/Repair	TSD facilities or those facilities where hazardous wastes are transporter, stored, treated, recycled, reprocessed, or disposed of, must be registered with EMB and shall comply with the requirements of DAO 2013-22.
Segregation	TSD facilities shall comply with the requirements of DAO 2013-22.
Separation /Dismantling	TSD facilities shall comply with the requirements of DAO 2013-22.
Recycling	TSD facilities shall comply with the requirements of DAO 2013-22. For export of wastes for recycling or recovery or disposal, an export clearance from EMB shall be secured and the notification procedure of the Basel Convention shall be followed.
Recovery	TSD facilities shall comply with the requirements of DAO 2013-22. For export of wastes for recycling or recovery or disposal, an export clearance from EMB shall be secured and the notification procedure of the Basel Convention shall be followed.
Disposal	TSD facilities shall comply with the requirements of DAO 2013-22. For export of wastes for recycling or recovery or disposal, an export clearance from EMB shall be secured and the notification procedure of the Basel Convention shall be followed.

There are 55 EMB-registered transporters and 33 EMB-registered TSD facilities for WEEE whose registration is valid as of October 2015. The detail is provided by EMB-DENR in response to the questionnaire. EPR has been applied by Globe Telecom, Inc. (July 2015-July 2016). The project aims to collect E-waste from different waste generators such as schools, companies, private entities, and government agencies, store these with their partner TSD facility prior to export for recycling, recovery and treatment. The project requests companies for donations of E-wastes earmarked for disposal. Once a donation is confirmed, Globe, in tandem with their partner transporter-TSD facility, assures the proper pick-up, transport, storage, and subsequent export of the E-wastes. Funds raised by the project will be donated to support the building of classrooms for selected schools which were affected by typhoon.

2.1.7.3 Technical Guidelines on transboundary movements of electrical and electronic waste and used electrical and electronic equipment, in particular regarding the distinction between waste and non-waste under the Basel Convention as adopted, on interim basis, by the twelfth meeting of the Conference of the Parties to the Basel Convention

Information on the components of the guidelines or part of it has been covered in national regulation on E-waste. EMB-DENR is currently finalizing the proposed "Technical Guidelines on the Environmentally Sound Management (ESM) of Waste Electrical and Electronic Equipment (WEEE)." It aims to provide the framework mechanism for the management of WEEE and institutionalize the principle of extended producer responsibility. Under the proposed guidelines, the definition of "Second-Hand or used EEE" refers to local or imported used EEE intended for direct reuse, where reuse includes repair, refurbishment or upgrading, but not major reassembly, and where functionality of essential key functions is evident. Importers of second-hand or used EEE are required the following:

a) Copy of the invoice and contract relating to the sale and/or transfer of ownership of the second-hand or used EEE;
b) Signed declaration that indicates that the second-hand or used equipment has been tested and is destined for direct reuse and fully functional; or is destined for reuse following minor repair, refurbishment, or upgrading;
c) Information on the further user and the distributer(s) or retailer(s);
d) Copy of Certificate of Testing or proof of functionality on every item within the consignment; and
e) Signed declaration from the holder who arranges the transport of the EEE that none of the equipment within the consignment is defined as or considered to be waste in any of the countries involved in the transport (countries of export and import, and, if applicable countries of transit).

2.1.8 Singapore

2.1.8.1 E-waste generation and flow

Based on market survey, approximately 60,000 tons (with no breakdown on the types of EEE) of common household electrical and electronic products are sold per year by retailers in Singapore. The typical E-waste flow in Singapore as well as in other countries based on discussions and exchange of countries' experiences at the Asian Network Meetings on Transboundary Movement of Hazardous Waste is illustrated in Figure 2.13.

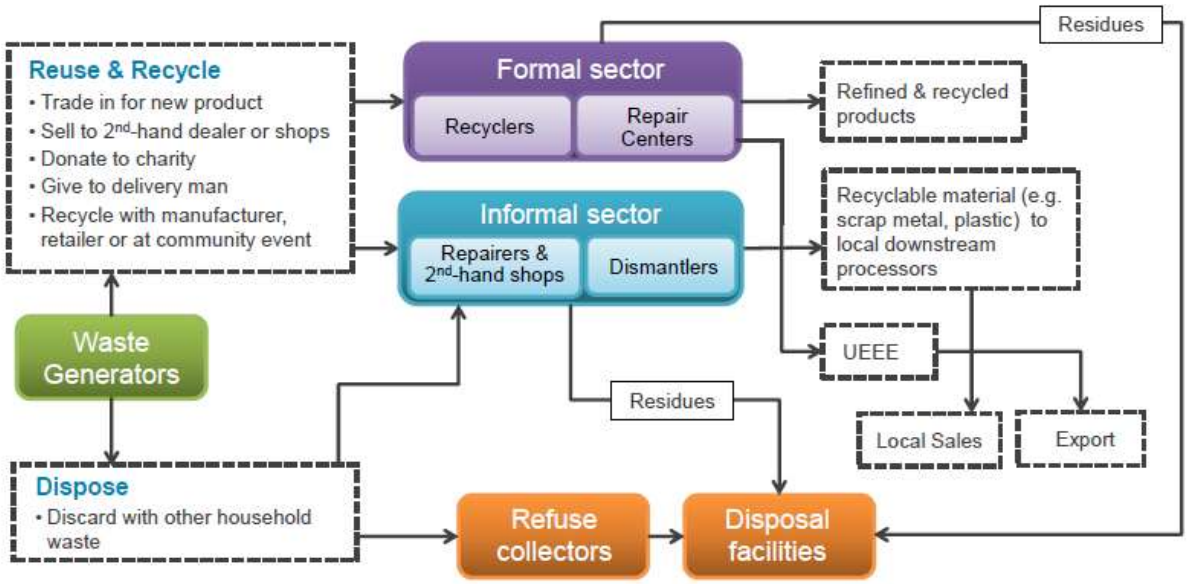


Figure 2.13 A typical UEEE and E-waste in Singapore

Regarding the amount of each type of used EEE/E-waste for domestic production, export & import and illegal trade currently, Parties to the Basel Convention are still deliberating on a clear definition to differentiate between E-waste and UEEE while adopting a set of preliminary guidelines on packaging, labeling and documentations at the Convention. Thus, there is still no global consensus on what constitutes as illegal trade insofar as UEEE and E-waste are concerned.

Nevertheless, the National Environment Agency (NEA) has worked with the Singapore Custom to put in place administrative controls within the TradeNet System[1] to reach out to

[1] TradeNet is an one-stop web-based platform that provides traders with an electronic platform to submit trade documents to all relevant government authorities (Singapore Custom and the controlling agencies) for their processing.

traders to provide the necessary supporting documentations (e.g. functionality test reports, contractual agreements with repair and refurbishment centers and recovery facilities, etc.) as part of the custom declarations when importing or exporting UEEE. (http://www.nea.gov.sg/docs/default-source/anti-pollution-radiation-protection/chemical-pollution/import-and-export-of-E-wastes-and-used-electronic-equipment.pdf).

Based on the information gathered on traders issued with Basel permits[2], the compiled data for E-waste imported/exported in accordance with the Basel Convention which is submitted as part of the yearly report to the Basel Secretariat from 2010 to 2014 is shown in Table 2.20 and Table 2.21.

Table 2.20 Data on import of E-waste from 2010-2014 in Singapore

No	Origin countries	Quantity (MT)					TOTAL
		2010	2011	2012	2013	2014	
1	Japan	385.233	624.645	463.740	1394.533	298.821	3,166.972
2	Thailand	615.950	349.267	609.062	703.286	258.085	2,535.65
3	New Zealand	8.880	4.822	345.914	216.722	444.218	1,020.556
4	Philippines	22.560	22.564	622.254	104.058	72.985	844.42
5	South Africa	62.680	-	-	-	-	62.680
6	Malaysia	0.661	7.899	-	80.169	0.406	89.135
7	Australia	944.780	565.465	926.845	-	-	2,437.090
8	Vietnam	0.736	-	-	-	34.712	35.448
9	China	226.339	391.705	31.535	41.863	24.869	716.31
10	India	523.373	612.332	400.058	112.898	164.44	1,813.101
11	Hong Kong	0.307	588.631	671.008	-	-	1,259.945
12	Korea	146.659	-	37,983	70.347	-	254.989
13	Indonesia	-	-	532.839	9.199	-	542.038
14	Srilanka	-	-	2.386	927.02	16.05	945.456
15	Brazil	-	-	767.621	575.183	243.622	1,586.426
16	Trinidad and	-	-				

[2] A Basel permit is issued to traders for the transboundary movement of hazardous waste.

No	Origin countries	Quantity (MT)					TOTAL
		2010	2011	2012	2013	2014	
	Tobago			31.351	33.238	-	64.589
17	Qatar					140.828	140.828
	TOTAL	1,935.271	2,193.418	4,369.794	4,268.516	1,699.036	17,515.633

Table 2.21 Data on export of E-waste from 2010-2014 in Singapore

No	Destination countries	Quantity (MT)					TOTAL
		2010	2011	2012	2013	2014	
1	Japan	642.620	756.297	68.775	1,988	1,885	40.692
2	Thailand	3,035.337	558.278	1,256.040	722	1,457	7,028.66
3	Canada	1.928	-	-	-	-	1.928

For a country to be able to provide a realistic projection on the amount of E-waste generated domestically, it would require data on the amount and type of EEE being imported. It will also be dependent on what is deemed as the useable lifespan of the respective types of EEE.

2.1.8.2 E-waste management

E-waste regulation

Currently, Singapore works closely with the industries to take responsibility for the recycling of their own electrical and electronic products on a voluntary basis. It works closely with its industry partners and communities to increase public awareness and encourage recycling of E-waste through voluntary programs led by industry partners (http://www.nea.gov.sg/energy-waste/3rs/E-waste-lamp-battery-recycling/E-waste-recycling). A set of Singapore Standards on the management of end-of-life Info-Communication Technology (ICT) equipment (SS 587) is developed as a reference for companies to implement proper management practices for end-of-life ICT equipment. A study is being commissioned by the NEA to look into more effective ways for the collection and recycling of E-waste in Singapore.

For transboundary movement of E-waste classified as hazardous waste under the Basel Convention. Singapore has enacted the Hazardous Waste (Control of Export, Import and Transit) Act (HWA) and its Regulations to implement the obligations under the Convention. For the purpose of domestic management as well as for import and export uses, Singapore has put in place domestic guidelines to distinguish UEEE from E-waste (see Figure 2.14) and they include the key provisions (e.g. supporting documentations and surveyor reports, etc.) contained in the technical guidelines adopted on an interim basis at the Basel Convention for the classification between UEEE and E-waste.

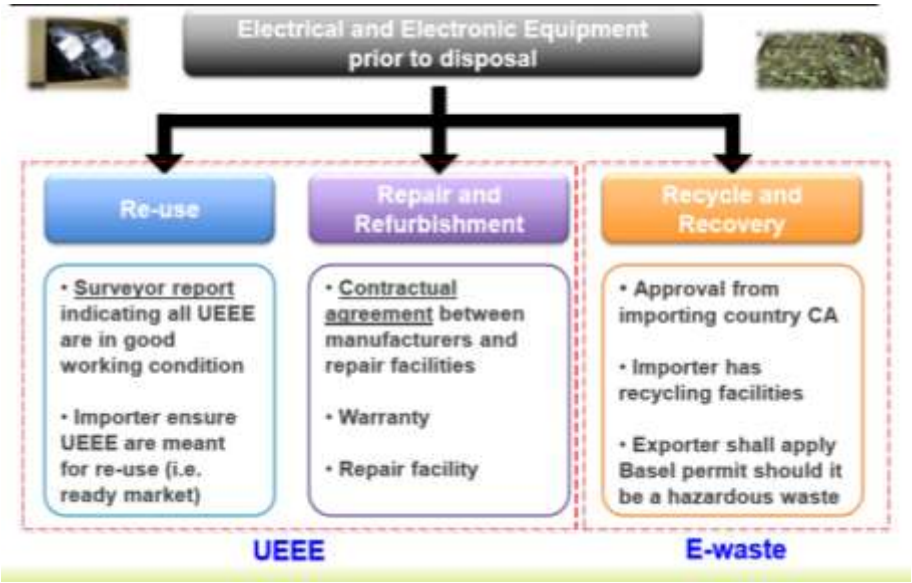


Figure 2.14 Guidelines for distinguishing UEEE from E-wastes in Singapore

Policy on export/import

As a party to the Basel Convention, Singapore follows closely to the obligations of Convention for the transboundary movement of hazardous waste. The Prior Informed Consent (PIC) procedure is applied for E-waste imports and exports in circumstances where exporting/importing countries classify E-waste as hazardous waste under the Convention framework. Singapore also adheres to the definition stipulated under the Basel Convention "A1180" for classification of metal scrap controlled as hazardous waste as seen in Figure 2.14 for the import/export of E-waste.

The HWA was enacted in 1997 to implement the obligations of the Basel Convention (http://statutes.agc.gov.sg/aol/search/display/view.w3p;page=0;query=DocId%3Ae90445e7-6339-4bd1-84ea-3aaf0ded6a24%20Depth%3A0%20Status%3Ainforce;rec=0). In addition,

Singapore applies the same import/export policy principles in reference to the preliminary technical guidelines adopted on an interim basis by the Basel Convention for its domestic guidelines. The domestic guidelines would be periodically reviewed to keep it relevant with the developments under the Basel Convention on the decisions adopted for UEEE and E-waste.



Figure 2.15 Guidelines for evaluating mixed metal scrap as hazardous waste/ non-hazardous waste in Singapore

Available resources (human resources, financial, technology, knowledge, institution, etc.)

The Waste Resource and Management Department (WRMD) and Pollution Control Department (PCD) in the National Environment Agency are the departments which look into the management of UEEE and E-waste as follows:

a) WRMD – It oversees the management of municipal solid waste including programs and initiatives to promote household waste recycling including E-waste recycling.
b) PCD – It is the Competent Authority of the Basel Convention for the transboundary movement of hazardous waste and it also oversees the proper and safe management of toxic industrial waste.

In addition, NEA also works closely with other key enforcement agencies (such as the Singapore Custom, Immigration & Checkpoint Authority) on the transboundary movement of hazardous waste under the Basel Convention framework as illustrated in Figure 2.16. Since Oct 2007, import/export shipments of used electronic and electrical appliances (including second hand electronic and electrical appliances) are required to be made to NEA through the TradeNet system.



Figure 2.16 Key enforcement agencies on hazardous wastes in Singapore

On E-waste management system the current flow of E-waste in Singapore and how they are being managed are illustrated in Figure 2.13. The E-waste study being commissioned by NEA will help Singapore to identify systems to manage the collection and recycling for E-waste more effectively.

2.1.8.3 Technical Guidelines on transboundary movements of electrical and electronic waste and used electrical and electronic equipment, in particular regarding the distinction between waste and non-waste under the Basel Convention as adopted, on interim basis, by the twelfth meeting of the Conference of the Parties to the Basel Convention and Ban Amendment

Singapore has already put in place a set of national guidelines to help differentiate between UEEE and E-waste. The current set of guidelines is largely in line with that in the Basel Convention and has included some of the key conditions from the preliminary guidelines which were adopted on an interim basis at the Basel Convention on E-waste and UEEE.
NEA will periodically review the current domestic guidelines in consultation with relevant stakeholders to keep it relevant with the developments on the technical guidelines adopted at the Basel Convention.

2.1.8.4 Identification of good practices in Singapore

Singapore has full recovery facilities of E-waste. Country visit was conducted during this study to Singapore. Good practices and technology which are applied in a full recovery facility that was visited are as follows:

a. Have specific area for loading, storage, dismantling (combination manual and machine) segregation, crushing, cyanide dissolution, stripping solution using electrolytic machine, ion exchange, melting by aqua regia.
b. The product 99.99% gold
c. Production of gold 10-22 kg/month
d. Palladium product using Pd refinery
e. Silver (Ag) recovery
f. Chemical treatment with acid to purify silver.
g. All workers using personal protective equipment, in Malaysia especially for laser cutting the workers using mercury mask
h. Each activity having dust collector and transported to air pollution control (Electrostatic precipitator and scrubber)
i. Concrete floor, lighting, ventilation, water collection that will send to WWTP
j. Good practice storage for each type of E-waste
k. Truck having GIS and monitor by CCTV in every area
l. There are also different room for lithium cutting in air vacuum room (Singapore)
m. Residues from scrubber/EP and sludge from WWTP sent to licensed hazardous waste facility
n. ODS is sent to licensed incinerator
o. Scrap metal or plastic sent to licensed recyclers
p. Effluent and emission should comply with industrial standard
q. Cyanide was stored in locked storage room with proper label and symbol, every usage is recorded in logbook (date, name, amount)
r. Having emergency response equipment e.g. fire extinguisher, hand washer, shower room, first aid box

The raw material are obtained from domestic and import.

<u>Synchronized Waste Management Program</u>

- Primary Activities:
  - De-manufacturing
  - Destruction
  - Recovery (Mechanical/Chemical)
- Repair, refurbishment & Remarketing

- Non-IP Sensitive IT Equipments

- Continuous Investment on Research & Development
  - For improved recovery yield & eco friendly process

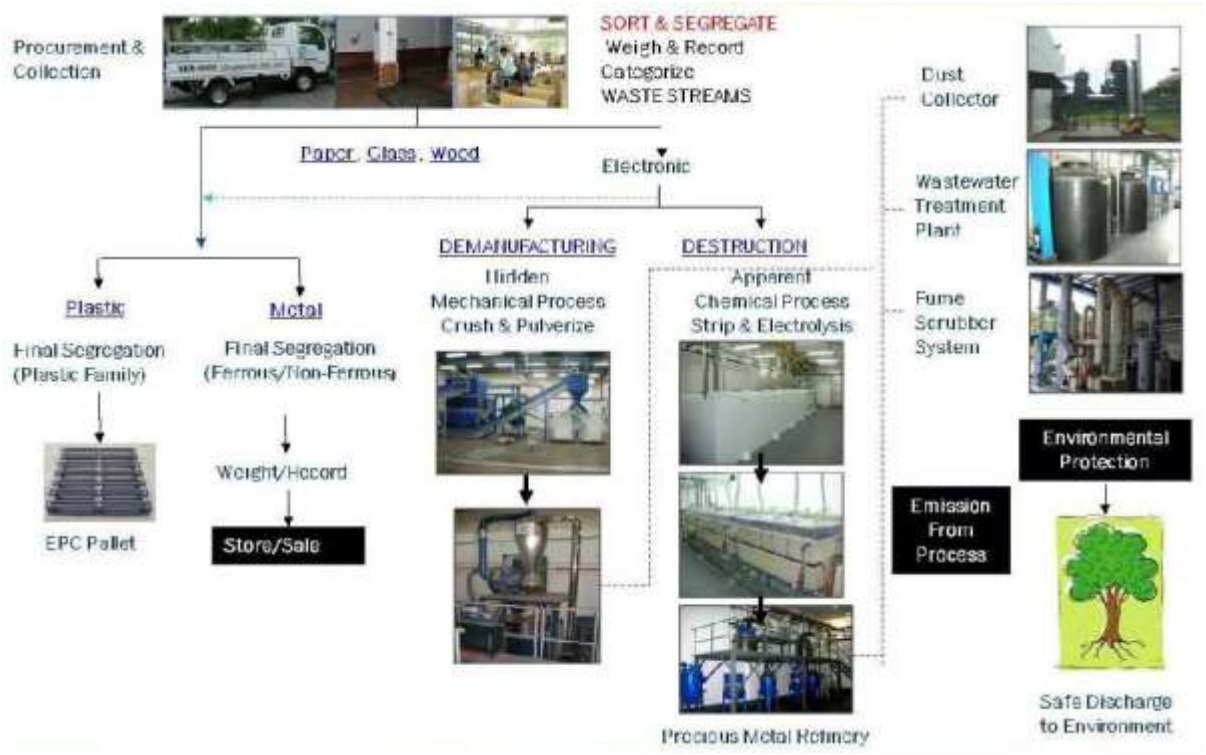


Figure 2.17 Overall process flow

Full recovery facility

s. Have specific area for loading, storage, dismantling (combination manual and machine) segregation, crushing, cyanide dissolution, stripping solution using electrolytic machine, ion exchange, melting by aqua regia.

t. The product 99.99% gold

u. Production of gold 10-22 kg/month

v. Palladium product using Pd refinery

w. Silver (Ag) recovery

x. Chemical treatment with acid to purify silver.

The raw materials are obtained from domestic and import.



Figure 2.18 Extruder



Figure 2.19 Vacuum mold forming machine





Figure 2.20 Primary crusher

Figure 2.21 Mobile crusher



Figure 2.22 Compactor



Figure 2.23 Shredder



Figure 2.24 Electrostatic separator



Figure 2.25 Auto sampler



Figure 2.26 Hammer mill



Figure 2.27 Extraction 1 - Stripping



Figure 2.28 Extraction 2-Electrolysis



Figure 2.29 Metal analysis: ICP



Figure 2.30 Laboratory



Figure 2.31 Cyclone dust collector



Figure 2.32 Wastewater treatment plant



Figure 2.33 Counter-flow wet scrubber system



Figure 2.34 Racking system



Figure 2.35 Cyanide storage area



Figure 2.36 Cyanide antidote storage area



Figure 2.37. Cyanide antidote

2.1.9 Thailand

2.1.9.1 E-waste generation and flow

Type of electrical and electronic equipment (EEE) covered in inventory is as follows:

1. television (CRT, LCD, Plasma)
2. camera/video camera
3. portable audio player
4. printer/facsimile
5. telephone
6. personal computer
7. air conditioners
8. refrigerator

The quantity of production of EEE (2007-2010) can be seen in Table 2.22 as follows:

Table 2.22. Quantity of production of EEE in Thailand

Product type	Quantity (1,000 units) in year			
	2007	2008	2009	2010
Television (CRT, LCD, Plasma)	7,808	7,221	6,022	6,055
Camera/ Video camera	3,904	4,076	4,662	5,930
Portable audio player	2,560	2,129	4,599	6,819
Printer /Facsimile	4,026	7,041	4,742	10,242
Telephone	4,206	2,262	2,741	3,815
Personal computer	1,638	1,452	1,528	1,692
Air conditioner	7,089	7,908	5,809	8,419
Refrigerator	4,455	5,093	4,736	5,656

Ref: National Integrated WEEE Management Strategy (2014-2021) (approved by the cabinet on March 17, 2015)

The quantity of import of EEE (2007-2010) can be seen in Table 2.23 as follow.

Table 2.23 Quantity of import of EEE in Thailand (2007-2010)

Product type	**Quantity (1,000 units) in year**			
	2007	**2008**	**2009**	**2010**
Television (CRT, LCD, Plasma)	1,017	1,329	1,314	2,323
Camera/ Video camera	1,623	1,992	1,936	2,174
Portable audio player	4,223	4,533	2,513	4,016
Printer /Facsimile	633	1,481	939	2,460

Telephone	12,878	15,570	15,024	19,668
Personal computer	652	1,100	1,341	1,549
Air conditioner	604	411	352	602
Refrigerator	67	69	56	91

Ref: National Integrated WEEE Management Strategy (2014-2021) (approved by the cabinet on March 17, 2015)

The quantity of export of EEE (2007-2010) can be seen in Table 2.24 as follows:

Table 2.24 Quantity of export of EEE in Thailand (2007-2010)

Product type	Quantity (1,000 units) in year			
	2007	2008	2009	2010
Television (CRT, LCD, Plasma)	4,702	4,381	3,522	3,400
Camera/ Video camera	3,549	3,796	4,238	5,391
Portable audio player	3,354	3,052	3,312	6,835
Printer /Facsimile	2,935	6,708	3,771	10,692
Telephone	3,721	2,961	2,658	3,383
Personal computer	105	68	59	61
Air conditioner	7,125	6,669	4,424	7,192
Refrigerator	3,048	3,610	3,158	4,027

Ref: National Integrated WEEE Management Strategy (2014-2021) (approved by the cabinet on March 17, 2015)

The quantity of consumption of EEE (2007-2010) can be seen in Table 2.25 as follows.

Table 2.25 Quantity of consumption of EEE in Thailand (2007-2010)

Product type	Quantity (1,000 units) in year			
	2007	2008	2009	2010
Television (CRT, LCD, Plasma)	4,123	4,169	3,814	4,978
Camera/ Video camera	1,978	2,372	2,360	2,713
Portable audio player	3,429	3,610	3,800	4,000
Printer /Facsimile	1,724	1,814	1,910	2,010
Telephone	13,363	14,871	15,107	20,100
Personal computer	2,185	2,484	2,810	3,180
Air conditioner	568	1,650	1,737	1,829
Refrigerator	1,167	1,401	1,392	1,630

Ref: National Integrated WEEE Management Strategy (2014-2021) (approved by the cabinet on March 17, 2015)

Consumer behaviour in the domestic WEEE management can be seen in Table 2.26 as follows.

Table 2.26 Consumer behaviour in the domestic WEEE management in Thailand

WEEE type	Mix dump)%(	Sell (%)	Give/Donate (%)	Keep (%)
Television (CRT, LCD, Plasma)	8.70	62.60	7.24	21.42
Camera	22.44	40.24	4.63	32.69
Video camera	10.26	25.64	15.38	48.72
Portable audio player	21.39	45.19	6.60	17.83
Printer	17.52	52.55	8.76	21.17
Facsimile	16.67	45.83	12.50	25.00
Telephone	36.60	38.99	4.51	19.89
Mobile phone	12.39	50.18	5.77	31.66
Personal computer	7.77	61.81	6.80	23.95
Air conditioner	9.01	66.74	6.47	17.78
Refrigerator	8.82	65.21	7.53	18.43

Ref: National Integrated WEEE Management Strategy (2014-2021) (approved by the cabinet on March 17, 2015)

The amount of domestic E-waste generation by volume is illustrated in table 2.27 as follows.

Table 2.27 E-wastes generation by volume in Thailand in 2014

No.	Type of E-waste	E-wastes generation (ton/year)
1.	Television	103,605
2.	Computer	55,276
3.	Mobile phone	1,657

Source: "The Study Project on Development of Estimation Method of Waste Electrical and Electronics Equipment" April 2012.

Import of E-waste from 2000-2014 was 7,964.739 tons and export 5,195.63 tons.

On illegal trade of UEEE/E-waste 196.11 tons of illegal hazardous garbage was seized at Laem Chabang Port by the Custom Department and Department of Industrial Works on 28 August 2015 from Japan mostly containing hazardous E-waste. The waste will be sent back to Japan on 29 July 2016.

The future projection of E-waste generation in year 2012–2016 was estimated using a Weibull Distribution Model together with Logistic Model. Market saturation, lifetime of product and consumption of EEE were taken into account in the estimation process. The

amount of generated E-waste in Thailand by unit (2012-2016) is illustrated in Table 2.28 as follows.

Table 2.28 Estimation of E-waste generation by unit (2012 - 2016) in Thailand

Product type	Quantity (1,000 units) in year				
	2012	2013	2014	2015	2016
Television	2,377	2,483	2,587	2,689	2,790
Camera/Video camera	724	785	875	983	1,059
Portable audio player	3,253	3,380	3,476	3,537	3,571
Printer /Facsimile	1,495	1,507	1,520	1,532	1,542
Telephone/ Mobile phone	8,524	9,146	9,750	10,337	10,907
Personal computer	1,789	1,999	2,210	2,421	2,630
Air conditioner	696	717	740	766	796
Refrigerator	822	872	922	972	1,023

Ref: National Integrated WEEE Management Strategy (2014-2021) (approved by the cabinet on March 17, 2015)

Data on lifetime of EEE in Thailand is illustrated in Table 2.29 as follows:

Table 2.29 The life time of EEE in Thailand

No	EEE	Life time
1	Television (CRT)	6.9/year
2	Television (LCD/Plasma)	3.8/year
2	Computer	3.65/year
3	Mobile phone	3.09/year
4.	Etc	

The number of unit EEE/household in Thailand is illustrated in Table 2.30 as follows:

Table 2.30 Number of unit EEE per household in Thailand

No	EEE	Unit/household
1	Television (CRT)	1.45
2	Television (LCD/Plasma)	0.39
2	Computer	0.78
3	Mobile phone	2.25
4.	Etc.	

2.1.9.2 E-waste management

Thailand has a draft E-waste regulation in place. Not specifically, E-waste regulation is covered by a hazardous waste management regulation under a Notification of the Ministry of Industry on a list of Hazardous Substance B.E. 2556 (2013) published on website http://www.diw.go.th.

Regarding UEEE and E-waste definition, UEEE is defined as electric and electronic equipment which have been used and still workable and kept in its original form or can be repaired, modified, reconditioned in order to be used as in its original purposes. Thailand does not have a definition for E-waste. The definition is still drafted under a WEEE Act. Thailand has no criteria to differentiate UEEE and E-waste but recognize measures for inspectors to investigate UEEE and E-waste. At present Thailand does not have classification for E-waste and being prepared under a draft WEEE Act.

Policy on import and export

The import activity of second-hand EEE in Thailand is banned based on the Notification of The Department of Industrial Works on criterion for import of UEEE which is considered as a hazardous substance into the Kingdom of Thailand (3rd Edition) B.E. 2550. The following used EEEs and parts or components of used EEEs are classified as hazardous substance type 3, on which the production, import, export, or having in possession, must obtain a permit. In accordance with the "Notification of Ministry of Industry on List of Hazardous Substances B.E. 2546 (2003) and amendments B.E. 2556 (2013)" issued pursuant to the Hazardous Substance Act B.E. 2535 (1992), the list are as follows:

1. Refrigerator
2. Television set
3. Radio
4. Video
5. DVD
6. VCD
7. Tape Cassette Player
8. Air-Conditioner
9. Washing Machine
10. Clothes Drying Machine
11. Dry Washing Machine

12. Rice Cooker
13. Electrical Pot
14. Microwave Oven
15. Electrical Oven
16. Telephone set
17. Facsimile
18. Telegram Transmission Machine
19. Calculating Machine
20. Electrical Typewriter
21. Copying Machine
22. Mobile Telephone
23. Computer
24. Monitor
25. Printer
26. Scanner
27. Electrical Fan
28. Water Cooler
29. Hair Dryer
30. Electrical Iron
31. Burglar Alarm
32. Compressor used in refrigerator Equipment
33. Parts or Components of refrigerator
34. Parts or Components of television
35. Parts or Components of radio
36. Parts or Components of video
37. Parts or Components of DVD
38. Parts or Components of VCD
39. Parts or Components of tape cassette player
40. Parts or Components of air-conditioner
41. Parts or Components of washing machine
42. Parts or Components of clothes drying machine
43. Parts or Components of dry washing machine
44. Parts or Components of rice cooker
45. Parts or Components of electrical pot

46. Parts or Components of microwave oven
47. Parts or Components of electrical oven
48. Parts or Components of telephone
49. Parts or Components of facsimile
50. Parts or Components of telegram transmission machine
51. Parts or Components of calculating machine
52. Parts or Components of electrical typewriter
53. Parts or Components of copying machine
54. Parts or Components of mobile phone
55. Parts or Components of computer
56. Parts or Components of monitor
57. Parts or Components of printer
58. Parts or Components of scanner
59. Parts or Components of electrical fan
60. Parts or Components of water cooler
61. Parts or Components of hair dryer
62. Parts or Components of electrical iron
63. Parts or Components of burglar alarm

Import of UEEE is allowed for direct reuse, repair and refurbishment whereas import of E-waste for final disposal is banned and restricted for 3R.

Available resources

Institutions involved in E-waste management in Thailand are as follows:

- Pollution Control Department
- Department of Industrial Works

Institutional arrangement in Thailand can be seen in Table 2.31 as follows.

Table 2.31 Institutional arrangement in Thailand

No	Issue	Institution
1	EEE production and import-export	-
2	UEEE and E-waste import-export	MoI, MoPH, MoInterior, MONRE

No	Issue	Institution
3	Collector of E-waste	MoI, MoPH, MoInterior, MONRE
4	Transporter of E-waste	MoI, MoPH, MoInterior, MONRE
5	Recycling Facilities of E-waste	MoI, MoPH, MoInterior, MONRE
6	Treatment/recovery of E-waste	MoI, MoPH, MoInterior, MONRE
7	Residue from treatment/recovery of E-waste	MoI, MoPH, MoInterior, MONRE

Current E-waste management system

There is an official E-waste management mechanism for household or industry based on regulation of Hazardous Substance Act B.E. 2535. The information is available in http://www2.diw.go.th/Haz_o/ hazard/lawsnew/Factory%20Act.mht.

Collection, transportation, refurbishment/repair, segregation, separation /dismantling, and recovery for TV, computer and mobile phones are conducted by the informal sector. Recycling and disposal are not carried out. There are 66 formal E-waste recycling/dismantling facilities (DIW, 2015). Thailand has an EPR concept which is under a draft WEEE.

2.1.9.3 Technical Guidelines on transboundary movements of electrical and electronic waste and used electrical and electronic equipment, in particular regarding the distinction between waste and non-waste under the Basel Convention as adopted, on interim basis, by the twelfth meeting of the Conference of the Parties to the Basel Convention and Ban Amendment

No information on component of the above guidelines or part of it been covered in Thailand regulation on E-waste.

2.1.9.4 Identification good practices in Thailand

Country visit was conducted during this study to Thailand to a refurbishing, reconditioning and re-manufacturing facility. Good practices in the facility are as follows:

Refurbishment, recondition and re-manufacturing facility:

1. Have different area for loading, storage, manual dismantling, segregation, refurbishing, reconditioning and re-manufacturing
2. Waste management processing:
    a. resource recovery

b. recycle products (re-manufacturing-cartridge & reconditioning and refurbishing)

3. All workers using personal protective equipment
4. Having dust collectors and collected dust sent to cement kiln
5. Weight measurement before and after processing
6. Effluent and emission should comply with industrial standard
7. Concrete floor, lighting, ventilation, water collection that will send to industrial park WWTP
8. Untreated hazardous waste sent to Japan

Raw materials are obtained from Asia Pacific.

2.1.10 Vietnam

2.1.10.1. E-waste generation and flow

Vietnam conducted an E-waste inventory in 2007. The type of EEE covered under the inventory is as follows:

1. Television sets
2. Personal computers
3. Mobile phones
4. Refrigerators
5. Air conditioners
6. Washing machines

Data regarding the domestic production, export & import, domestic consumption of EEE from 2009-2014 can be obtained directly from Ministry of Industry and Commerce.

The amount of each type of UEEE/E-waste (domestic generation, export & import and illegal trade) from 2009-2014 in Vietnam is 18,000 tons/year calculated from hazardous waste reports by treatment facilities, but in reality can be higher. There is no data on the lifetime of EEE and the number of unit EEE/person in Vietnam.

There is no information on import data of UEEE and E-waste from 2009-2014. Export of E-waste from 2009-2014 was 12,644 MT. The detailed data on exportation of E-waste is provided by VEA in response to the questionnaire. Data on illegal transboundary trade of UEEE/E-waste can be obtained through a formal letter to Ministry of Finance (Custom).

Future projection of E-waste

Based on E-waste inventory in 2007, data on E-waste generation is illustrated in Table 2.32 as follows.

Table 2.32 Data on E-waste generation of each type of EEE in Vietnam

Televisions

Year	Waste Generation (unit)
2009	619,269
2010	742,509
2011	891,804
2012	1,072,933
2013	1,293,110
2014	1,561,087
2015	1,887,138
2016	2,282,966
2017	2,761,651
2018	3,337,803
2019	4,028,063
2020	4,852,039

Personal Computers

Year	Waste Generation (unit)
2009	195,514
2010	217,189
2011	270,874
2012	369,061
2013	420,850
2014	486,752
2015	644,208
2016	736,993
2017	869,512
2018	1028052
2019	1217478
2020	1444038

Mobile Phones

Year	Waste Generation (unit)
2009	2,745,097
2010	2,808,043
2011	3,230,788
2012	3,263,096
2013	3,295,727
2014	3,328,684
2015	3,361,971
2016	3,395,591
2017	3,429,547
2018	3463842
2019	3498480
2020	3533465

Refrigerators

Year	Waste Generation (unit)
2009	346,036
2010	397,972
2011	467,037
2012	546,733
2013	689,466
2014	825,410
2015	1,026,974
2016	1,190,945
2017	1,392,355
2018	1,634,982
2019	1,923,584
2020	2,267,318

Air Conditioner

Year	Waste Generation (unit)
2009	86,548
2010	107,519
2011	128,000
2012	132,607
2013	209,548
2014	313,336
2015	318,143
2016	409,545
2017	495,011
2018	598,020
2019	722,566
2020	873,163

Washing Machine

Year	Waste Generation (unit)
2009	472,631
2010	542,918
2011	636,596
2012	775,838
2013	937,420
2014	1,083,151
2015	1,247,801
2016	1,444,845
2017	1,672,279
2018	1,939,401
2019	2,254,210
2020	2,625,882

2.1.10.2. E-waste management

E-waste regulation

Vietnam does not have a specific regulation on E-waste. E-waste regulation is covered by a hazardous waste management regulation, as follows:

1. Law on Environmental Protection No. 55/2014/QH13
2. Decree No 38/2015/ND-CP regarding the management of waste and scraps
3. Circular No 36/2015/TT-BTNMT regarding hazardous waste management

The regulation is published on website in the following link:
http://quanlychatthai.vn/?DCategoryID=415

E-waste regulation is also covered by another regulation, as follows:
Decision No.16/2015/QD-TTg regarding on Retrieval and Disposal of Discarded Products

Note: Products to take-back is not only E-waste, but mostly focus on E-waste, both from industry and household. Now, Vietnam is drafting a Circular under Decision No.16/2015/QD, and is expected to be issued by the end of this year. It will focus on responsibility of company and household to take back E-waste in the list.

The regulation is published on website in the following link:
http://quanlychatthai.vn/Pages/DocView.aspx?DocumentID=851925

E-waste is managed by the Vietnam Environment Administration (VEA), Ministry of Natural Resources and Environment (MONRE). There is no definition of E-waste and UEEE and no classification for E-waste.

Regarding the policy on transboundary movement of second hand/UEEE the export activity of second hand/UEEE is not banned in Vietnam. Import activity of second-hand EEE however is banned based on the Decree No. 187/2013/ND-CP regarding the detaied implementation of Trade Law on International Commerce of Commodities and Agent Activities including Purchasing, Selling, Sourcing, Outsourcing, Bordergate Transfer, and Transiting of Commodities with Foreign Countries**.** Regarding policy on transboundary movement of E-waste, export activity of E-waste is not banned in Vietnam while import activity of E-waste is banned, based on the Law on Environmental Protection No. 55/2014/QH13.

Available resources in Vietnam are illustrated in Table 2.33 as follows.

Table 2.33 Available resources in Vietnam

Resources	Description Details	Constraints (if any)
Human Resources	Officials in MONRE, DONRE, stakeholders (generators, treatment/recovery organizations, etc)	
Financial	Financial source from the Government and other stakeholders	

Technology	Licensed equipments in treatment facilities	
Knowledge	Experts, officials in MONRE, DONRE, stakeholders	
Institution	MONRE	
Local government regulation	DONRE	

Institutional arrangement in Vietnam is illustrated in Table 2.34 as follows.

Table 2.34 Institutional arrangement in Vietnam

No	Issue	Institution
1	EEE production and import-export	Custom and MoIC
2	UEEE and E-waste import-export	VEA-MONRE, Custom
3	Collector of E-waste	VEA -MONRE/DONRE
4	Transporter of E-waste	VEA –MONRE/DONRE
5	Recycling Facilities of E-waste	VEA –MONRE/DONRE
6	Treatment/recovery of E-waste	VEA-MONRE/DONRE
7	Residue from treatment/recovery of E-waste	VEA -MONRE/DONRE

Current E-waste management system

E-waste is categorized as hazardous waste, included fluorescent light, accumulator and batteries. Electrical and electronic equipment which is categorized as E-waste and regulated in Vietnam are: compact light, fluorescent light, desktop or laptop, computer monitor; CPU (micro processor), Printer, fax machine, scanner, photo camera, movie camera, cell phone, tablet computer, DVD, VCD, CD recorder and other tape or disc player, photocopier, television, refrigerator, air conditioner and laundry machine.

There are no criteria to distinguish between E-waste and UEEE.

There is an official mechanism for E-waste from household and industry. The scope of the mechanism for collecting and processing, based on (regulation): Decision No.16/2015/QD-TTg and Circular No 36/2015/TT-BTNMT. Since 1 July 2016, company has responsibility to set up collection points. Transportation will be carried out by licensed transportation.

Some companies set up collection points in supermarkets, near centres, so household can bring it there. Licensed transporters then take E-waste to recycling facility.

Now, Vietnam increases enforcement in law, sanction/penalty in the future.

Formal and informal sectors participate in E-waste management.

Formal and informal sectors participation on E-waste management activities for television, computer and mobile phone are as follows:

1. Television (CTR, LCD and LED): formal and informal sectors participate in collection, transportation, separation/dismantling, recycling, recovery and disposal activities. All these activities in compliance with Decision No.16/2015/QD-TTg and Circular No. 36/3025/TT-BTNMT
2. Computer (CPU, CRT, LED, and LCD): formal and informal sectors participate in collection, transportation, separation/dismantling, recycling, recovery and disposal activities. All these activities in compliance with Decision No.16/2015/QD-TTg and Circular No. 36/3025/TT-BTNMT
3. Mobile phone (handset and battery): formal sectors participate in collection, transportation, separation/dismantling, recycling, recovery and disposal activities. Informal sectors participate in collection, transportation, recycling, recovery and disposal activities (not participate in separation/dismantling activity). All these activities in compliance with Decision No.16/2015/QD-TTg and Circular No. 36/3025/TT-BTNMT

Detailed information on formal and informal sectors participation in existing E-waste management and future plan is provided by VEA in response to the questionnaire.

Environmental standard applied for collection, transportation and sepatation/dismantling of E-waste activities (TV and computer) is regulated by MONRE, for recycling, recovery and disposal activities (TV and computer) refers to QCVN 07:2009/BTNMT regarding hazardous waste thresholds.

Detail information on BAT, good practices and environmental standard for disposal options can be seen on the website http://quanlychatthai.vn.

List of the company involved in E-waste management, can be seen on the website http://quanlychatthai.vn/.

A Decision No.16/2015/QD-TTg dated 22 May 2015 of the Prime Minister on regulation on recall and treatment of discarded products provides provision for mandatory recall and treat discarded E-waste and will be given supportive and preferential policies.

The list of discarded product and schedule of recall and treatment shall be defined in the Appendix of the Decision No.16/2015/QD-TTg and EEE including in the list.
Type of EEE which is included in the appendix of the decision mentioned above are as follows:

1. Compact light; fluorescent light
2. Desktop or laptop; computer monitor; CPU (micro processor)
3. Printer; fax machine; scanner
4. Photo camera; movie camera
5. Cell phone; tablet computer
6. DVD, VCD, CD recorder and other tape or disc player
7. Photocopier
8. Television; refrigerator
9. Air conditioner; laundry machine

1 July 2016 was the schedule of recall and treatment for all type of EEE above.
Responsibility and right concerning recall and treatment of discarded products is also explained in the Decision No.16/2015/QD-TTg, as follows:

- responsibility of manufacturers
- right of manufacturer
- responsibility of consumers, distribution facilities, waste transportation and treatment organizations, and collecting organizations or individuals
- right of consumers, collecting organizations or individuals and distribution facilities
- responsibility of the Ministry of Natural Resources and Environment
- responsibility of provincial people's committees

Vietnam does not have reference used as guidelines in E-waste management.

2.1.10.3 Technical Guidelines on transboundary movements of electrical and electronic waste and used electrical and electronic equipment, in particular regarding the distinction between waste and non-waste under the Basel Convention as adopted, on

interim basis, by the twelfth meeting of the Conference of the Parties to the Basel Convention and Ban Amendment

Information on the components of the guidelines or part of it has been covered in national regulation on E-waste. In Vietnam, Law on Environmental Protection 2014 do not allow import any waste. But special case such as scrap, old ship for recycling and used machinery can still be imported. Imported scrap must be in the list of Prime Minister and follow regulations. Some metal scraps still contain hazardous waste.

2.1.10.4. Identification of good practices in Vietnam

Country visit was also conducted during this study to Vietnam. Good practices and technology in a recycling facility that was visited are as follows:

1. Process:
    a. Crushing, Furnace (check weight, separation crushing and furnace)
    b. Process chemical: dissolution purification
2. Valuable metal sent to Japan
3. Exhaust gas, waste water sent to treatment system (gas, water)
4. Emergency response requirement available

Raw material used is obtained from domestic source.

2.2 Outside ASEAN Countries

2.2.1 E-waste regulation and policy (on E-waste management and export import)

Based on the Basel Convention Annex VIII, E-waste is categorized as hazardous waste with the exception that the E-waste does not have the same characteristic as prescribed in Annex III of the convention. Specific of E-waste regulation in ASEAN countries are not available. Only Cambodia has specified regulation on E-waste and Indonesia, Malaysia, the Philippines and Thailand are in draft form. Regulations are important for controlling the improperly managed throughout its life cycle. Many of the ASEAN countries are draft the specific regulations on E-waste, it will also can be used the specific regulation on E-waste from other countries, e.g. China and EU.

Legislation on E-waste in China

The Chinese government has issued a variety of environmental laws, regulations, standards, technical guidance and norms related to E-waste management over the past decade. Five of the most important ones are illustrated as follows [Wang, F., Kuehr, R., Ahlquist, D., and Li, J. 2013].



Figure 2.38. Key national legislation and policies related to E-waste management in China

MEP : Ministry of Environmental Protection

MIIT : Ministry of Industry and Information Technology

NDRC : National Development and Reform Commission
NPC : National People's Congress

In order to deal with the problems arising from the illegal import of E-waste, the government has passed numerous regulations to restrict and even ban the importation of E-waste and has signed on to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, a multilateral environmental agreement, as well as the Basel Ban Amendment.

The first policy in Figure 2.38, Catalogue for managing the import of wastes, which was passed in 2000, included second-hand electronic equipment and E-waste in the "List of Prohibited Goods to be imported for Processing or Trade", which is updated regularly. This policy focuses on the control of illegal E-waste shipments through Custom administration. However E-waste is still entering China through multiple illegal channels despite of the official ban.

The second key policy in Figure 2.38, The Technical Policy on Pollution Prevention and Control of WEEE enacted in 2006 stresses the importance of proper E-waste management in China. It sets forth the overall guiding principles of "Reduce, Re-use and Recycle" (3R) and "Polluter Pays" (i.e. shared responsibility of producers, retailers and consumers). However, it is only a guiding law that lacks the specifics necessary for implementation.

The third policy, The "Ordinance on Management of Prevention and Control of Pollution from Electronic and Information Products" primarily regulates the environmentally-friendly design of new electrical and electronic equipment and restricts the use of hazardous materials therein. This policy applies exclusively to producers and manufactures of electrical and electronic equipment. The ordinance includes requirements for eco-design, restrictions on the use of six hazardous substances (lead, mercury, cadmium, chromium, and polybrominated biphenyl or polybrominated diphenyl ethers) in electronic products, and requirements for producers to provide information on the components and hazardous substances present in their products, as well as the period of safe use and the potential for recycling.
The "Administrative Measures on Pollution Prevention of WEEE" establishes the licensing system for recycling companies and stipulates the technical and environmental standards with which companies must comply to receive a treatment license. As a supporting standard for

this policy, The Technical Specifications of Pollution Control for Processing Waste Electrical and Electronic Equipment, provides the technical standards and specifications for various E-waste treatment processes and activities such as storage, transport, dismantling and waste handling, as well as for equipment and material fractions.

Finally, the "Regulation on Management of the Recycling and Disposal of Waste Electrical and Electronic Equipment" is the most critical and comprehensive E-waste legislation to date. It establishes a national E-waste collection and recycling system and outlines various stakeholders' responsibilities, including per-product fees and treatment subsidies for producers and recyclers, respectively. The regulations also establish a "specialized fund" to subsidize the formal collection and recycling of E-waste. Producers and importers of electronic products are required to contribute to this fund. The regulations also stipulate a standard and certification system for E-waste recycling and disposal enterprises in order to monitor and ensure the safe and responsible processing of E-waste. However, the regulations do not explicitly define specific collection or recycling targets. To date, the effectiveness and outcomes of the regulations have yet to be evaluated. In July 2012, the Chinese government released the details of the China E-waste Fund Management Measures, which specifies the treatment fees, means and frequency of fee collection, fund contributors and list of eligible recyclers. Table 2.35 lists the primary responsibilities of different stakeholders as stipulated under the regulations.

Table 2.35 Stakeholder E-waste management responsibilities under national E-waste legislation in China

Stakeholders	Responsibilities
Producers (including importers & agents)	- "Green" design and production of EEE - Pay treatment fees for products put on the market
Retailers and service companies	- Provide information in their stores/companies regarding E-waste collection and treatment through formal channels
Refurbishment companies	- Guarantee the quality and safety of refurbished products - Clearly label repaired equipment with "refurbished
E-waste collection companies	- Provide multiple channels and means to consumers for convenient collection of E-waste - Transfer collected E-waste to licensed E-waste treatment companies

E-waste recycling and treatment companies	- Obtain E-waste treatment license - Comply with national E-waste treatment standards - Establish environmental quality monitoring system for treatment facilities - Establish information management system for treated E-waste

Source: Wang, F., Kuehr,R., Ahlquist, D., and Li, J. 2013

According to the management measures stipulated in the "specialized fund" for E-waste treatment, producers and importers of EEE must pay specified treatment fees for the products they put on the Chinese market. The collected fees will be placed in the fund and then allocated to licensed recyclers to cover costs related to the collection and treatment of E-waste. Table 2.36 lists the product-specific fees to be paid by producers and the subsidies to be received by recyclers in 2012. Due to lack of managerial experience and baseline data on such a program, official collection and recycling targets have yet to be set.

Table 2.36 National "specialized fund" for E-waste treatment in China, product-specific fees and subsidies (2012)

	TV (CRT and flat panel)	**Refrigerator**	**Washing Machine**	**Air Conditioner**	**Computer (desktop and laptop)**
Producer fee (per unit sold)	RMB 13 / USD 2	RMB 12 / USD 1.9	RMB 7 / USD 1.1	RMB 7 / USD 1.1	RMB 10 / USD 1.6
Treatment subsidy to recycler (per unit	RMB 85 / USD 13.5	RMB 80 / USD 12.7	RMB 35 / USD 5.5	RMB 35 / USD 5.5	RMB 85 / USD 13.5

Source: Wang, F., Kuehr,R., Ahlquist, D., and Li, J. 2013

Legislative in European Union (EU) Countries

EU promulgated Directive 2011/65/EH of the European Parliament and of the Council of June 8, 2011 on the restriction on the use of certain hazardous substances in electrical and electronic equipment. A number of substantial changes are made to Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

The contents of the regulation include subject matter, scope, definition, prevention, adaptation of the Annexes to scientific and technical progress, review and amendment of list of restricted substances in Annex 1, obligation of manufacturers, obligation of authorized representatives, obligation of importers, obligation of distributors, cases in which obligations

of manufacturers apply to importers and distributors, identification of economic operators, EU declaration of conformity, general principles of the CE marking, rules and conditions for affixing the CE marking, presumption of conformity, formal objection to a harmonized standard, market surveillance and controls of EEE entering the Union Market, Committee procedure, exercise of delegation, revocation of the delegation, objections to delegated acts, penalties, review, transportation, entry into force and addresses.

The collection, treatment, recycling and disposal of waste EEE as set out in Directive 2002/96/EC of the European Parliament and the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE) are necessary to reduce the waste management problems associated with the heavy metals and flame retardants concerned.

Each member countries of EU also has its own regulations especially for collection, fee, EPR as follows [Renew Tees Valley Ltd, as cited in Sahwney, P. et al 2008]. Some examples are as follows.

EC Member

The Netherlands

Transposition/In force

January 2005

Key provisions

WEEE from Households

Municipalities must provide sites where households can return WEEE 'at least' free of charge. Retailers must take back products free of charge on a 1:1 basis. From August 2005, producers are required to take back their own brands from municipal collection sites and to meet the costs of sorting and transport. Producers may set up their own systems for recovery of WEEE.

Historic Waste

Costs to be met through current market share on pay as you go basis Financial Guarantee: Required from individual compliers. Collective compliance scheme serves as guarantee

B2B WEEE

Producers have a responsibility for B2B WEEE placed on market post-13 August 2005.

Producers responsible for pre-13 Aug 2005 WEEE if replacement purchased, otherwise End User Responsibility

Visible Fee

Allowed until 2011 (2013 Large Appliances)

Compliance

NVMP system began work in 1999 and will continue to be the main compliance organization.

- ICT-Milieu runs a take-back scheme for IT, telecoms and office equipment
- Stichting Lightrec is responsible for the collection of commercial and household lamps and luminaires

EC Member

Spain

Transposition/In force

February 2005

Key provisions

Collection of WEEE from households

Producers will be responsible for collecting and recycling all products they place on the market after 13 August 2005. For products placed on the market before that date, producers will be responsible for products in proportion to their market share.

Register of producers provided for in Royal Decree 208/2005

As requested by producers there will be one national register rather than each Autonomous Region having its own. The registering authority is the National Register of Industrial Establishments, which according to Spanish officials, is expected to be up and running before August 13th.

Takeback system

In most cases, the returning of goods will be at no cost to the product's final owner. There are several manners in which to dispose of WEEE.

The consumer may return the WEEE to a distributor from whom they are buying an equivalent or replacement product, or may drop them off at an authorized location. A

distributor must receive the item and store it until it can be processed correctly, by means of scheduled collections by the item's producer or their representative organization. Local authorities, in municipalities with more than 5000 people, will also be responsible for collecting WEEE from households and storing it until it is collected for sorting and treatment by producers or their collective organization. A municipality with less than 5000 people will adhere to the collection standards set by the respective autonomy. In cases where the above methods of disposal would prove to be a sanitary or security risk, the product's final owner will be responsible for the correct processing of the WEEE. In most cases, the WEEE producer will bear the cost and responsibility of the collection, treatment, and final disposal of the WEEE.

Compliance

Producers may fulfill their WEEE management, collection and treatment obligations individually or through a collective in the region in which the company operates, must authorize the collective schemes. The applications for authorization must include the territorial scope, the name and addresses of the organization which will be managing the operation, the points of collection and the manager of each, the means of financing the project, and the procedures for providing information to public authorities.

The authorizations will then be granted for a five- year period, on a renewable basis

- The ECOLEC Foundation has been created as a collective management system set up by the business associations that represent the manufacturing sector and importers of large and small electrical appliances
- Tragamovil (Mobile Phones), Ecofimatica (reprographics) and Ecoasimelec have been set up by the sociación Multisectorial de Empresas Españolas de Electronica y Communicaciones
- SIG Lamparas (Lamps and Lighting Equipment)
- ECOTIC (Consumer Electronics)

2.2.2 BAT and BEP including Environmental Standards outside ASEAN Countries

Technology of E-waste in South Africa

General facility design and basic tools required for operation

Whilst there are no hard and fast rules about how to optimally set up an E-waste facility, there are guidelines that should be followed to assist.

- The facility should be in an existing industrial zoned area in an existing building with all the necessary infrastructure already in place, including water, sanitation and electricity.
- The key working areas should offer good natural lighting and ventilation.
- The facility should be fully roofed (including the storage area the facility needs ample storage space both for E-waste materials received and for refurbished equipment and/or dismantled components prior to dispatch. Note that items such as CRT monitors and plastic shells require a large amount of space for temporary storage prior to being taken to a downstream recycler or a (hazardous) landfill site of any incoming or outgoing E-waste and any components) and must have an impermeable floor. Extinguisher, fire blankets, evacuation drill) in place, in order to comply with relevant local safety regulations (check with the municipality). Computer plastics are treated with poisonous flame retardant chemicals and as a result produce highly hazardous fumes when burnt, so this is a serious health risk for workers that need to be responsibly addressed through pro-active planning as part of routine operational management set-up.
- A secure store for the valuables that are being dismantle is essential, i.e. a safe or a lockable area.
- Ensure that workers have access to and USE standard personal protection equipment (PPE) items whenever required, including: closed shoes, overalls, gloves, security glasses and masks (the latter two are required for any dismantling activities).
- One also needs to invest in an industrial type scale to be able to weigh E-waste delivered and removed from site.
- Hessian bags or other storage type containers will be required to store sorted E-waste.
- If faced with different types of E-waste, one will need to put up leak proof containers where fluorescent tubes etc. can be safely stored so that glass is not broken before such materials can be sold or disposed.
- A set of magnetic screw drivers will suffice to do most of the basic dismantling and pre-processing activities.

  Further equipped with a trimming knife, a pair of scissors, a hammer, chisels, cable cutters and pliers and a basic tool-set, and ideally neatly stored in a toolbox.

More information is available on the official publication and full list findings under www.ewasteguide.info/files/2008_ Schluep_REWAS.pdf

Good housekeeping

General

The responsible handling of E-waste in any stage of management (from receiving it at the gate, to list storage, sorting, dismantling, repair, refurbishment, baling and dispatch for transport to a downstream recycler or to the landfill site) is absolutely crucial. It is essential that an entire recycling operation has a good housekeeping schedule.

A roster must be kept that clearly describes good housekeeping requirements to check that the facility is run without creating any negative environmental and health and safety impacts.

With regards to environmental protection, the roster must include housekeeping strategies that can fully ensure the prevention of any odor, litter, storm water contamination or any other nuisance factors. Any E-waste storage and processing such as dismantling must be performed under a roof and on a floor with an impermeable surface so that E-waste is not exposed to the elements and cannot contaminate water, air or soil. Manual dismantling will ensure that no air pollution (e.g. in the form of dust loaded with heavy metals) is generated, as is the case with mechanical crushing or other mechanical, thermal or chemical processes. Also, the manual dismantling process does not involve the use of any water.

Recording incoming E-waste

To comply with the Second-Hand Goods Act, any incoming material needs to be recorded by writing down the serial number or bar-code of any received equipment and where it was received from.

There are basically 3 points in the operation of an E-waste business where data is captured. First, when it is received at the gate e.g. from a collector, then when it is put into storage and then a data record is kept of parts and components that have been dismantled as value adding steps and sold on to the relevant buyers.

Keeping track of the processed equipment flow is important as it underpins the further evaluation of financial statements that will be required from a registered and licensed E-waste business.

Storage

Whether under or over the threshold limits requiring a waste management license, one needs to ensure that the methodology of storing and sorting waste is sound.

- All E-waste should be stored in a suitable area that is weatherproof and is situated away from any living areas.
- It must be stored away from any storm water drains or natural water systems.
- Sorting areas must be regularly cleaned and at the end of the day the facility must be swept.
- Make sure the processed or baled recyclables are collected regularly or taken to a reputable recycler on time. It is recommended that when nearing ¾ of the allowable limit, one should contact the recycler to collect, or prepare to transport the materials.

Testing of equipment for functionality prior to dismantling

When it comes to the potential financial benefits through re-selling, the "recovery of function" is always preferable to the "recovery of materials" by subsequent dismantling.

This is also in line with the preferred waste management hierarchy where the reuse of materials is by far more preferential with regards to the environmental impact created.

Unfortunately experience in South Africa has shown that most E-waste derived from public collection sources and households is rarely suitable for reuse and mostly very outdated due to the fact that E-waste is traditionally stored in-house for very long times (as there is still a perceived value to it). E-waste sources coming from businesses and government sources are typically better in quality, however it is often the case that components such a hard-drives are missing due to selected cherry picking by the owners themselves or the staff concerned with overseeing "temporary storage" facilities.

A small E-waste business is very unlikely to get access to corporate E-waste streams, unless it is fully licensed, registered and equipped with high-tech testing, do refurbishment and most importantly, data destruction.

A small business is mostly concerned with the testing of components as complete units, e.g.: a complete PC unit, is unlikely to be obtained often. However, components such as monitors, towers, keyboards, mice etc can be tested easily by connecting such items to an otherwise fully equipped electrical or electronic unit with known functionality.

Other main components to be tested (as they are sellable for reuse on their own) include memory cards, disk drives, hard drives, power supplies and network cards.

Note that typically most component reuse takes place (either formally or informally) before it is passed on as E-waste to a dismantler, which is why the concern will be mostly with the recovery of "materials" and not "function".

Any residual waste (originating from materials or components that cannot be repaired or refurbished or dismantled for material recovery or are valueless to the business due to the lack of down-stream recycling demand) must be placed within a designated and clearly labelled bin. Residual waste must be disposed of weekly at a licensed waste disposal facility and hazardous waste components (such as non-functioning monitors) must be taken to a hazardous landfill site. All safe disposal certificates must be retained on site.

Pre-processing and dismantling

With rapidly tightening legislation and increasing controls, the E-waste handling landscape in South Africa is changing dramatically and as a small E-waste business one must be fully aware that the operational range is likely to be limited from the outset to selected activities that are mostly revolving around value-adding steps before components (or fractions thereof) are handed over to an end-use recycler who has the facilities and controls in place (e.g. high-tech mechanical printed wire board shredders, cable granulators, plastic injection moulding machines, CRT glass cutters, etc.) to further refine and enrich the material streams that will eventually end up predominantly in local and even international refineries and smelters.

Typical E-waste trading commodities

A small business by nature is likely to be mostly concerned with value adding steps and hardly provides the final treatment solution hence pre-processing and in particular component dismantling is the key activity a small E-waste business should be concerned with. All E-waste (components) dismantled and segregated must be placed separately

in clearly identifiable suitable sorting bins. The table below lists the typical fractions that medium enterprises and large scale end-recyclers are keen to buy. If delivery of an E-waste mix entirely unsorted one will still be paid for it but receive very little compared to separating the printed wire boards up-front. Also, make sure that buyers are found for other materials such as the plastics, as this will increase profit margin and decrease the landfill cost for the not so valuable and hazardous parts in the E-waste that need proper disposal.

Table 2.37 Copy of a list of sought after items from a buyer

Description
High grade printed circuit boards (computers, servers, cell phone)
Medium grade printed circuit boards (copiers, printers, phones)
Low grade printed circuit boards (rest)
Mixed printed circuit boards
Processors ceramics
Processors Plastics:
IT plugs (plugs from printer cables/computer cables)
Hard drives (HDD)
PC power supply (PC-PSU)
Old copper cables (thin without plugs)
Old copper cables (thick without plugs)
Cables (mixed with plugs)
Computer boxes (full) servers, switchboards (full)
Unsorted E-waste (computers, printers, copiers, monitors, etc.)

Especially in countries like South Africa where labour costs are comparably low (while first world dismantling and shredding technology is often unaffordable), manual dismantling can be a very effective and efficient way to recover the economic and environmental value in E-waste. Also, manual disassembly can greatly improve the value yield of the material as precious metals can be lost in a basic shredding process. Furthermore, manual dismantling can be generally done by unskilled labour (which need however to receive adequate on-the-job-training) and with very simple tools.

The technology available in Asian countries was reported by Amit Jain in the Expert Review Meeting on the compendium of technologies for used tyres and E-waste on 25-26 August 2016 in Bangkok, Thailand as follows:

Technologies for primary and secondary dismantling;

1. Flow diagram for the recycling of WEEE or E-waste
2. Manual decontamination or dismantling process
3. Flow diagram for second level WEEE or E-waste treatment
4. Process flow diagram of CRTs
5. Precious metals recovery process
6. Conceptual CFL/FL waste treatment scheme and process flow in Kerala
7. Rare earth elementary from powder.

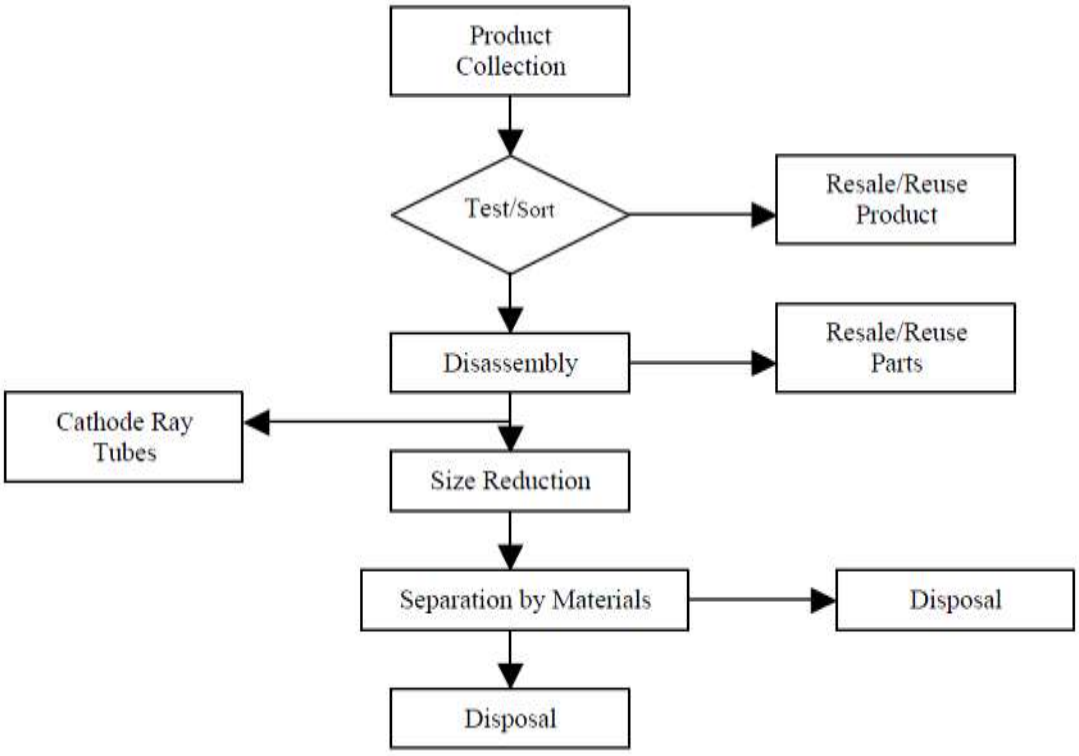


Figure 2.39 Flow diagram for the recycling of WEEE or E-waste



Figure 2.40 Manual decontamination or dismantling process

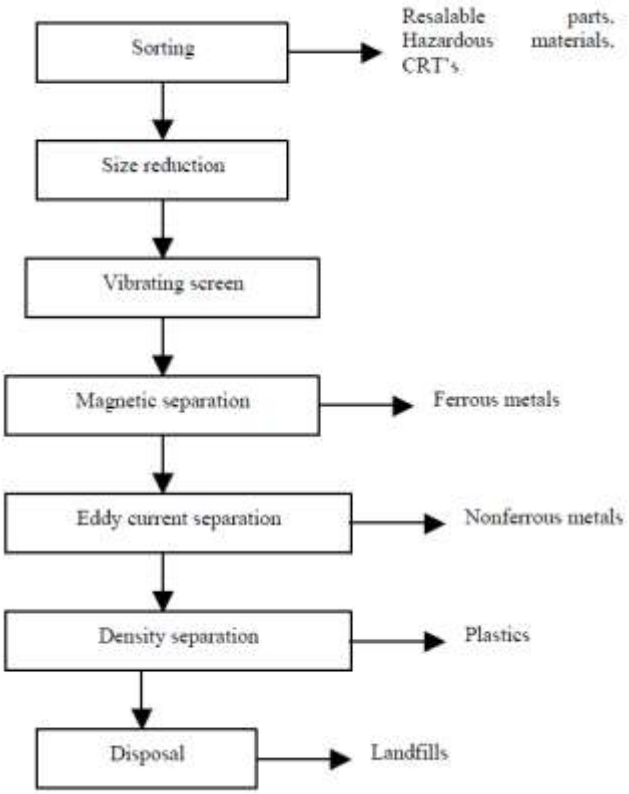


Figure 2.41 Flow diagram for second level WEEE or E-waste treatment

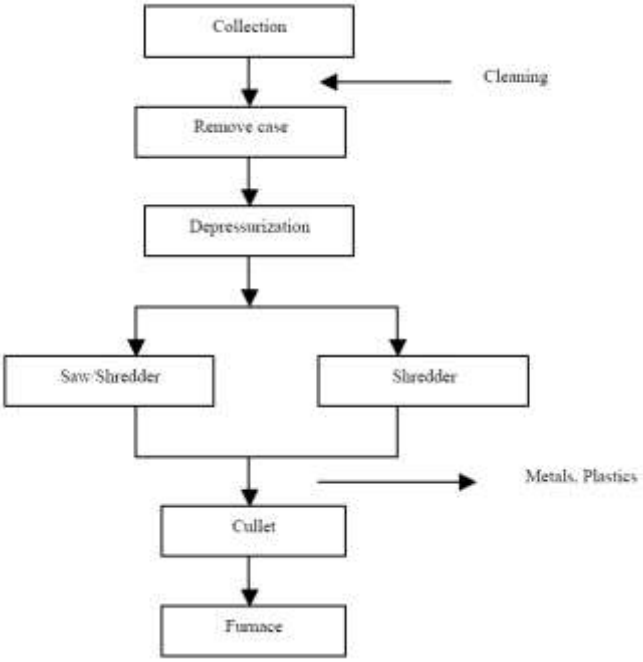


Figure 2.42 Process flow diagram for recycling CRTs

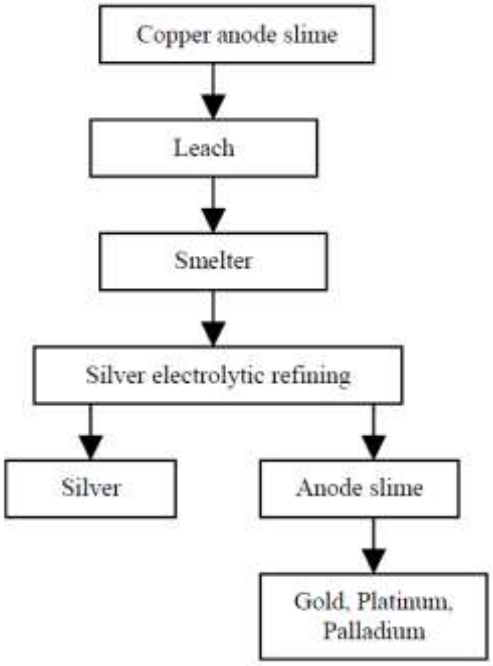


Figure 2.43 Precious metals recovery process

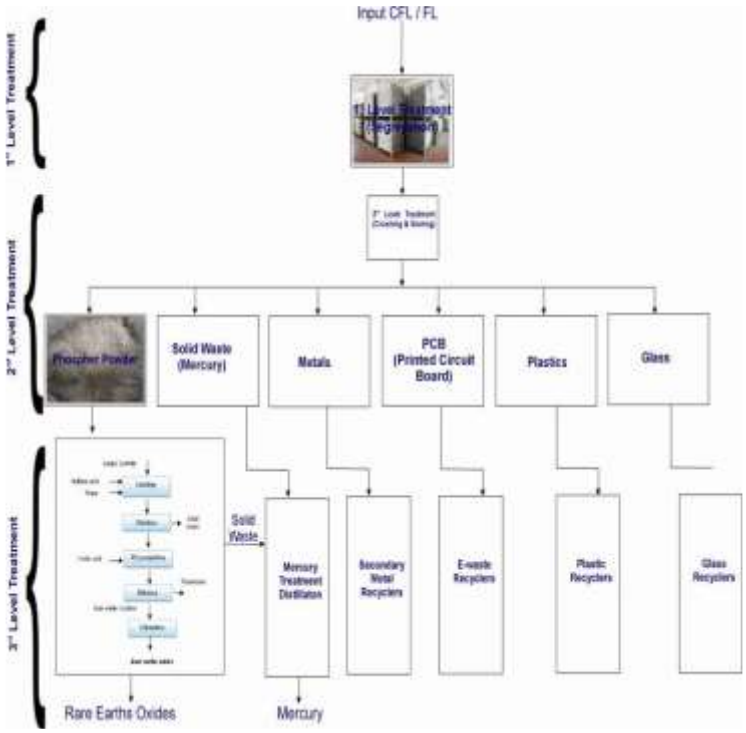


Figure 2.44 Conceptual CFL/FL waste treatment scheme and process flow in Kerala

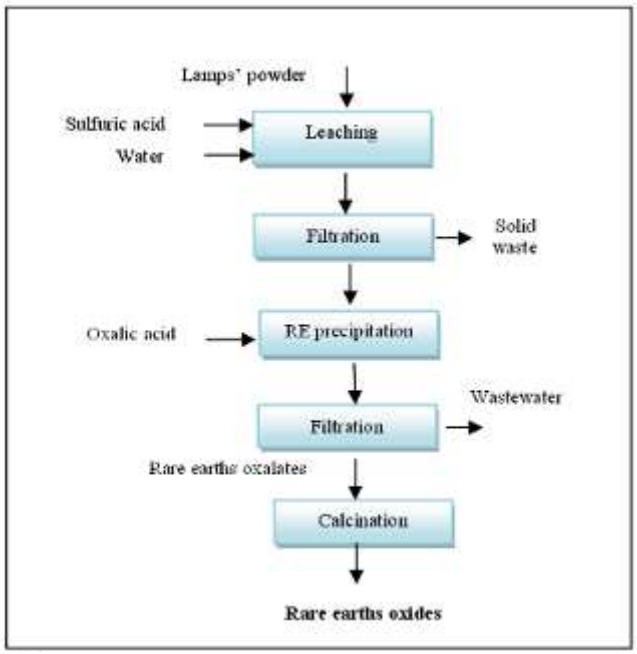


Figure 2.45 Rare earth elements extraction from powder

2.2.3 EPR System

Within the ASEAN countries, only Vietnam applied mandatory EPR and 3 (three) countries (Malaysia, Philippines, and Singapore) are voluntary as conducted by several transnational electronic industries (Dell Computer, Hewlett Packard, dan Nokia). While still not broadly

carried out, those companies have developed a take back program. In those countries, EPR regulations are being drafted. In Indonesia EPR regulated by Government Law No. 81/2012 on Municipal Waste and Similar Waste to Municipal Waste are mandatory.

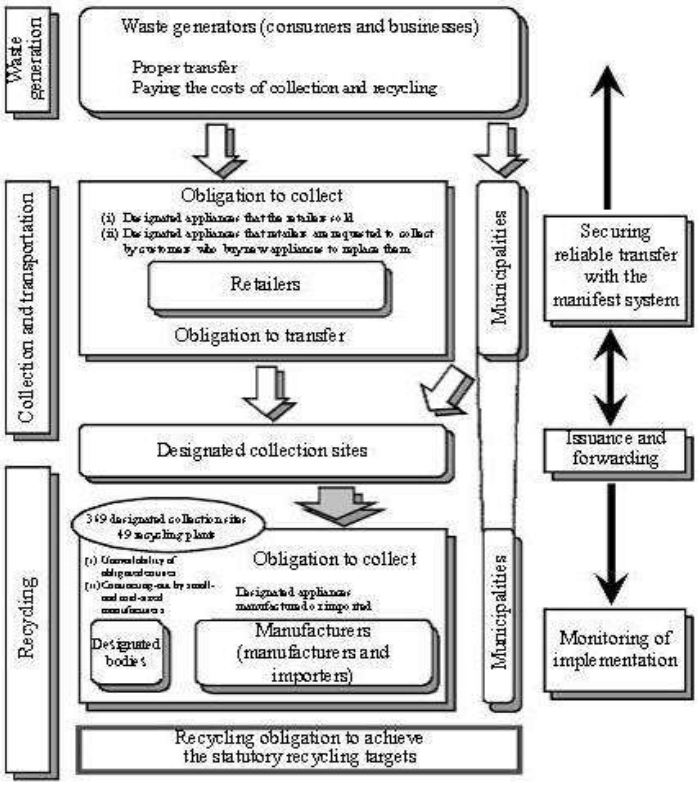
Some other countries such as Japan, Korea, Taiwan and Switzerland have implemented EPR. In Japan, recycling and transportation of E-waste are financed by consumer, while in Korea dan Taiwan recycling cost is producer responsibility. In Switzerland, a consortium of producer and importer was enacted to manage E-waste generation. Financing pattern for E-waste in Indonesia is still on planning phase.



Figure 2.46 EPR system from Japan

2.2.3.1 Japan

The Waste flows and stakeholder roles under the Home Appliance Recycling Act is described in the following figure.



Source: Association for Electric Home Appliances (AEHA), Annual report on home appliance recycling for FY2012 [in Japanese]

Figure 2.47 Waste flows and stakeholder roles under the Home Appliance Recycling Act

Responsibilities under the Act

The Home Appliance Recycling Act defines the responsibilities of consumers, retailers, and manufacturers as follows:

- Consumers as Disposers [cost-bearing and transfer]:

  Consumers and businesses that wish to dispose of the waste home appliances are responsible for paying for both the collection/transportation fee and the recycling fee as well as for proper returning of them to the retailers from whom they were bought.

- Retailers [collection from disposers and transfer to manufacturers, etc.]:

  Retailers are responsible for collecting the home appliances that they sold or, at the request of customers who buy a replacement appliance from them, taking back the old appliances owned by these customers as well as transferring these end-of-life products to the responsible manufacturers, etc.

- Manufacturers and importers of home appliances (here in after referred to as "Manufacturers") [collection and recycling]: Manufacturers have the obligation to

collect and recycle the home appliances they manufactured or imported.

However, small and medium-sized Manufacturers can contract out this responsibility to other bodies designated under the Act ("designated bodies"). The act defines the size of small and medium-sized Manufacturers as having manufactured or imported less than the number of units shown below in the previous three years (for domestic shipments only):

- Less than 900,000 air conditioners
- Less than 900,000 TV sets (CRT, LCD and plasma types)
- Less than 450,000 electric refrigerators and freezers
- Less than 450,000 electric washing machines and clothes dryers

- Responsibilities of the national government

  The national government is responsible for supporting activities, which is necessary for proper and effective collection, transport and environmentally sound recycling, including promoting research and development, providing information, developing related facilities, providing technical assistance, conducting environmental education, and implementing information dissemination activities.

- Responsibilities of municipalities

  Municipalities are responsible for managing municipal waste. They are therefore responsible for managing waste home appliances or WEEE outside the scope of the collection and management obligations of the producers under the Home Appliance Recycling Act. Municipalities can transfer the targeted household appliance waste under this act they have collected to Manufacturers who have the obligation to collect such waste. Or, if local governments wish, they can also recycle it themselves.

<u>Cost-bearing mechanism</u>

Consumers pay both the collection/transportation fee and the recycling fee when they dispose of their WEEE. The collection/transportation fee is set by the retailers, and the recycling fee by the Manufacturers. The act stipulates that the recycling fee shall not exceed the cost of recycling.

The collection/transportation fee represents the primary logistics fees. In the case of collection by a retailer, this consists of (i) the fee for collection of the waste home appliances from the consumer's home and its transportation to a retailer's shop; and (ii) the fee for

transportation from the retailer's shop to a designated collection site. In the case of collection by a local government, the collection/transportation fee represents the fee for the collection of the waste home appliances from the consumer and its transportation to a designated collection site. Note that the collection/transportation fee does not include the fee for secondary logistics, i.e., transportation from a collection site designated by Manufactures to a recycling plant. Retailers and local governments set their own collection/transportation fees depending on the transportation distance as well as the type and size of the waste home appliances (Table 2.38). Some retailers charge only the second fee described above when customers buy a replacement appliance from them. Many major mass retailers charge 525 yen per unit regardless of the type and size of the waste home appliances.

Different manufacturers charge different recycling fees, which are subject to regular review. However, leading manufacturers have been charging a uniform amount as shown in the Table 2.39.

Table 2.38 Average collection/transportation fees that retailers charge for collecting the four categories of waste home appliances (unit: JPY)

	Collection/transportation fees (Primary logistics)
Air conditioners	2,450
TV sets	2,000
Refrigerators and freezers	2,600
Washing machines	2,050

Note: Except for remote islands.
Source: Compiled from the AEHA, Annual report on home appliance recycling for FY2012 [in Japanese]

Table 2.39 Trends in the recycling fees for major manufacturers (unit: JPY)

FY		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Air conditioners		3,675						3,150	2,625			2,100		1,575
TV sets	16 inch~	2,835							2,835					
	~15 inch								1,785					
Refrigerators	171 L~	4,830							4,830					
	~170 L								3,780					
Washing machines		2,420												

Source: Compiled from the AEHA, Annual report on home appliance recycling for FY2012 [in Japanese]

Penalties

Retailers and Manufacturers who neglect their obligations for collection and recycling as stipulated in this recycling act, provide false information, or impose unlawful charges are subject to corrective recommendations, corrective orders, or penalties. Monetary penalties

range from a fine of up to 100,000 yen to a fine of up to 500,000 yen. Individuals who commit illegal dumping are subject to up to five years in prison or a fine of up to 10 million yen (or 300 million yen for corporations) under the Waste Management and Public Cleansing Act.

Transparency of the selection of the collectors

As far as the primary logistics are concerned, retailers do not have to obtain a license for waste collection and transportation for their collection and transportation of the waste home appliances. They can also contract out this operation, but only to operators with a license for the collection and transportation of municipal or industrial waste. Secondary logistics, i.e., transportation from a designated collection site to a recycling plant, however, requires certification by the competent ministry or a license for the collection and transportation of both municipal and industrial wastes. These license and certification systems ensure the transparency of the selection of the collectors.

EPR perspective implications for developing countries

The law for the recycling of specified kinds of home appliances in in Japan adopts the principles of EPR, which extends the manufacturers responsibility from the production stage to the whole life cycle of the product, including the post use and disposal stages. Specifically, the law for the recycling of specified kinds of home appliances clarifies that the take-back and take-in flow of used home appliances originating from consumers and the responsibilities of the respective actors within that flow. Flows of used home appliances and the roles of associated actors under the law for the recycling of specified kinds of home appliances are illustrated below.

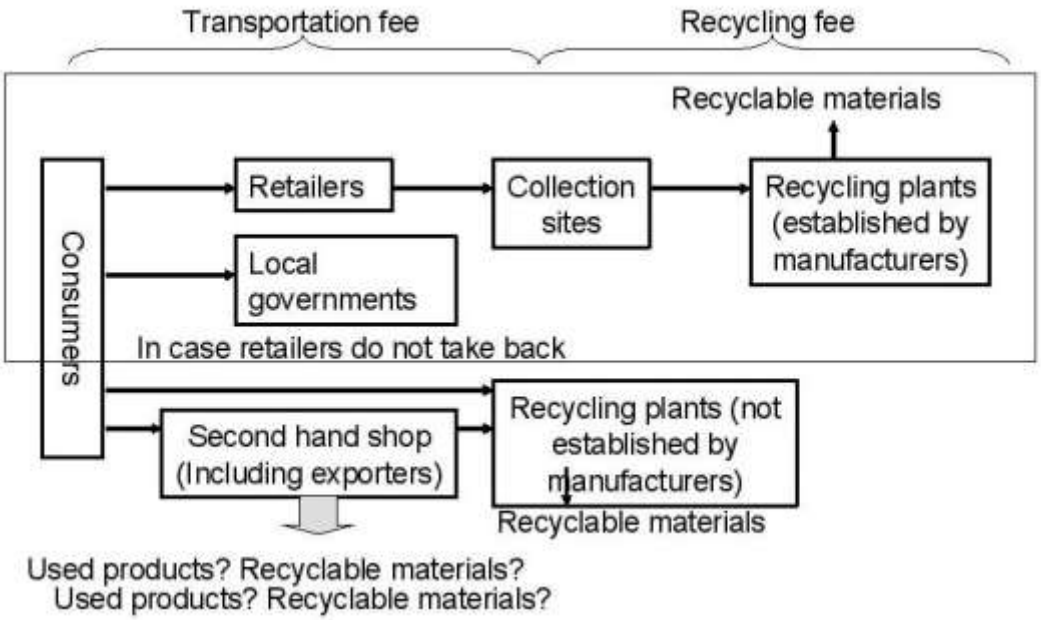


Figure 2.48 Flow of used home appliances and the role of associated actors under Japan's the law for the recycling of specified kinds of home appliances

When discarding used home appliances, consumers are responsible for the cost of transportation as well as E-waste recycling. Recycling fees range from 2,400 yen (washing machines) to 4,600 yen (refrigerators). Transportation costs are paid separately to retailers who convey the used home appliances to the collection sites, which are designated by the manufacturers. Upon the request of consumers, retailers are obliged to take back used home appliances. Retailers then must transport the used home appliances from the consumers to the collection site.

Manufacturers are required to either establish their own recycling facilities or commission commercial recycling companies to fulfill their recycling obligations. They are additionally required to achieve compulsory recycling rates to ensure effective utilization of resources. These rates are: 50% for the television sets, 50% for refrigerators and washing machines and 60% for air conditioners.

Regarding the role of municipal authorities in collection, they are no longer obliged by the law for the recycling of specified kinds of home appliances to collect used home appliances. However, they still collect and treat used home appliances in their area of jurisdiction, which includes appliances that have been illegally dumped. In this case, municipalities, like retailers, do receive fees for transportation and recycling from consumers and deliver the used home appliances to designated collection sites.

From above, it is evident that the law for the recycling of specified kinds of home appliances provides a legal framework for assigning responsibilities to manufacturers, retailers and consumers, with manufacturers having the responsibility of physically collecting and recycling used home appliances disposed by consumers.

2.2.3.2 South Korea

Producer deposit-refund system (1992-2002)

Recycling management in South Korean began with the enactment of the Law for Promotion of Resources Saving and Reutilization in 1992. To address the rapid increase of waste for which there was insufficient landfill available, the act aimed to conserve resources and preserve the environment by promoting recycling. Because the Law for Promotion of Resources Saving and Reutilization was regulated comprehensively, E-waste was managed as one category containing four items out of seven categories with 18 items (including packaging and products) under the Producer deposit-Refund (PDR) system. Television sets and washing machines were included in 1992, followed by air conditioners in 1993 and refrigerators in 1997.

Structure of collection and cost allocation

The PDR system depends upon three main actors: the Ministry of Environment (MOE), the Korea Recycling Corporation (KORECO) and the manufacturers for each products item, the MOE requires manufacturers to pay advance deposits to cover recycling costs these deposits are calculated from the number of products shipped during the previous year. KORECO manages the administration regarding accomplishment and unreturned deposits. Deposits are returned to the extent that E-waste is properly collected and recycled. The defining characteristic of the PDR system is that it emphasizes the manufacturer economic responsibility for promoting E-waste recycling, institutionalizing it in the form of deposits. The deposit rate rose from 30 won/kg in 1992 to 38 won/kg in 1996 for more recycling by manufacturers.

Treatment and policy challenges

Manufacturers reactions to the PDR system is divided chronologically in two periods before and after 1996, the year in which the deposit rate was increased. In the first period (1992-

1996), manufacturers contracted out their E-waste recycling to commercial recycling companies to secure the return of their deposits. The latter period (1997-2002), manufacturers chose to construct several recycling plants on a regional basis for E-waste recycling.

Total deposits and refunds rates are shown in Table 2.40. The increase in deposits since 1997 was caused by the addition of refrigerators and the increase of deposits rate in previous year. Free take-back by Samsung started in 1995 and the build-up of recycling plants including that Asan[3] both had an effect on the steady rise of the refund rate, however, from policy perspective, a refund rate less than 10% is considered to be quite a low level of accomplishment.

Table 2.40 Changes in deposits and refund rates under the PDR system in South Korea

	1993	1994	1995	1996	1997	1998	1999
Deposits (million won)	3,491	5,015	4,977	6,356	14,476	14,097	8,356
Refund rate (%)	0.03	0.6	3.04	5.56	8.3	7.3	8.7

There are two main policy challenges understood to be exist within the PDR system. The first is the lack of economic incentives for manufacturers. The deposits rate is far lower than the actual costs of recycling. As such, it made more economic sense for manufacturers to pay the deposit rather than to recycle E-waste.the actual cost was 169.1 and 160.1 won/kg for television sets and refrigerators, respectively, which is approximately more than four times higher than the deposit rate [KORECO, 1990, as cited in Chung, S.W., and Suzuki, R.M., 2008]. The second point relates to improper recycling of E-waste via the municipality route. There was a strong possibility that E-waste discharged to the municipalities would be improperly treated, thus causing environment impacts [Kim 1998, as cited in Chung, S.W., and Suzuki, R.M., 2008]. When consumers discharge the E-waste to the municipality route under the PDR system, they commonly pay a certain fee (3,000 to 10,000 won) according to the type of item.

Producers recycling system (2003 to present)

[3] Three main manufacturers (Samsung, Hyundai and Daewoo) agreed to build recycling plants on a regional basis to cover the whole country. Due to different understanding of E-waste recycling, construction of E-waste recycling plants was carried out separately under the PDR system

In January 2003, the Producer Recycling (PR) System, which emphasizes the role of manufacturers in E-waste recycling as a substantial one, was launched under an amendment to the recycling act. In addition to the four established items, computers (2003), audio equipment and mobile phones (2005) and OA equipment (printers/copy machines/faxes) (2006) were included, making the total items by 2006.

Structure of collection and costs allocation

The PR system was instituted for the purpose of extending the formerly limited responsibility of manufacturers and even suggesting specifically how to induce manufacturers to participate more directly in E-waste recycling.

The PR system works in the following way: Firstly, while considering the recent recycling performances and recycling quantities undergone by manufacturers, the MOE annually announces the item-specific (i.e., refrigerators, washing machines, etc.) rates. Thus, in the case where a new appliance is purchased, manufacturers are obliged to collect the used home appliance per consumer's request. Each item has a certain recycling target within the range of 55 to 70% based on weight. Each manufacturer can fulfill their legal obligation in one of three ways. One way is to construct their own recycling pant and do their own recycling. Another is to outsource the job to commercial recycling companies. The third is to join the Producer Responsibility Organization (PRO), pay the required fees, and have them do the recycling. Manufacturers can choose whichever option suits them best. Both individual responsibility[4] and collective responsibility[5] are possible under the PR system. In the event that the manufacturers do not fulfill the mandatory recycling rates. Furthermore, they must take on an additional financial burden by paying a recycling charge. The Korea Environment and Resource Corporation (ENVICO) is responsible for the overall duties associated with the running system, such as keeping records on product shipments for each manufacturer, investigating the state of recycling performance and levying a recycling charge.

Regarding the actual responsibilities and roles of consumers and municipalities, no significant change is seen from those under the PDR system. It is still highly probable that

[4] A manufacturer ("producer" in original context) takes individual responsibility if he takes responsibility for the end of life management of this own product (Tojo 2004).

[5] Manufacturers ("producer" in original context) take collective responsibility if those in the same product group jointly fulfill their responsibilities for the end of life management their products regardless of the brand (Tojo 2004)

consumers will discharge E-waste to commercial recycling companies or exporters on the basis of economic aspects of E-waste.

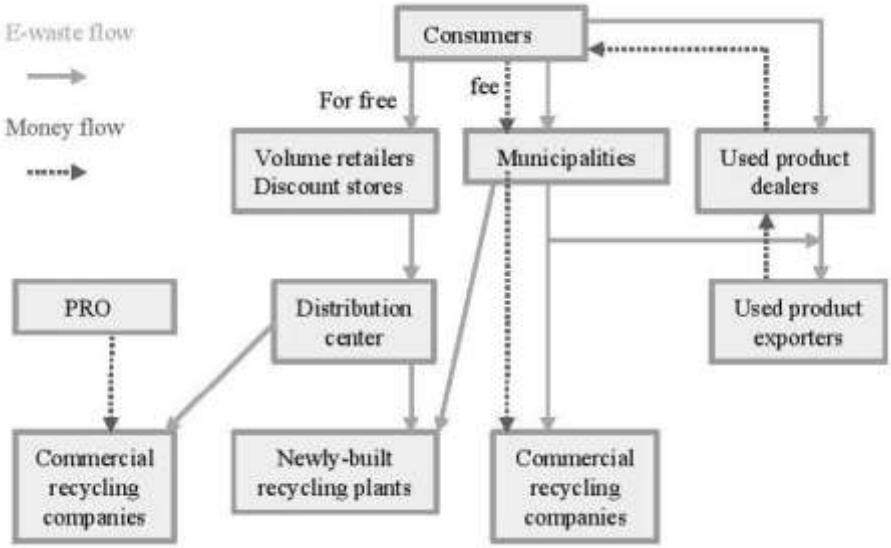


Figure 2.49 General E-waste flows in South Korea

Treatment and policy challenges

The PR system was launched in 2003, but a two-year pilot program which laid the foundation for the PR system was carried out prior to that, following a voluntary agreement entered into in June 2000 by three major manufacturer (Samsung, LG and Daewoo) and MOE. During this period, manufacturers were required to construct nationwide recycling infrastructure rather than depositing.

In reality, the actual recycling was carried out by the Association of Electronic Environment (AEE) by proxy. Specifically, with a few year's gap between each, the manufacturers constructed three recycling plants, starting with Samsung's Asan Recycling Plants (1998) and followed by LG's Chilseo Recycling Plants (2001) and finally the Metropolitan Recycling Plants (2003), by which they successfully increased their recycling capacity. These plants constructed by the manufacturers mainly recycle refrigerators and washing machines.

The commercial recycling companies that contract with AEE are paid by volume recycled. In 2006 there were 28 such companies (six for television sets and monitors, 10 for computers, seven for CRTs and five for mobile phones).

However, only about 40% (98 out of 232) of the municipalities actively cooperate with manufacturers. Cooperation between manufacturers and municipalities does not occur smoothly due to the poor financial situation of the municipalities. Instead, recycling costs are imposed on manufacturers and municipalities are required to pay the costs of transportation to the manufacturers recycling facilities.

2.2.3.3 Taiwan

Background to the legislation

In Taiwan, mixed metal scrappers, known as fei-wuchin, have traditionally treated E-waste. However, their methods of extracting metals, such as burning nonmetal parts or refining metal with chemicals, had high environmental impacts, including air pollution caused by burning in fields, polluting water and soil with heavy metals and illegal dumping of unwanted parts [EPA, 1985, as cited in Chung, S.W., and Suzuki, R.M., 2008]. As a countermeasure, the Environment Protection Administration (EPA) in 1984 organized mixed metal scrappers together in two districts in an attempt to effectively monitor their recycling practices. This measure, however, only to be unsuccessful. In 1986, polluted water containing heavy metals that had originated in the monitored districts ended up in neighboring sea areas, affecting nearby oyster farms.

In this content, the EPA sought to reduce environmental pollution by introducing a government-led recycling scheme. In 1998, for the purposes of reducing waste, promoting resource collection and ensuring efficient use or resources, the Recycling Fund Management Committee (RFMC) system was introduced. Similar to that of South Korea, it was comprehensively regulated to include 10 categories, including home appliances and IT equipment, which contain eight and 11 items, respectively.

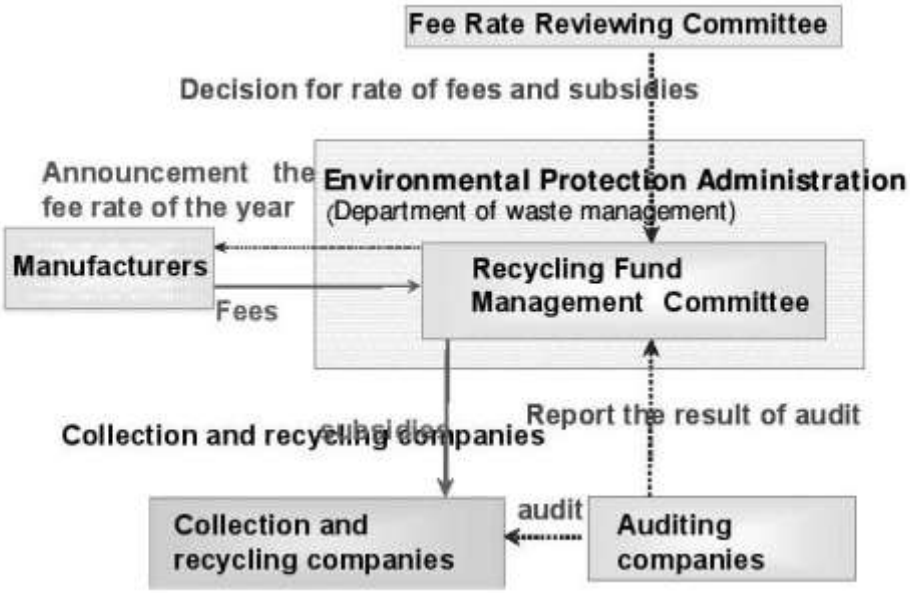


Figure 2.50 Flow of funds and subsidies in Taiwan

Taiwan's E-waste recycling scheme can be summarized as having three main features. First, the RFMC system emphasizes the economic responsibility of manufacturers. The second feature is the economic incentive (subsidies) used to induce commercial recycling companies to participate in the scheme. The third is that the proper treatment of E-waste is thoroughly guaranteed, which creates a huge monitoring costs.

2.3. Illegal Traffic of E-waste and Take Back Experiences

2.3.1. ASEAN Countries

2.3.1.1. Malaysia

There was an experience of transboundary movement of E-waste from Singapore to Malaysia by road. In only 24 hours the trucks that contained the E-wastes have been taken back by Singapore. This can be achieved since the two countries have good cooperation, where the focal point of the Basel Convention in Singapore was informed on the regulation and policy of import of E-waste into Malaysia. Singapore also informed their policy of export and import of E-waste and other waste to the focal point of the Basel Convention in Malaysia. Therefore the custom in the border could inform the focal point of Malaysia (DOE) and will check the container on E-waste. In 24 hours it will be taken back by Singapore. But since in Singapore E-waste is not hazardous waste so it is allowed to export.

On 2013, Malaysia experienced returning shipment to Japan. Malaysia notified the government of Japan but did not succeed since the Japanese government could not identify the exporter.

Malaysia also had a complete and successful take-back case of illegal traffic of E-waste exported from a Party to the Basel Convention listed in Annex VII of the Basel Convention. The year of notification was in 2012 and the year of take-back was in 2013. The type of waste is electronic and electrical equipment (SW 110/A1180) with the gross weight of 11,000 kg of 1291 pcs of LCD monitor. Take back procedure was successfully implemented and the waste was disposed in the state of origin in accordance with paragraph 2(a) of Article 9 of the Basel Convention. The type of illegality is that there were no notification and consent pursuant to the provisions of the Basel Convention [DOE, 2016]

2.3.1.2. Myanmar

In 2015, Myanmar experienced cases of illegal exports of four containers of illegal hard disks and diskettes by Beng Beng Trading Co. Ltd from China. The waste was taken back with the exporting country's expenses. In the same year, there was also a case of illegal export of two containers of used computer parts of accessories and used game machine with accessory parts

from Japan by Chang Min Import & Export Co. Ltd. The waste was also taken back to Japan with the exporting country's expenses.

2.3.1.3 Indonesia

In Indonesia, according to Law No. 32 Year 2009 regarding Environmental Protection and Management, Article 69 point (1.c) and (1.d), importing waste and hazardous waste are forbidden. In accordance with Law No. 18 Year 2008 concerning Solid Waste Management, solid waste is not allowed to be imported into Indonesia.

Import of waste is allowed if there are other regulations which allow it. The Ministry of Industry Decree No. 31 Year 2016 allows import of waste such as metal scrap (e.g. aluminum, scrap, steel scrap), paper scrap, plastic waste, glass waste, cotton scrap, rubber scrap. Such waste should be imported by a producer importer and should obtain a recommendation from the Director General of Domestic Waste, Hazardous Wastes and Substances, Ministry of Environment and Forestry of Indonesia.

Under Ministry of Trade Decree No.127 year 2015 concerning the importation of second hand product, in Article 5, it is stated that second hand computer and monitor can be imported after fulfilling certain requirements.

With this loop hole there are several cases of illegal traffic of hazardous wastes in year 2008-2010. In 2009, PT. IAL imported 9 containers of CRT monitors and 1 container in 2010 that were hazardous waste listed under the hazardous waste management regulation in Indonesia and the Basel Convention. One container was successfully re-exported to USA. Scrap metals contaminated by hazardous waste are successfully re-exported to UK and Netherland. Several developing countries did not respond to the letter of notification for re-export sent by the exporting country.

Re-export of illegal import of hazardous waste can take a long time due to the certain procedures. Custom will inform Ministry of Environment and Forestry (MOEF) and together with MOEF officials will conduct an inspection to the port to check the container. Other related institutions will be informed, e.g. Ministry of Trade, Ministry of Industry, Basel Convention Secretariat on the result of the inspection. If hazardous waste is found, the investigator from MOEF will conduct the inspection. MOEF will then inform the focal point

of the Basel Convention in the country of export. Court process will state that the waste should be re-exported to the exporting country or to other countries than can receive the waste.

2.3.1.4 Thailand

196.11 tons of hazardous waste was sent back to Japan. The waste was seized following an inspection of container at Laem Chabang Portby the Custom Department and the Department of Industrial Works on 28 August 2015. The hazardous waste was illegally imported into Thailand from Japan through the Laem Chabang Container Port in Chorbun Province. They opened 8 containers shipped from Japan and declared in custom documents. The seven other containers were found to contain electronic and electrical wastes. Electrical and electronic waste is classified as hazardous waste (Type 3) under the Hazardous Substances Act B.E. 2535 (1992). The production, import, export or having possession of the waste must obtain a permit according to the Basel Convention. Import of this kind of waste must receive prior permission from the Thai Government before they can be imported to Thailand. Japan's Ministry of the Environment will take legal action against those involved in exporting the waste to Thailand. More than 190 tons of hazardous electronic and electrical waste (E-waste) will be sent back to Japan on 29 July 2016. It is expected to arrive there on 7 August 2016. In this case the importer had falsely declared the goods imported to Thailand. Legal action according to the Hazardous Substances Act B.E. 2535 (1992 and the Custom's Act B.E. 2496 (1926) will be taken by Thai authorities against the importer.

Japan also presented a case study during Asian Network Workshop on 6-8 September 2016 in Semarang, Indonesia on take-back from Thailand as mentioned below:

- Metal scraps exported to Thailand contained E-waste
- The container was taken back to Japan on 24 August 2016
- MOE and METI investigated the container and confirmed the metal scrap contained E-waste
- The Government of Japan now analyzed the hazardous component in the E-waste.

2.3.2. Other Countries

Export from Hong Kong to Turkey

Ivan Lo from Environment Protection Department of Hong Kong SAR Government presented their experience for re-export of E-waste during the Asian Network Workshop on 6-8 September 2016 in Semarang, Indonesia. In 2015, Turkey exported 2,000 kg mobile phone batteries and power pack by sea to Hong Kong. The goods description in the bill of lading is power supply, but it was found as waste batteries and power packs. The date of loading was 12 July 2015 and detention notice by Hong Kong Custom was on 7 August 2015. The date of import into Hong Kong was 10 August 2015 and the date of arrival at country of origin was 17 September 2015.

The enforcement action taken was that Hong Kong EPD conducted prosecution against the importer. The Court hearing date was set on 8 March 2016 and the results was that the importer pleaded guilty and was fined HK$ 29,000 (about US$ 3,700). Ministry of Environment and Urbanization, Turkey disposed the returned E-waste under control and penalty was imposed on the exporter.

Re-export from Hong Kong to Europe

In 2005, a country in Europe exported flat panel displays and batteries to Hong Kong by sea. The quantity of E-waste is about 400 pieces of flat panel displays and 1,000 pieces of notebook computers with flat panel displays as well as 60 pieces of notebook computer batteries.

The goods description on cargo Manifest is IT equipment, but it was found as flat panel displays and batteries. The date of loading was on 16 July 2015 and the date of import into Hong Kong was on 4 September 2015. The Detention notice by Hong Kong Custom and EPD was on 18 September 2015. The shipment was returned on 25 September 2015 and arrived at country of origin on 30 October 2015. Enforcement actions were taken by Hong Kong EPD. The importer was prosecuted and court hearing was conducted on 29 March 2016. The result was that the importer pleaded guilty and was fined HK$ 25,000 (about US$ 3,200). For the environment agency of the export country, the shipment was not classified as waste export and no action was taken against the exporter.

Chapter 3

Overall Analysis of the Data Collection

3.1 Overall Analysis of the Data Collection in ASEAN Countries

3.1.1 Baseline data and information on E-waste generation and flows

3.1.1.1 Data on E-waste generation (2009-2014)

Table 3.1 Data on E-waste generation (2009-2014) in ASEAN countries

Issue \ Countries		Brunei	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Data on E-waste generation	Available		V	V		V		V	-	V	V
	Not available	V			V	V	V		-		

1. **Cambodia:** Based on National Inventory of UEEE in Cambodia 2007, estimation of E-waste discarded (TV, AC, Refrigerator, Computer and Mobile Phone) in 2009: 223,883 sets and in 2010: 125,180 sets.
2. **Indonesia**: Quantity of E-waste: 212,782 MT during 2010-2014 (only from one treatment company).
3. **Malaysia:**
   - No specific data available for domestic E-waste generation
   - Quantity of E-waste generated by industries in Malaysia:
     - 2009: 134,035.70 metric tons
     - 2010: 163,339.80 metric tons
     - 2011: 152,722.04 metric tons
     - 2012: 78,278.05 metric tons
     - 2013: 52,978.13 metric tons
     - 2014: 57,103.40 metric tons
   - Data on quantity of E-waste generated by household is still under internal review.

4. **Philippines:** Data is available for year 2014, M506 (WEEE) 69.86 MT.
5. **Thailand:** Data is available for year 2014 (T/year): for TV (103,605); computer (55,276); mobile phone (1,657).
6. **Vietnam**: Quantity of E-waste: 18,000 MT/year (calculated from report by treatment companies).

6 (six) countries have data on E-waste generation but most of the data do not present the total amount of E-waste generated.

3.1.1.2 Data on domestic consumption of EEE (2009-2014)

Table 3.2 Data on total domestic consumption (2009-2014) in ASEAN countries

Issue \ Countries		Brunei	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Total domestic consumption of EEE	Available			-				-	V	V	
	Not available	V	V	-	V	V	V	-			V

1. **Singapore:** Based on market survey, approximately 60,000 tons (with no breakdown on the types of EEE) of common household electrical and electronic products are sold per year by retailers in Singapore.
2. **Thailand:** Data is available for year 2009 and 2010 in thousands of pieces:
   - for year 2009: TV (3,814), personal computer (2,810), telephone (15,170), camera/video camera (2,360), portable audio player (3,800), printer/facsimile (1,910), AC (1,737), refrigerator (1,392)
   - for year 2010: TV (4,978), personal computer (3,180), telephone (20,100), camera/video camera (2,713), portable audio player (4,000), printer/facsimile (2,010), AC (1,829), refrigerator (1,630).

Only Thailand has detailed data on domestic consumption of EEE (National Integrated WEEE Management Strategy, 2014-2021). The inventory was conducted in 2012.

3.1.1.3 Data on UEEE and E-waste import (2009-2014)

Table 3.3 Data on UEEE and E-waste import (2009-2014) in ASEAN countries

Issue \ Countries		Brunei	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Data on used EEE and E-waste import	Available	V		V		V		V	V	V	V
	Not available		V		V		V				

1. **Brunei Darussalam:** No importation of E-waste during 2009-2014.
2. **Indonesia**: E-waste import is prohibited. For UEEE (computer and monitor) that meets the criteria of the Ministry of Trade is permitted. The quantity of UEEE import data is available in the Ministry of Trade.
3. **Malaysia:** No data found on import E-waste into Malaysia (year 2012-2014).
   UEEE were imported to Malaysia from USA and Singapore. Used computer/laptop was imported to Malaysia from Australia and New Zealand.
4. **Philippines**: import of UEEE and E-waste came from Thailand, USA, Korea, Hong Kong, Japan, UK, New Zealand, Costa Rica, Singapore, Laos, Canada, Australia, Germany, Israel, Italy, Belgium as follows:
   - 2009: 1,100 (MT) and 421,478 (pcs/boxes/units/sets/pkgs)
   - 2010: 18,765 (pcs/boxes/units/sets/pkgs)
   - 2011: 3960 (MT) and 1,534 (pcs/boxes/units/sets/pkgs)
   - 2012: 514.34 (MT) and 70,071 units
   - 2013: 5,600.81 (MT) and 547,174 (pcs/boxes/units/sets/pkgs)
   - 2014: 500 (MT) and 89,430 (pcs/boxes/units/sets/pkgs)
5. **Singapore:** Import of E-waste originated from Japan, Thailand, New Zealand, Philippines, South Africa, Malaysia, Australia, Vietnam, China, India, Hong Kong, Korea, Indonesia, Sri Lanka, Brazil, Trinidad and Tobago, Qatar, with total amount (MT)

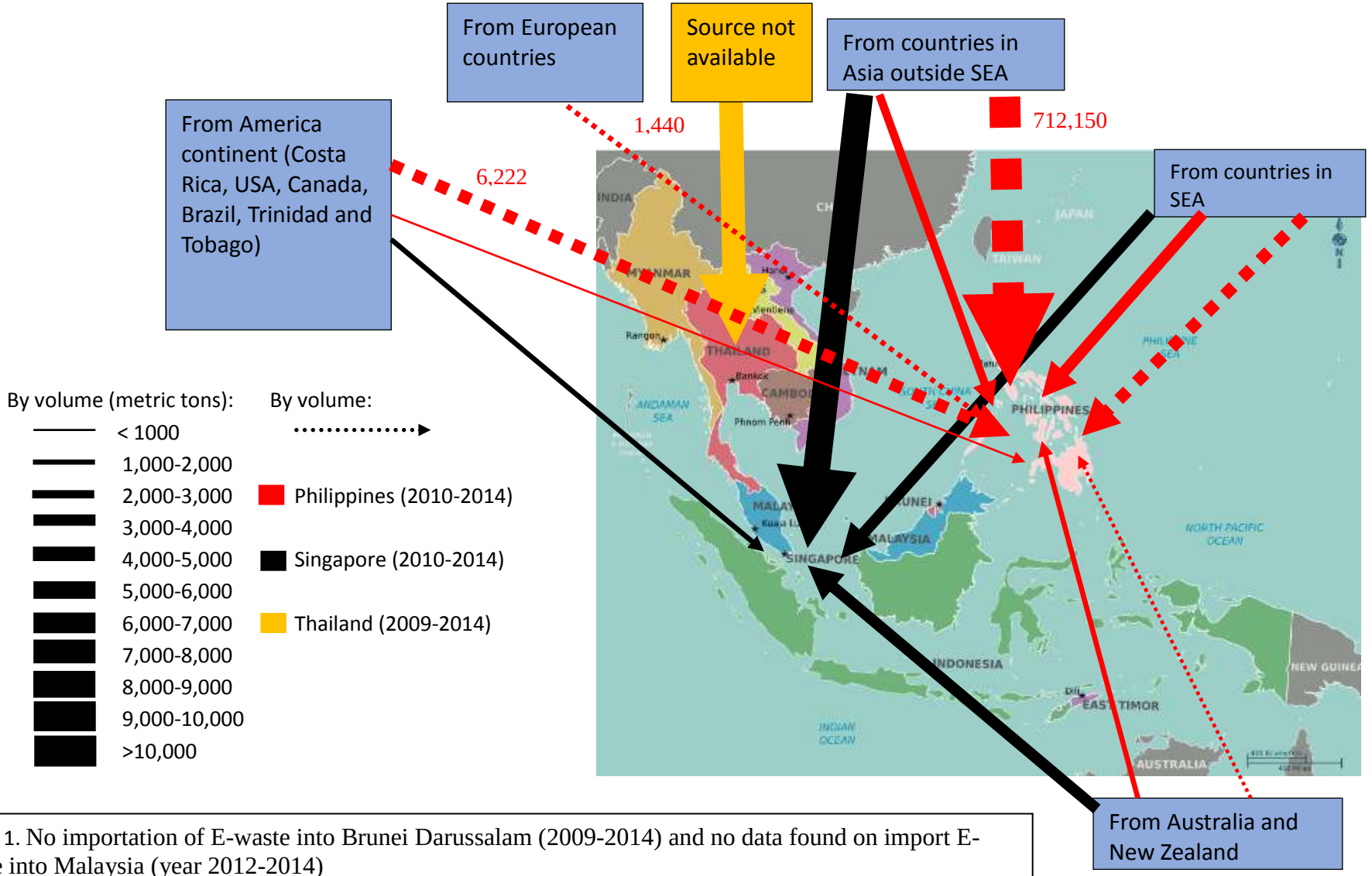
for year 2010 (1,935.271), 2011 (2,193.41), 2012 (4,369.79), 2013 (4,268.51), 2014 (1,699.036).

6. **Thailand:** the amount of E-waste imported in 2000-2014 was 7,964.739 MT.
7. **Vietnam:** not allowed to import UEEE and E-waste .

7 (seven) countries have data on import of UEEE and E-waste.

Origin countries of E-waste to the ASEAN countries were as follows:

- Countries within ASEAN: Thailand, Malaysia, Vietnam, Indonesia, Singapore, Lao PDR
- Within Asian countries outside ASEAN: mainly originated from Japan and Korea and also Hong Kong, China, India, Sri Lanka, Qatar, Israel
- Australia and New Zealand
- European countries: Italy, Belgium and Germany
- America continent: Costa Rica, USA, Canada, Brazil, Trinidad and Tobago



Note: 1. No importation of E-waste into Brunei Darussalam (2009-2014) and no data found on import E-waste into Malaysia (year 2012-2014)
2. For Philippines: no distinction was made for import of UEEE and E-waste

Figure 3.1 Import of UEEE and E-waste in ASEAN countries

3.1.1.4 Data on UEEE and E-waste export (2009-2016)

Table 3.4 Data on UEEE and E-waste export (2009-2016) in ASEAN countries

Issue \ Countries		Brunei	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Data on used EEE and E-waste export	Available	V		V		V		V	V	V	V
	Not available		V		V		V				

1. **Brunei Darussalam:** During 2009-2014, there was no export of E-waste. In 2015, about 6.45 MT of electronic board scrap was exported to Japan.
2. **Indonesia:** in 2015 export amounts to 1,687.4 MT, in 2016 export amounts to 706.7 MT
3. **Malaysia:** Quantity of E-waste exported from Malaysia (year 2012-2014):
   - 5,454.9 MT to Asian countries (Japan, Thailand, Korea, Hong Kong and Singapore)
   - 240.8 MT to Europe (Sweden, Italy, Finland, Netherland, Belgium, Germany and Denmark)
   - 1,761 MT to America (US and Canada).
4. **Philippines:** Philippines exports UEEE and E-waste to Japan, Korea, Thailand, Singapore and Belgium. Total quantity for year 2009: (3,944.5 MT), 2010: (2,650 MT), 2011: (2,720 MT), 2012: (6,810 MT), 2013: (2,080 MT), 2014: (9,150 MT).
5. **Singapore:** Singapore exports E-waste to Japan, Thailand and Canada. Total quantity for year 2010-2014: to Japan 6,640.692 MT, to Thailand 7,028.66 MT and to Canada 1.928 MT.
6. **Thailand:** the amount E-waste exported to Thailand between 2000-2014: 5,195.63 MT.
7. **Vietnam:** export quantity of E-waste between 2009-2014 to Singapore, (batteries) 1,929 MT; to Korea (accumulator) 9,700 MT; to Canada (batteries 15 MT; to Malaysia (HDD) 400 MT; to Japan (PCB) 600 MT.

7 (seven) countries have data on export of UEEE and E-waste.

Destination countries of export of E-waste from the 7 ASEAN countries are as follows:

- Countries within ASEAN: Thailand, Malaysia and Singapore

- Within Asian countries (outside ASEAN): mainly to Japan and Korea and also to Hong Kong
- European countries: Sweden, Italy, Finland, Netherlands, Belgium, Germany and Denmark
- US and Canada.

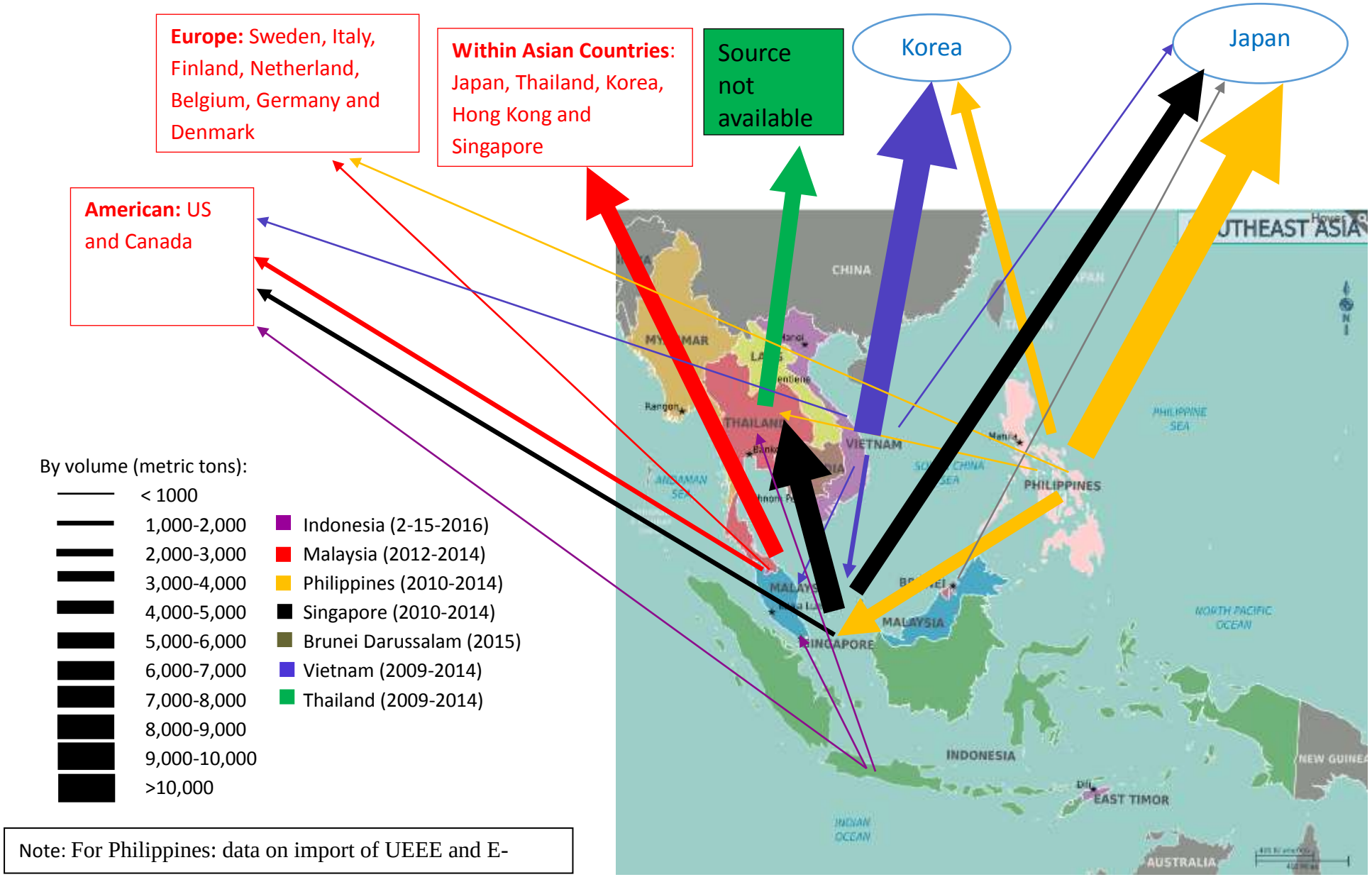


Figure 3.2 Export of UEEE and E-waste in ASEAN countries

3.1.1.5 Data on number of unit EEE/thousands person

Table 3.5 Data on number of unit EEE/thousands person in ASEAN countries

Issue \ Countries		Brunei	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Number of unit/thousands persons	Available	-		-	V			-	-	V	
	Not available	-	V	-		V	V	-	-		V

Only Lao PDR and Thailand has data on number of unit EEE/ (thousands person/household), as follows.

Table 3.6 Number of unit EEE/thousands person in Lao PDR

No	EEE	Unit/thousand persons
1	Television (CRT)	136
2	Television (LCD)	59
3	Video/DVD player	92
4.	Hi-fi system	75
5.	Computer	71
6.	Mobile phone	264*
7.	Electric cooking stove	147
8.	Rice cooker	170
9.	Microwave oven	11
10.	Washing machine	75
11.	Vacuum cleaner	2
12.	Air conditioner	17
13.	Refrigerator	187
14.	Electric fan	174
15.	Electric kettle	130
16.	Electric water heater	17
17.	Water pump	38
18.	Electric iron	164

Table 3.7 Number of unit EEE/household in Thailand

No	EEE	Unit/household
1	Television (CRT)	1.45
2	Television (LCD/Plasma)	0.39
2	Computer	0.78
3	Mobile phone	2.25

3.1.1.6 Data on lifetime of EEE

Table 3.8 Data on lifetime of EEE in ASEAN countries

Issue \ Countries		Brunei	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Lifetime of EEE	Available	-		-				-	-	V	
	Not available	-	V	-	V	V	V	-	-		V

Only Thailand has data on lifetime of EEE, as follows.

Table 3.9 Lifetime of EEE in Thailand

No	EEE	Life time
1	Television (CRT)	6.9/year
2	Television (LCD/Plasma)	3.8/year
3	Computer	3.65/year
4	Mobile phone	3.09/year

3.1.1.7 Data on future projection of E-waste

Table 3.10 Future projection of E-waste in ASEAN countries

Issue \ Countries		Brunei	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Data on future projection of E-waste	Available		V	-		V		-	-	V	V
	Not available	V		-	V	V	V	-	-		

1. **Cambodia:** 22,443 metric tons in 2019.
2. **Malaysia:** Information from an E-waste recycling facility in Malaysia that estimation shows that it generates 53 million pieces of E-waste in 2020.

3. **Thailand:** estimation of E-waste generation (2012-2016) for television, camera/video camera, portable audio player, printer/facsimile, telephone/mobile phone, personal computer, air conditioner and refrigerator for year 2012:19,680,000 unit, 2013: 20,889,000 unit, 2014: 22,080,000 unit, 2015: 23,237,000 unit, 2016: 24,318,000 unit.
4. **Vietnam:** Vietnam has data on E-waste generation until 2020 based on data E-waste inventory in 2007.

Only 4 (four) countries have data on future projection of E-waste from inventory activities.

3.1.1.8 Develop future projection of E-waste

Lack of data is the major challenge in developing future projection of E-waste. Data that is required to develop future projection of E-waste are as follows:

1. Quantity of domestic EEE production and consumption
2. Quantity of export and import of EEE
3. Lifetime of EEE
4. Number of unit EEE/thousand persons
5. Quantity of domestic E-waste generation
6. Domestic E-waste generation rate (kg/inhabitant)

Detailed data above are not available in most ASEAN countries.

3.1.2 Assessment of current E-waste management system

3.1.2.1 E-waste regulation

Table 3.11 Information on E-waste regulation in ASEAN countries

Issue \ Countries		Brunei	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam	Note
E-waste Regulation	Specified		V	V*		V*		V*		V*		*in draft form
	Not specified	V		V	V	V	V	V	V	V	V	

1. **Brunei Darussalam**: Covered under Hazardous Waste (Control of Export, Import and Transit) Order 2013.
2. **Cambodia**: Sub-Decree on E-waste Management had been enacted on 1 February 2016.
3. **Indonesia:**
    - For E-waste from industry Govt. Reg.101/2014 on Hazardous Waste Management
    - For household and municipal waste Act No 18/2008 on Solid Waste Management categorized as specific municipal solid waste
    - under preparation (Ministry of Environment and Forestry Regulation on Municipal Electronic Waste Management).
4. **Lao PDR :** Covered under Regulation:
    - Law on Environment Protection No. 29/NA, 18 December 2012. Article 38, 39 and 40
    - Ministerial Instruction on Hazardous Waste Management No. 0744/MONRE, 11 February 2015.
    - Ministerial Agreement on Waste Management from Processing Industry and Handicraft No. 0555/IC, dated 20 March 2012.
5. **Malaysia :** Covered by hazardous waste regulation:
    - Environmental Quality (Scheduled Wastes) Regulations 2005.
    - Guidelines for the Classification of Used Electrical and Electronic Equipment in Malaysia, 2nd Revision, 2010 is to assist in identifying and classifying Used EEE and E-waste as prescribed under the First Schedule Environmental Quality (Scheduled Wastes) Regulations 2005
    - Malaysia is drafting regulation and promotion of household E-waste.
6. **Myanmar:** Myanmar does not have regulation for E-wastes. The E-waste has not been categorized as hazardous waste.
7. **Philippines :**
    - Regulation that control E-waste is under DENR Administrative Order (DAO) 2013-22 or the Revised Procedures and Standards for the Management of Hazardous Wastes.

- The EMB-DENR is currently finalizing the proposed "Technical Guidelines on the Environmentally Sound Management (ESM) of Waste Electrical and Electronic Equipment (WEEE)."

8. **Singapore**: For transboundary movement of E-waste classified as hazardous waste under the Basel Convention, Singapore has enacted the Hazardous Waste (Control of Export, Import and Transit) Act (HWA) and its Regulations to implement the obligations under the Convention.
9. **Thailand :**
    - Thailand has a draft of E-waste regulation that is draft WEEE Act B.E.
    - Not specifically, E-waste regulation is covered by hazardous waste management regulation: Notification of the Ministry of Industry on a list of Hazardous Substance B.E. 2556 (2013).
10. **Vietnam:**

    E-waste regulation is covered by hazardous waste management regulation:
    - Law on Environmental Protection No. 55/2014/QH13
    - Decree No 38/2015/ND-CP regarding the management of waste and scraps
    - Circular No 36/2015/TT-BTNMT regarding hazardous waste management.

    E-waste regulation is covered by other regulation: Decision No.16/2015/QD-TTg regarding on Retrieval and Disposal of Discarded Products. Products to take-back are not only E-waste, but mostly focus on E-waste, both from industry and household. At present Vietnam is drafting the Circular under the Decision No.16/2015/QD.

1 (one) country has enacted a Sub-decree on E-waste Management, 3 (three) other countries are drafting specific regulation on E-waste.

3.1.2.2 Institutional arrangement

Table 3.12 Information on institutional arrangement in ASEAN countries

No	Countries / Issue	Brunei	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
1	EEE production and import-export	Custom	Custom, MOC	MOI, MOT, Custom	-	-	-	-	-	-	Custom, MOIC
2	UEEE and E-waste import-export	Custom DOEPR	MOE, Custom MOC	MOT, MOEF, Custom	MOE	DOE Custom	Custom MoC, MOECF	Custom EMB-DENR	NEA, Custom	MOI, MOPH, MOInterior, MONRE	VEA-MONRE, Custom
3	Collector of E-waste	DOEPR	MOE	MOEF, Local Govt.	MOE	DOE	CDC, MOECF	EMB-DENR	NEA	MOI, MOPH, MOInterior MONRE	VEA-MONRE /DONRE
4	Transporter of E-waste	DOEPR	MOE	MOEF, MOTrans	MOE	DOE	CDC, MOECF	EMB-DENR	NEA	MOI, MOPH, MOInterior, MONRE	VEA-MONRE /DONRE
5	Recycling facilities of E-waste	DOEPR	MOE	MOEF	MOE	DOE	CDC, MOECF	EMB-DENR	NEA	MOI, MOPH, MOInterior, MONRE	VEA-MONRE/ DONRE
6	Treatment/recovery of E-waste	DOEPR	MOE	MOEF	MOE	DOE	CDC, MOECF	EMB-DENR	NEA	MOI, MOPH, MOInterior, MONRE	VEA-MONRE/ DONRE
7	Residue from treatment/ recovery of E-waste	DOEPR	MOE, Local Municipality	MOEF	MOE	DOE	-	EMB-DENR	NEA	MOI, MOPH, MOInterior, MONRE	VEA-MONRE/ DONRE

3.1.2.3 Formal and informal sector participation in E-waste management

Table 3.13 Formal and informal sector participation in E-waste management in ASEAN countries

Issue \ Countries		Brunei	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Formal and informal sector participation	Formal	V		V		V	V	V	V	V	V
	Informal		V	V	V	V	V	V	V	V	V

Table 3.13 shows that the informal sector participated in E-waste management in most of the countries within ASEAN.

Table 3.14 Formal sector participation in E-waste management in ASEAN countries

No	Issue \ Countries	Brunei	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
1	Collection	V		V		V	V	V	V	V	V
2	Transportation	V		V		V		V	V	V	V
3	Refurbishment/Repair					V		V	V	V	
4	Segregation	V		V		V	V	V	V	V	
5	Separation/Dismantling	V		V		V		V	V	V	V
6	Recycling			V		V	V	V	V		V
7	Recovery					V		V	V		V
8	Disposal			V		V	V	V	V	V	V

Table 3.15 Informal sector participation in E-waste management in ASEAN countries

No	Countries / Issue	Brunei	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
1	Collection		V	V	V	V		V		V	V
2	Transportation		V	V	V	V	V	V		V	V
3	Refurbishment/Repair		V	V	V	V	V		V	V	
4	Segregation		V	V		V		V		V	
5	Separation/Dismantling		V	V	V	V	V	V	V	V	
6	Recycling		V	V	V	V		V			V
7	Recovery		-	V		V		V		V	V
8	Disposal		V	V	V			V			V

Table 3.15 shows that the informal sector participated in most of the E-waste management activities.

From the results of the field trip and response to the questionnaire, there are a few full recycling and disposal facilities with environmental sound management. Even in Indonesia, licensing of E-waste is only issued to 1 (one) recycling facility while others are for collection and dismantling. There are many activities on E-waste on illegal refurbishment.

Full recovery facility with BAT and BEP is very expensive. It was mentioned by recyclers in Singapore, Malaysia, Thailand and Vietnam that if the illegal facilities are not controlled by government it will be difficult for them to compete with the illegal facilities. As in Indonesia, the junkman pay for the household E-waste with a much higher price. They are aware that facilities without BEP and BAT will result in lower cost of production.

3.1.2.4. E-waste definition

Table 3.16 Information on E-waste definition in ASEAN countries

Issue \ Countries		Brunei	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
E-waste definition	Available	V	V			V		V	V		
	Not available			V	V		V			V	V

1. **Brunei Darussalam:** The definition of E-waste is any discarded electrical and electronic devices.
2. **Cambodia**: E-waste is defined as all electronic and electrical equipment not used anymore but still in the whole figure or broken (not function) or separating/recycling of EEE (source: Sub-Decree on E-waste).
3. **Indonesia:** E-waste is defined as electronic goods that are not functioning and/or not used anymore originating from household, office, commercial activity, etc (in draft form) .
4. **Malaysia:** E-waste is categorized as scheduled wastes under the code SW 110, First Schedule Environmental Quality (Scheduled Wastes) Regulations 2005. The SW 110 wastes are defined as waste from electrical and electronic assemblies containing components such as accumulators, mercury-switches, glass from cathode-ray tubes and other activated glass or polychlorinated biphenyl-capacitors, or contaminated with cadmium, mercury, lead, nickel, chromium, copper, lithium, silver, manganese or polychlorinated biphenyl.
5. **Philippines:** Waste electrical and electronic equipment (WEEE):
   Include all waste electrical and electronic equipment that contain hazardous components such as lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls (PBBs) and polybrominated diphenyl ethers (PBDEs) that includes its peripherals i.e., ink cartridges, toners, etc.
6. **Singapore**: adheres to the definition stipulated under the Basel Convention "A1180."
7. **Thailand:** Not yet (under draft WEEE Act).

   5 (five) ASEAN countries have definition of E-waste.

3.1.2.5 UEEE definition

Table 3.17 Information on UEEE definition in ASEAN countries

Issue \ Countries		Brunei	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Used EEE definition	Available		V	V				-	-	V	
	Not available	V			V	V	V	-	-		V

1. **Cambodia:** Used electronic and electric equipment (UEEE) means a second hand electronic and electric equipment (as refer to above captioned items), requiring to classify as reusable equipment or may be continued to use. (Source: Draft of Technical Guideline Management of Waste Electrical and Electronic Equipment (WEEE) in Cambodia).
2. **Indonesia:** UEEE (only for computer and monitor) is defined as electronic goods that fulfill requirements as follows: Still in function (proven by certificate), the lifetime is not more than 5 years, new technology: with type of monitor LCD and LED. Must be in one complete set and imported with proper packaging.
3. **Thailand:** Used EEEs means electric and electronic equipment which have been used and still workable and kept in its original form or can be repaired, modified, reconditioned in order to be used as in its original purposes.

Cambodia, Indonesia and Thailand have definition of UEEE.

3.1.2.6 Criteria to differentiate UEEE and E-waste

Table 3.18 Information on criteria to differentiate UEEE and E-waste in ASEAN countries

Issue \ Countries		Brunei	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Criteria to differentiate Used EEE and E-waste	Available			V	V	V			V		
	No criteria	V	V				V	V		V	V

1. **Indonesia:** UEEE (only for computer and monitor) is defined as electronic goods that fulfill requirements as follows: still in good condition including components packaged in one complete set, still functioning, lifetime not more than 5 years since production, the latest specification and type i.e. CPU minimum Core 2 Duo or equivalent including accessories and using LCD or LED type monitor.
2. **Lao PDR**: UEEE is the second hand of electrical and electronic equipment that can be use, but the E-waste is electrical and electronic equipment that cannot use anymore.
3. **Malaysia:** DOE Malaysia has published a guidance document to differentiate whether Used EEE is categorized as E-waste or non-waste, refer to Guidelines for the Classification of Used Electrical and Electronic Equipment in Malaysia, 2010
4. **Philippines:** Presently, there is no distinction between used EEE and E-waste. Used EEE is classified as E-waste.
5. **Singapore :** Singapore has put in place domestic guidelines to distinguish UEEE from E-waste and they include the key provisions (e.g. supporting documentations and surveyor reports, etc.) contained in the technical guidelines adopted on an interim basis at the Basel Convention for the classification between UEEE and E-waste.
6. **Thailand:** Thailand has no criteria to differentiate UEEE and E-waste, only recognition measure for inspector to investigate UEEE and E-waste.

At present, 4 (four) countries have criteria to differentiate UEEE and E-waste. Malaysia has detailed criteria and reflected in a specific published DOE guideline which is The Guidelines for the Classification of Used Electrical and Electronic Equipment in Malaysia, 2010.

3.1.2.7 E-waste classification

Table 3.19 Information on E-waste classification in ASEAN countries

Issue \ Countries		Brunei	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
E-waste classification	Have classification					V		-	-		
	No Classification	V	V	V	V		V	-	-	V	V

Malaysia: Environmental Quality (Scheduled Wastes) Regulations 2005. The Guidelines for the Classification of Used Electrical and Electronic Equipment in Malaysia, 2010 is to assist in identifying and classifying UEEE and E-waste as prescribed under the First Schedule Environmental Quality (Scheduled Wastes) Regulations 2005.

3.1.2.8 Export import policy on UEEE

Table 3.20 Information on export import policy on UEEE in ASEAN countries

Issue \ Countries		Brunei	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Policy on UEEE export and import	Export allowed	V	V	V		V	V	V	V	V	V
	Export banned				V						
	Import allowed	V	V	V		V	V	V	V	V	
	Import banned				V						V

1. **Brunei Darussalam:** Import activity of UEEE is not banned, only if the UEEE falls under Annex IX of the Basel Convention (i.e. B1110).

2. **Cambodia:** Exportation of UEEE to abroad have to permit letter from MOE and apply document to procedure of imported country. Some kind of UEEE has to be prohibited import into Kingdom of Cambodia and this needs to be identified by inter-ministries circular for MOE and MOEF.
3. **Lao PDR**: Policy on import and export of UEEE is banned in Lao. Import and export of E-waste is banned in Lao based on the Prime Minister's Office Notice No. 829/PMO, dated 13 June 2016.
4. **Malaysia:** Any exportation/importation of UEEE is restricted and exporter/importer required obtaining the written approval from Director General prior to the exportation/importation.
5. **Philippines:** Import activity of UEEE is not banned, however it is regulated and subject to compliance with the requirements of DAO 2013-22
6. **Myanmar:** Myanmar does not have regulation for E-wastes. The E-waste has not been categorized as hazardous waste.
7. **Indonesia:** UEEE (only for computer and monitor) that fulfill requirements as follows: Still being function (proven by certificate), the lifetime is not more than 5 years, new technology: with type of monitor LCD and LED, must be in one complete set, must be imported in proper packaging.
8. **Singapore**:
    - for re-use: surveyor report indicating all UEEE are in good working condition and importer ensure UEEE are meant for re-use
    - for repair and refurbishment: contractual agreement between manufacturers and repair facilities, warranty and repair facility.
9. **Thailand:** Import of UEEE allowed for direct reuse, repair and refurbishment.
10. **Vietnam**: based on the (regulation) Decree No. 187/2013 / ND-CP regarding the detail implementation of Trade Law on International Buying and Selling of Commodities and Agent Activities including Purchasing, Selling, Sourcing, Outsourcing, Border-gate Transfer, and Transiting of Commodities with Foreign Countries.

Most of the countries within ASEAN allow the importation and exportation of UEEE.

3.1.2.9 Export import policy on E-waste

Table 3.21 Information on export import policy on UEEE in ASEAN countries

Issue \ Countries		Brunei	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Policy on E-waste export and import	Export allowed	V	V	V		V	V	V	V	V	V
	Export prohibited				V						
	Import allowed					V	V		V	V	
	Import prohibited	V	V	V	V			V			V

1. **Cambodia:** all importation of E-waste from abroad into Kingdom of Cambodia is prohibited and exportation of E-waste to abroad have permit letter from MOE.
2. **Lao PDR:** Policy on import and export of UEEE is banned in Lao. Import and export of E-waste is banned in Lao based on the Prime Minister's Office Notice No. 829/PMO, dated 13 June 2016.
3. **Malaysia:** The exportation/importation of hazardous waste/ scheduled wastes (i.e. E - waste) are restricted and subject to the written approval of Director General of Environment prior to any movement/shipment.
4. **Philippines:** Import activity of E-waste intended for disposal is strictly prohibited.Import of E-waste intended for recycling is allowed subject to the requirements of DAO 2013-22 and the Basel Convention.
5. **Singapore:** Singapore follows closely to the obligations of Convention for the transboundary movement of hazardous waste. The Prior Informed Consent (PIC) procedure is applied for E-waste imports and exports in circumstances where exporting/importing countries classify E-waste as hazardous waste under the Convention framework. Singapore applies the same import/export policy principles in reference to the preliminary technical guidelines adopted on an interim basis by the Basel Convention for its domestic guidelines.

6. **Thailand:** ban on the import of E-waste for final disposal and restriction on the import of E-waste for 3R.
7. **Vietnam**: based on the (regulation) Law on Environmental Protection No. 55/2014/QH13.

Most of the countries in SEA allow exportation of E-waste and prohibit importation of E-waste.

3.1.2.10 Company involvement in E-waste management

Table 3.22 Information on company involved in E-waste management in ASEAN countries

Issue \ Countries		Brunei	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Data on company involved in E-waste management	Available	V		V		V		V	V	V	V
	Not available		V		V		V				

1. **Brunei Darussalam**: there is only 1 company (collection, segregation and dismantling)
2. **Indonesia:** there are 6 companies for collection and 2 companies for recycling.
3. **Malaysia:** As of July 2016, there are total 129 E-waste facilities in Malaysia which covered 97 partial recovery E-waste facilities (physical or manual segregation of E-wastes for further processing) and 32 full recovery E-waste facilities which can process the E-wastes to recover the precious metals. List of the company involved in E-waste management refer to the link: http://eswis.doe.gov.my/facilityList.aspx
4. **Philippines:** provided details data on EMB-registered Transporters and TSD facilities for WEEE/E-waste who registration is valid as of October 2015.
5. **Singapore:** http://www.nea.gov.sg/energy-waste/3rs/E-waste-lamp-battery-recycling/E-waste-recycling
6. **Thailand**: there are 66 facilities (dismantling and recycling facilities).

7. **Vietnam:** Details on the website http://quanlychatthai.vn/

7 (seven) countries have information on companies involved in E-waste management and some of them are published in the website. This will inform stakeholders where to send their waste to these facilities within their own boundaries or abroad depending on the types of waste

3.1.2.11 Guidelines on E-waste management

Table 3.23 Information on guidelines on E-waste management in ASEAN countries

Issue \ Countries		Brunei	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Guidelines on E-waste management	National guidelines		V	-	-	V	-	V	V	-	
	Basel Convention guidelines	V		-	-		-	V		-	
	Not available			V	-		-			-	V

1. **Cambodia:** MOE Cambodia has developed the Guidelines on the ESM of WEEE in Cambodia.
2. **Malaysia:** Guidelines for the Classification of Used Electrical and Electronic Equipment in Malaysia, 2nd Revision, 2010 is to assist in identifying and classifying Used EEE and E-waste as prescribed under the First Schedule Environmental Quality (Scheduled Wastes) Regulations 2005.
3. **Philippines:** EMB-DENR is currently finalizing the proposed "Technical Guidelines on the Environmentally Sound Management (ESM) of Waste Electrical and Electronic Equipment (WEEE).

4. **Singapore:** Singapore has already put in place a set of national guidelines to help differentiate between UEEE and E-waste.

3 (three) countries have guideline for E-waste management. Specific technical guidelines on E-waste will assist in providing guidance in the management of E-waste on technical as well as policy to all stakeholders (generators, transporter, importer, exporter, treatment facilities, relevant authorities involved in the management of E-wastes).

3.1.2.12 Incentive mechanism

Table 3.24 Information on incentive mechanism in ASEAN countries

Issue \ Countries		Brunei	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Incentive mechanism	Applied							V	-	-	V
	Not applied	V	V	V	V	V	V		-	-	-

Philippines: Establishment of treatment, storage and disposal (TSD) facility for hazardous waste is included in the Philippines investment priorities plan (IPP).

Vietnam: A Decision No.16/2015/QD-TTg dated 22 May 2015 of the Prime Minister on regulation on recall and treatment of discarded products provides provision for voluntary recall and treat discarded E-waste and will be given supportive and preferential policies.

3.1.2.13 Extended Producer Responsibility (EPR)

Table 3.25 Information on Extended Producer Responsibility (EPR) in ASEAN countries

Issue \ Countries		Brunei	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
EPR	Applied					V		V	V		V
	Not applied	V	V	V	V		V			V	

1. **Malaysia:** EPR applied in several areas and on voluntary basis.
2. **Philippines:** July 2015-July 2016: Program 1 Phone, Globe Telecom, Inc.

   The project aims to collect E-waste from different waste generators such as schools, companies, private entities, and government agencies, store these with their partner TSD facility prior to export for recycling, recovery and treatment. The project requests companies for donations of E-wastes earmarked for disposal. Once a donation is confirmed, Globe, in tandem with their partner transporter-TSD facility, assures the proper pick-up, transport, storage, and subsequent export of the E-wastes. Funds raised by the project will be donated to support the building of classrooms for selected schools which were affected by typhoon.
3. **Singapore:** Currently, Singapore works closely with the industries to take responsibility for the recycling of their own electrical and electronic products on a voluntary basis. It works closely with its industry partners and communities to increase public awareness and encourage recycling of E-waste through voluntary programs led by industry partners (http://www.nea.gov.sg/energy-waste/3rs/E-waste-lamp-battery-recycling/E-waste-recycling).
4. **Thailand:** Thailand EPR concept under draft WEEE.
5. **Vietnam**: EPR in Vietnam is in compliance with Decision No.16/2015/QD-TTg and Circular No. 36/3025/TT-BTNMT.

In Vietnam, the list of discarded product and schedule of recall and treatment shall be defined in the Appendix of the Decision No.16/2015/QD-TTg and including EEE.

Type of EEE which is included in the appendix of the decision mentioned above are as follows:

10. Compact light; fluorescent light

11. Desktop or laptop; computer monitor; CPU (micro processor)
12. Printer; fax machine; scanner
13. Photo camera; movie camera
14. Cell phone; tablet computer
15. DVD, VCD, CD recorder and other tape or disc player
16. Photocopier
17. Television; refrigerator
18. Air conditioner; laundry machine

1 July 2016 was the schedule of recall and treatment for all type of EEE above.
Responsibility and right concerning recall and treatment of discarded products is also explained in the Decision No.16/2015/QD-TTg, as follows:

- responsibility of manufacturers
- right of manufacturer
- responsibility of consumers, distribution facilities, waste transportation and treatment organizations, and collecting organizations or individuals
- right of consumers, collecting organizations or individuals and distribution facilities
- responsibility of the Ministry of Natural Resources and Environment
- responsibility of provincial people's committees.

3 (three) countries applied EPR on a voluntary basis and 1 (one) has a mandatory EPR regulation in 2016 but not yet applied.

In Singapore and Malaysia voluntary EPR are practiced by some manufacturer brands. EPR concept is under preparation in Thailand under a draft WEEE.

In Indonesia, even though the Law for Household Management mentions that every product containing non-biodegradable material should follow the EPR system or they should changes with biodegradable material. Nevertheless, manufactures are still reluctant to do the EPR.
Under the Indonesian draft E-waste regulation, the concept of EPR and recycling fee are not mentioned. This is because the manufacturers and the Indonesia Consumers Organization do not

agree with the concept. The manufacturer claimed that the dropping point facilities are not well established all over Indonesia. For recycling fee both manufacturers and the Indonesian Consumers Organization do not agree because it will increase the price of EEE.

3.1.2.14 Data on illegal traffic

Table 3.26 Information on illegal traffic in ASEAN countries

Issue \ Countries		Brunei	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Data on illegal traffic	Available	V	V	V		V	V		-	V	
	Not available			-	V			V	-		V

1. **Brunei Darussalam:** no illegal cases were reported for both import and export of hazardous waste.
2. **Cambodia**: In 2013, 42 tons of scrap E-waste (3 containers) through Trapeng Thlong International check point in Kampong Cham province.
3. **Indonesia**: In 2009 and 2010 there were cases of illegal import of used CRT monitor from USA.
4. **Malaysia:** Data of illegal traffic relevant to Paragraphs 2, 3 and 4 of Article 9 since Year 2008 - August 2015: 53 cases (Data from National Reporting submitted by Malaysia to the Secretariat of the Basel Convention).

   Illegal shipment of E-waste (2009-2014) was from USA, Australia, China, Hong Kong, India, Indonesia, Japan, Korea, Latvia, Lithuania, New Zealand, Pakistan, France, Philippines, Singapore, Sweden and Taiwan.
5. **Myanmar:** In 2015, there are 2 take-back cases of E-waste from China and Japan. The waste was send back to the exporting countries.
6. **Thailand**: 196.11 tons of illegal hazardous garbage was seized at Laem Chabang Port by the Custom Department and Department of Industrial Works on 28 August 2015 from Japan mostly containing hazardous E-waste. The waste will be sent back to Japan on 29 July 2016.

6 (six) countries reported data on illegal traffic.

No storage regulation and no system of collection for E-waste, weak control and public awareness program and no incentive will make illegal trade, illegal dumping and transboundary movement of E-waste from one country to other country more conducive. In controlling transboundary movement of E-waste, specific HS code for UEEE and E-waste and also the criteria for distinguishing E-waste and UEEE should be developed and agreed upon by ASEAN countries.

The import and export of UEEE and E-waste will require close cooperation between custom officers and competent authorities and the focal points of the Basel Convention in each country. In Malaysia and Singapore, manifest control of each UEEE imported is applied through an online system by Custom and MOE.

In Singapore the Custom will check randomly for each E-waste and UEEE imported, but the E-waste and UEEE transiting to Singapore will not be checked by Custom.

3.1.2.15 Basel Convention Technical Guidelines on TBM of E-waste and UEEE and national regulation

Table 3.27 Information on BC Technical Guidelines on TBM of E-waste and UEEE and national regulation in ASEAN countries

Issue \ Countries		Brunei	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Basel convention TG on TBM of E-waste and used EEE covered in national regulation (component/part)	Covered			-	V	V	-		V	-	
	Not covered	V	V	-			-	V		-	V

1. **Lao PDR:** Part of the Technical Guidelines on transboundary movements of electrical and electronic waste and used electrical and electronic equipment is covered in hazardous waste management instruction.
2. **Malaysia:** Some of the components in the Technical Guidelines on transboundary movements of electrical and electronic waste and used electrical and electronic equipment had been covered in "Guidelines for The Classification of Used Electrical and Electronic Equipment in Malaysia, 2010."
3. **Philippines:** The EMB-DENR is currently finalizing the proposed "Technical Guidelines on the Environmentally Sound Management (ESM) of Waste Electrical and Electronic Equipment (WEEE)". It aims to provide the framework mechanism for the management of WEEE and institutionalize the principle of extended producer responsibility.
4. **Singapore:** Singapore has already put in place a set of national guidelines to help differentiate between UEEE and E-waste. The current set of guidelines is largely in line with that in the Basel Convention and has included some of the key requirements from the interim guidelines adopted at the Basel Convention on E-waste and UEEE. NEA also takes guidance from the newly adopted technical guidelines on E-waste and UEEE to revise the current guidelines and it will conduct industry consultations with the relevant stakeholders to study the feasibility of incorporating the guidance in the technical guidelines.

Some of the components in the BC Technical Guidelines on transboundary movements of electrical and electronic waste and used electrical and electronic equipment had been covered in national regulation/ technical guidelines in 3 (three) countries.

3.1.2.16 Ban Amendment

Table 3.28 Information on ban amendment in ASEAN countries

Countries / Issue		Brunei	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Ban Amendment	Ratified	V		V		V					

3 (three) countries in SEA have ratified the Ban Amendment.

3.2. Identification of Gaps and Barriers

Based on the baseline data information on E-waste generation and flow as well as the current E-waste management system practiced within ASEAN countries and outside ASEAN countries, gaps and barriers were identified.

3.2.1. Data on E-waste generation in ASEAN countries

Data on E-waste generation in ASEAN countries were found to be limited. Only Cambodia reported their 2007 national inventory on E-waste and also for years 2009 and 2010 (TV, AC, refrigerator, computer, mobile phone). From Indonesia, data on the quantity of E-waste obtained were found only from one treatment facility. The Philippines and Thailand have data available for year 2014 whereas Vietnam obtained the report from treatment companies.

On domestic consumption Thailand provided information on EEE for years 2009 and 2010 on various types of products while Singapore provided yearly consumption of around to 60,000 tons of common household EEE products sold per year by retailers.

Not all countries managed to provide data on the quantity of import and export of UEEE and E-waste. Import data on E-waste are not available in Brunei Darussalam, Indonesia, Malaysia and Vietnam due to their national policy to ban import, however UEEE are allowed following certain criteria. Indonesia permits the import of UEEE limited to computers and monitors. The Philippines and Singapore recorded E-waste import originating from the American continent (i.e. Costa Rica, USA, Canada, Brazil, Trinidad and Tobago); from Africa (South Africa); from European countries and from other Asian countries apart from ASEAN.

Export of E-waste were recorded by seven of the ASEAN countries: Brunei Darussalam (on electronic board scrap to Japan) Indonesia, Malaysia, Philippines, Singapore, Thailand and Vietnam whereas the Philippines reported export both their E-waste and UEEE mostly to countries within Asia.

Countries receiving import of E-waste and UEEE from ASEAN countries are the USA and Canada, Sweden, Italy, Finland, the Netherlands, Belgium, Germany and Denmark, Japan, Korea, Hong Kong. Within ASEAN, export destinations of E-waste and UEEE are Malaysia, Singapore and Thailand.

On the number of units of EEE/person/household only Lao PDR and Thailand had available data.

Thailand reported future projection of E-waste generated but only until 2012-2016 for most types of EEE including television, camera, etc. Vietnam has data on E-waste generation until 2020. Malaysia's inventory on E-waste data generated from household is still under review with support by JICA, but there was information from an E-waste recycling facility in Malaysia that estimation shows that it generates 53 million pieces of E-waste in 2020.

Within the ASEAN countries not all information on E-waste generation are made available and also its prediction except those carried out by Cambodia, Malaysia, Thailand and Vietnam reaching as far as 2020. In carrying out the prediction of E-waste generated in each countries, various information will be required to conduct an inventory such as data on production, export and import, domestic sales/domestic consumption of EEE, number of EEE/person consumed and lifetime of EEE. As previously mentioned Singapore and Thailand had data on EEE consumption.

These data on EEE production, import-export, domestic consumption (EEE/person) and lifetime of EEE are not available in most countries within ASEAN. These data are essential for conducting a proper inventory on EEE and E-waste in predicting future E-waste generation in each individual ASEAN country. To carry out the sound management of E-waste and UEEE, data on E-waste generation and export and import of UEEE is also very important.

3.2.2 Regulation and policy of E-waste

A comprehensive policy and regulation is important in preventing the illegal E-waste activities in conducting 3R within the region. Most ASEAN countries do not have specific regulations on E-waste management except for Cambodia which has a specified sub-decree on E-waste management. Indonesia, Malaysia, the Philippines and Thailand are preparing their specific E-waste management regulation which will contain provisions on E-waste collection, storage, transportation, recycling and treatment as well as on landfill throughout its E-waste life cycle conducted in an environmentally sound manner.

Myanmar, Singapore do not categorize E-waste as hazardous waste as compared to the other ASEAN countries which categorizes it as hazardous. Singapore in exporting its E-waste follows the provisions of the Basel Convention for certain types of E-waste categorized as hazardous.

Five ASEAN countries have definition of E-waste. Lao PDR, Myanmar, Vietnam do not have definition on E-waste and Indonesia and Thailand have E-waste definition under their draft WEEE Act/regulation.

On UEEE, six countries within ASEAN have definitions on UEEE or have developed criteria to distinguish between E-waste and UEEE. For example in Indonesia, UEEE can be imported with criteria and in compliance with the UEEE definition and criteria as follows; “UEEE (only for computer and monitor) is defined as electronic goods that fulfills the requirements as follows: still functioning (proven by certificate), using LCD and LED type monitors, must be in one complete set and must be in proper packaging with a lifetime of not more than five years.

Malaysia also has similar criteria with Indonesia in distinguishing between UEEE and E-waste, however in Malaysia the lifetime could not be more than 3 years. With these criteria in place Indonesia, Malaysia and Singapore can import UEEE as products. Indonesia imports UEEE and carried out refurbishment activities in one facility in Semarang and exports the repaired UEEE as product. Lao PDR and Vietnam does not import UEEE.

In general, there is no clear classification made towards E-waste such as those available in other developed countries. In Japan the main type of E-waste originates from home appliances, namely television, air conditioners, washing machines and refrigerators as well as computer monitors and cell phones. The EU classified E-waste into large and small household appliances, equipments on information and telecommunication, consumers, lighting, tools, toys, leisure, sports, medical, monitoring instruments and dispensers. With these set categories, in their management they could start setting targets for E-waste to be collected, recycled/recovery or treated to reduce the harmful effect to human health and the environment.

3.2.3 BAT and BEP/Good Practices and Technology

Activities involving 3R and treatment facilities in ASEAN countries are practiced by the informal as well as formal sector except for Brunei Darussalam which does not have an informal facility. Usually informal facilities in conducting 3R activities and treatment do not apply BAT or BEP and will have detrimental impact on human health and environment. One company in Singapore has plans to set up a fourth facility complying with Singaporean environmental standard which will cost around 17.5 million SGD (Singapore dollars) with a return on investment (ROI) at 20% per year. In Vietnam, the cost of such facility will amount to 8 million USD (US dollars). With the recycling-recovery facilities having permits established in Malaysia, Indonesia, Singapore and Thailand, best practices and environmental standard will be required and using good technology. One permitting full recovery facility in Malaysia has a machine collection of CFC contained in certain E-wastes. The CFC will be collected and sent to the Quality Alam treatment facility equipped with an incinerator that could perform to comply with the standard for dioxin-furan at 99.9999%. In Malaysia full recovery facilities have several processing namely CRT processing line, bulb and lamp crushing system, aluminium can processing line, computer and equipment disassembly line, tank bottle processing line, computer data destruction system, HEPA dust collection and dust waste which will then be sent to a permitting final disposal.

The company produces silver, gold, platinum, palladium and rhodium. The facility also operates a laser cutting tool for CRT dismantling. The process line of recovery of E-waste is as follows:

collection → transport → safe storage → dismantling → and segregation → crushing process → recovery process → final treatment and disposal for non-recovered waste.

Singapore has a similar activity for full recovery facility but they are also equipped with a dust collector using a cyclone dust collector treated by counter flow wet scrubber system and waste water treatment facility. The standard air emission and effluent standards complies with air industrial waste standard of Singapore.

In Singapore one of the facilities have capabilities as follows; primary activities, demanufacturing, destruction, recovery (mechanical/chemical); repair, refurbishment and remarketing for non-IP sensitive IT equipments and continuous investment on research & development. The overall process flow of the Singapore facility is very good on BAT and BEP as mentioning as follows; From procurement and collection → sort and segregate (weight & record categories of waste stream) → (plastic → final segregation → EPC pallet) and metal (final →segregation → ferrous/non ferrous → weight/record →store/sale) and electronic will demanufacturing, hidden mechanical process with crush and pulverize and destruction (Apparent chemical process, strip and electrolysis and precious refinery). The good practice for pollution control is that the facility is equipped with a dust collector, waste water treatment plant, fume scrubber system and should comply with industrial effluent and emission standards. If compared to the technology implemented by other developed Asian countries will not be too different and also complies with available environmental standards.

The province of West Java, Indonesia conducted E-waste urban mining activities in a study in 2015 and reported that illegal collectors have collected E-waste in Cirebon the amount of 1.2 ton/month/collector, Bandung City 0.4 ton/collector/year, Bandung District 1.25 ton/collector/year. Activities of these collectors will comprise of dismantling, segregation, crushing manually and the use of mercury to extract and produce the gold.

Even though E-waste is hazardous as stipulated in the list of hazardous waste and specific waste for E-waste from household should acquire permit for storage, collection, transporting, recycling, recovery and treatment/landfill, the illegal practice are plentiful in West Java and the

other provinces. In West Java the potential precious metal production extracted from E-waste are copper 58,297.2 kg/year; gold 485,92 kg/year and silver 2,429.16 kg/year as well as other minerals 35,949.94 kg/year. The income projection for informal facilities are calculated at IDR 307,903,764,- in 2016 as compared to those obtained from legal facility at IDR 221,975,196,-

With the amount of benefit gained through urban mining from E-waste recycling/recovery activities, provides an alternative source for workers economically but at the same time these informal activities are not environmental friendly.

In a formal activity on E-waste recycling/recovery the environmental requirement are as follows:

- Facility is located in the industrial zone/estate
- Should have an EIA study and acquire environmental permit
- Having hazardous waste permit
- Comply with requirements of a hazardous waste permit (storage, waste water treatment, air pollution control, transportation with manifest, treatment and landfill for hazardous waste, emergency response etc.)
- Monitoring & reporting.

The criteria of landfill construction and site requirements in Indonesia are similar with those found in developed countries such as Australia. For informal facilities, to formalize their activity will require an environmental permit for hazardous waste management which are deemed costly and would also acquire training skills. Hence, that is why the informal sectors do not wish to change their activities and apply legally.

Good practices are used by Xerox recycling facility in Thailand which is the regional facility in Southeast Asia countries for Xerox refurbishment and recycling. Asia-Pacific countries sent their Xerox E-waste to this facility. This facility can be used as a model to set-up E-waste regional facility for different types of E-waste.

The recycling facility for E-waste in Vietnam is dedicated only for crushing, furnace (check weight, separation, crushing and furnace) and to process chemical dissolution purification. The valuable metals are sent to Japan for refinery.

3.2.4 EPR

In reducing illegal activities it is very important to develop an environmentally sound system for collection of E-waste from household, industry and office. In improving the E-waste collection system, several countries have implemented the extended producer responsibility (EPR). Within ASEAN countries only Vietnam is implementing mandatory EPR. Singapore and Malaysia are implementing it voluntarily. In Indonesia even though the Solid Waste Management Law 2008 stipulates that packaging using non degradable material should be collected by producers for recycling and treatment/landfill or the producers should treat it by themselves. But the producers have not yet complied with the law, and the industrial association proposed to the government a roadmap for various types of wastes for 10 years ahead since 2008.

Vietnam's regulation on EPR consists of 5 types of wastes in which E-waste is one of the wastes type. In the Decision No. 16/2015/QD-TTg dated May 22, 2015 of the Prime Minister to recall and treatment of discarded products, it is described that the E-waste type are for compact light, fluorescent light, desktop or laptop, computer monitor, CPU (micro-processor), printer, fax machine, scanner, photo camera, movie camera, cell phone, tablet computer, DVD/VCD, CD recorder and other tape or disc player, photocopy, television, refrigerator, air conditioner and laundry machine. If we look into more detail on the Vietnam regulation as compared to the Indonesia regulation, the Vietnam regulation is more detailed and mentions responsibility of the stakeholders of E-waste such as consumers, distributors, facilities, transporters and treatment facilities, collector organizations or individuals. It also mentions the responsibility of the Ministry of Natural Resources and Environment as well as the Provincial People Committee.

If one observes the Japanese regulation on implementing the EPR, targets are set for each type of E-waste that should be collected in the regulation. It mentions also the price for consumer to pay, retailer and the producers that should be paid. It also regulates for the type and brand that should collected in what facility of collection and recovery. It should also specify where the producers should pay for the recycling processing.

Malaysia in implementing the EPR on a voluntary basis is working closely with the full recovery facility owners. In Malaka the CEO of the recovery company said that they facilitated the storage

facilities for consumer to drop their E-waste. In cooperation with the government they have promoted the "Alam Alliance" program for public awareness. They managed several public awareness program in school, offices, NGO, etc. At present, the Malaysian Government is supported by JICA on the study of E-waste in developing guidelines on collection fee of storage, transportation and recycling using the polluters pays principle (producer, importer, consumers, retailers), EPR system, reporting and the technology. The result of this program will be finalized in January 2019.

In Singapore certain brand of E-waste voluntary carry out the EPR. A person that buys a new TV in a department store, the consumer will be charged 50 SGD for collect-back fee. When the retailers take back the equipment it will sell it to the formal and informal sector. The informal sector will then sell the E-waste to reused market or to formal facilities. Thailand also conduct a pilot project on take back of E-waste by producers on a voluntary basis in 2014.

Learning from the developed countries in implementing the EPR it is clear that what is needed is a specific regulation on waste and EPR for E-waste. The content of the EPR for E-waste are an obligation of the consumer to drop their E-waste in collection bin appointed by the government, pay for the collection and transportation fee. The obligation of the take back by retailers especially for large E-waste is to pay transportation fee to the recycler facility. The producer's obligation is to recycling the E-waste by themselves or in cooperation with a recycler facility, pay for the 3R of E-waste. It also mentions the responsibility of the Ministry of Environment. The Ministry of Industry in Japan set-up the 3R fee and regulates and enforcement. Municipalities in Japan collect and transport the E-waste to collection centres or directly to the 3R facilities, especially in rural areas.

In Korea the producers are paid through municipalities and the municipalities carry out the collection, storage and transportation to 3R facilities.

The implementation of 3Rs in Japan and the European Union are not done directly to all types of E-waste but through a stepwise mode for the type of E-waste that is more valuable when 3R is applied. The targets are set for E-waste that can be collected and recycled, reused and recovered. So, in implementing the EPR of E-waste, public awareness is also very important as what has

been carried out in Malaysia and Singapore through supporting the producer that are willing to conduct the EPR voluntary and have it announced to the public. It is also very important to foster cooperation between government, producer, recycler and consumer and developing an effective program such as "Alam Alliance" even before having the regulation on E-waste and EPR in place.

3.2.5 Illegal traffic

Based from the experiences, illegal traffic of E-waste occurred because of different waste classification in different countries. The Hong Kong classified E-waste as any substance or article once given up by its original users, irrespective whether it is still functioning or can be sold for a value. In other countries the items were not waste because they might still be functional. Malaysia stated good cooperation between the focal point of Basel Convention Parties and the exchange of information on each respective country's policy is very important which is valuable to be informed to the exporter and importer. It will also require good cooperation between Custom and DOE and should apply e-info in carrying out inspection and decision making of action for re-export. This has been successfully carried out in Singapore with "TradeNet."

Indonesia's experience in re-exporting was that it took longer (at least more than 1 year) for returning the illegal import of E-waste. This is because to re-export the E-waste should require court approval, since E-waste that was imported will be used as evidence in court due to the violation of the law. Sometimes the verdict of court hearings will be not guilty since the importer is using the export country regulation which state that E-waste is not hazardous waste. It is very important to disseminate the regulation of each country and inform the Basel Convention that explain more detail the issues related to transboundary movement of illegal waste.

Chapter 4

Recommendation for E-waste Management within ASEAN Countries and Implementation of the Basel Convention

Based on the information from the previous chapters, 8 (eight) recommendations are proposed to improve the E-waste management system within ASEAN countries.

4.1. Recommendation 1: Conduct a national inventory on E-waste from all sources (household, industry, business entities, etc.) using a harmonized guideline for ASEAN countries

As identified, it is shown that data on UEEE and E-waste is limited. Hence it is recommended that each ASEAN country should conduct a national inventory on E-waste. The inventory of E-waste will be very important as a base data to improve the E-waste management system at the national level. Based on the inventory, the current situation on amount of EEE, UEEE and E-waste and their management can be identified. The database can be used to develop strategies for E-waste management and develop an E-waste management mechanism (model for collection system, transportation, mapping system of treatment facilities and disposal) including strengthening existing regulations and policy.

For conducting an inventory, it is proposed to use harmonized guidelines for ASEAN countries. This will result in better development of E-waste management and the development of a regional strategy for E-waste management in ASEAN. Some references are made available in conducting a national inventory of E-waste, among others:

1. BCRC-SEA Technical Guidelines on E-waste Inventory
   The guideline explains the methodology for inventory development and E-waste generation estimation methods. The guideline also focus on the methods that are used to optimize available secondary data on an E-waste inventory
2. Southeast Asia Countries Inventory Project
   This project focuses on survey methods and provides technical details

Countries within the ASEAN member states that conducted the E-waste inventory were: Malaysia in 2008, Cambodia in 2007, Vietnam in 2007 and Thailand in 2007 and 2012.

For the E-waste inventory carried out in Thailand, the E-waste generation was estimated using a Weibull Distribution Model together with Logistic Model. Market saturation, lifetime of product and consumption of EEE were considered in the estimation process.

The general procedure for estimating and projecting annual quantities of e-waste generation is illustrated in Figure 4.1.

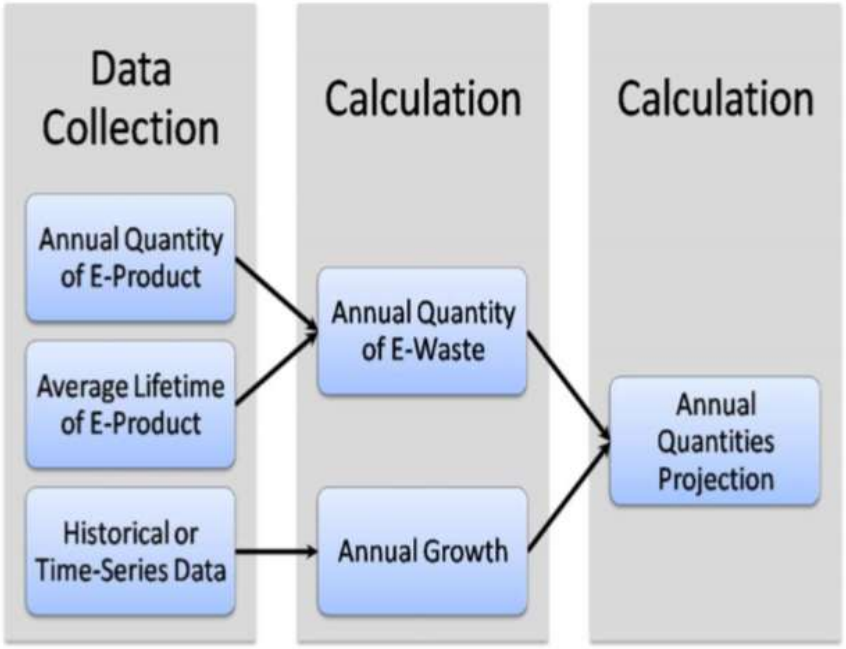


Figure 4.1 General procedure for estimating and projecting annual quantities of e-waste generation

Annual quantity of e-product can be calculated from data on EEE production, EEE import and EEE export.

Average lifetime of e-product can be estimated from primary data obtained through questionnaire and/or interview to household, business entities, retailer, etc. or through secondary data.

Annual quantities projection of E-waste can be calculated from data on annual quantities and annual growth.

Detailed inventory can also include data on import and export of UEEE and E-waste.

In accordance with the recommendation to use a harmonized guideline for ASEAN countries, E-waste classification is also proposed for ASEAN countries and can refer to the classification developed by United Nations University (UNU), as follows:

1. **Temperature exchange equipment**. Also more commonly referred to as, cooling and freezing equipment. Typical equipments are refrigerators, freezers, air conditioners, heat pumps.
2. **Screens, monitors**. Typical equipments comprise televisions, monitors, laptops, notebooks, and tablets.
3. **Lamps**. Typical equipments comprise straight lamps and LED lamps.
4. **Large equipments**. Typical equipments comprise washing machines, cloth dryers, dishwashing machines, electric stoves, large printing machines, copying equipment and photovoltaic panels.
5. **Small equipment**. Typical equipment comprises vacuum cleaners, microwaves, ventilation equipment, toasters, electric kettles, electric shavers, scales, calculators, radio sets, video cameras, electrical and electronic toys, small electrical and electronic tools, small medical devices, small monitoring and control instruments.
6. **Small IT and telecommunication equipment**. Typical equipment comprises mobile phones, GPS, pocket calculators, routers, personal computers, printers, telephones.

With this classification the Harmonized System Number (HS number) can be developed further through mutual agreement amongst ASEAN countries. If countries have different classifications on E-waste and UEEE, it will become more difficult to control the transboundary movement of UEEE and E-waste.

4.2. Recommendation 2: Develop specific regulation for E-waste management from household and industry, including policy and control on export and import of UEEE and E-waste

E-waste generation is increasing globally as well as within the ASEAN region. Most of the E-waste management activities (collection, transportation, dismantling, refurbishment, recycling, recover and disposal) within ASEAN countries are carried out by informal sectors without applying environmentally sound management. However, there are also formal sectors applying good practices of E-waste in an environmentally sound manner. Without specific regulations in place, the increase in E-waste generation may also increase E-waste treated by the informal sector. When improperly managed throughout its life cycle, E-waste will result in the adverse effects to human health and create environmental problems due to its potentially hazardous waste component contained within it and its socio-economic ramifications. On the other hand, E-waste recovery produces precious metal such as gold, copper, silver, zinc, etc which makes the E-waste recovery attractive economically. National governments should realize that the recycling and recovery of E-waste construe a large potential for mineral resources recovery and can promote green investment. Because of lacking of awareness towards this issue, governments are sometimes lagging in responding and in developing the specific regulations on E-waste.

At present, some of the ASEAN countries have stated their intention to develop specific regulations on E-waste management. A Sub-decree on E-waste management had been enacted on 1 February 2016 in Cambodia. Malaysia, Indonesia and Thailand are drafting specific regulations on E-waste management. EMB-DENR Philippines is currently finalizing the proposed "Technical Guidelines on the Environmentally Sound Management (ESM) of Waste Electrical and Electronic Equipment (WEEE).

An environmentally sound management (ESM) of E-waste is strictly required to protect human health and the environment. There is a general lack of legislation or enforcement in most ASEAN countries. To improve the E-waste management system, the development of specific policy and regulation for E-waste management from household and industry is proposed.

Specific regulations for E-waste management from household and industry may include:

1. A clear definition of UEEE and E-waste
2. Classification of E-waste

3. E-waste management system (collection, transportation, storage, segregation, dismantling/separation, crushing, refurbishment/reconditioning, recycling, recovery, waste treatment facility and disposal)
4. Environmental impact assessment (EIA) and licensing/permit for facilities
5. Emergency response
6. Environmental standards
7. Criteria to distinguish UEEE and E-waste
8. Import and export requirement, policy and control
9. EPR system
10. Responsibility of all stakeholders, consumers, retailers, transporters, collectors, 3R facilities, producers, central and local government.
11. Collection, transportation and 3Rs fees.
12. Public awareness
13. Monitoring and reporting
14. Administrative sanction e.g. penalties
15. Criminal sanctions

4.3. Recommendation 3: Technology (BAT/BEP)

For good practices and technology that can be applied within the ASEAN countries can refer to the good practices and technology applied in Indonesia, Malaysia, Singapore, Thailand and Vietnam.

4.4. Recommendation 4: Public awareness program

The informal recycling and informal dismantling or refurbishment is triggered by the lack of public awareness and no regulation. For example the household E-waste is very difficult to be collected by recycler companies because of the lack of information on the impact of E-waste to health and the environment and no obligation to manage E-waste in an environmental sound manner.

Most of the recycling-recovery industries collect their E-waste from industries and business offices. One Indonesia company already acquiring a permit for dismantling– crushing of E-waste was unsuccessful due to the lack of E-waste resource for processing by the company.

Potential source of E-waste from household is large. Malaysia and Singapore in developing their specific regulation on E-waste recognizes the importance of E-waste collection from household activities. Hence a large public awareness program is very essential. With cooperation between 3Rs companies, producers and also government, programs for increasing the public awareness can be created. The Malaysian program on public awareness can be used as references for other countries.

Proposed programs on public awareness are as follows:

a. Public awareness through partnership between government, recycling/recovery facilities, EEE manufacturer, community, and civil societies and media.
b. Develop guidelines for public awareness
c. Training of trainers
d. Incentives and disincentives

4.5. Recommendation 5: Setting up regional E-waste management facilities

Many countries such as Brunei Darussalam, Indonesia and Malaysia have ratified the Ban Amendment. Hence it will be difficult for these countries to have a regional facility for E-waste categorized as hazardous waste under the Basel Convention and under their hazardous waste regulation. Malaysia and Indonesia have regulations to distinguish between E-waste and UEEE. Thailand on the other hand already has a regional facility for recycling and refurbishment. Singapore also has a recycling and recovery facility with BAT and environmental sound management.

Consideration in setting up a regional E-waste management facility is as follows:

d. Refer to regional facility in Thailand and Singapore
e. Only can be established in countries that allow import of E-waste
f. BAT/BEP criteria refer to regional facilities in Indonesia, Malaysia, Singapore, Thailand and Vietnam

4.6. Recommendation 6: Controlling the illegal traffic of E-waste

In controlling the illegal transboundary movement of hazardous wastes can only be achieved through the utmost effort of all parties concerned both locally and internationally. This would include source interception, intelligence sharing between competent authorities, joint operations to tackles transboundary movement, guideline for checking the container by Custom and environment agency officers, if possible using electronic exchange of information as implemented by Singapore, Malaysia and South Korea. It could also be carried out by having environmental agency officers establishing an office in the harbor. Re-export of E-waste to the country of origin could be carried out faster after detection of E-waste in containers by environment and custom officers and inform the focal point of the Basel Convention or Ministry of Environment in the country of origin as soon as possible.

Regulation should also be applied to shipping companies to ship back the illegal E-waste to the country of export. Hence it will overcome the difficulties in handling shipment cost for the re-export (take back) procedure.

4.7. Recommendation 7: Exchange of information between ASEAN countries.

Malaysia explained the re-export of E-waste within the border areas of Singapore and Malaysia. Once information is obtained action is immediately taken. This can occur since each country has introduced their regulation and policies on E-waste export and import. For these activities BCRC-SEA can used their website to inform ASEAN countries on the regulation, policies of export-import, BAT & BEP of 3Rs facilities, the criteria to distinguish UEEE and E-waste, facilities that can receive E-waste and UEEE.

4.8. Recommendation 8: EPR System

Each country not yet implementing the EPR system can initiate operating the EPR voluntarily with several brand name companies from their mother company to cooperate with 3R facility or retailers. Regulation on EPR should be developed providing provisions among others: obligation of consumer to drop their E-waste in the collection bin designated by municipality, fee for collection, transportation from dropping point appointed by local municipalities to 3R

companies, responsibilities of retailers to take back for the large E-waste and pay for the transportation to 3R facilities, producer's responsibility for 3R and treatment and pay for the 3R fee, using the manifest system for transportation, set target of certain E-waste type in implementing the EPR.

The EPR system can refer to the system that is already being implemented in Japan or South Korea or the European Union. The EPR system in Japan and European Union are implemented not directly to all types of E-waste, but through stepwise approach for certain types of E-waste that are more valuable and setting achievable target of E-waste that can be collected, recycled, reused and recovery. The implementation of the EPR system can reduce the illegal collection practice using illegal facilities for 3R activities. Public awareness also plays an important role in the implementation of the EPR system.

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