Asia Region

Data Collection Survey on E-waste Management in Malaysia and Surrounding Countries

Final Report

July 2014

Japan International Cooperation Agency (JICA)
EX Research Institute Ltd.

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Target Countries of the Field Survey in the Study

Source: United Nations (http://www.un.org/depts/Cartographic/map/profile/seasia.pdf)

	Malaysia Area: Approx. 330,000 km^2 Population: 29.33 million (2012)
	Kingdom of Thailand Area: 514,000 km^2 Population: 65.931 million (2010)
	Republic of Indonesia Area: Approx. 1.89 million km^2 Population: Approx. 247 million (2012)

Source: Ministry of Foreign Affairs of Japan, Regional Affairs (http://www.mofa.go.jp/mofaj/area/asia.html)

Currency Exchange Rates

	USA (USD)	Malaysia (MR)	Thailand (THB)	Indonesia (IDR)
Japan (JPY)	103.41	31.623	3.135	0.00845

Source: JICA (July)
http://www.jica.go.jp/announce/manual/form/consul_g/ku57pq00000kzv7m-att/rate_2014.pdf

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Figures and Tables

Abbreviations	English
3R	Reduce, Reuse, Recycle
ABS	Acrylonitrile Butadiene Styrene
AEC	ASEAN Economic Community
AFTA	ASEAN Free Trade Area
AGC	Attorney General Chamber
AIT	Asian Institute of Technology
ASEAN	Association of South East Asian Nations
ASGM	Artisanal Small-scale Gold Mining
B3	Limbah Bahan Berbahaya Dan Beracun (Hazardous and Toxic Waste)
BAPEDAL	Badan Pengendalian Dampak Lingkungan (Environmental Impact Management Agency, Indonesia)
BAT	Best Available Technology
BCRC-SEA	Basel Convention Regional Centre for South-East Asia
BMA	Bangkok Metropolitan Administration
BWG	Better World Green Co., Ltd.
CFC	Chlorofluorocarbons
CPU	Central Processing Unit
CRT	Cathode Ray Tube
CSR	Corporate Social Responsibility
DANIDA	Danish International Development Agency
DIW	Department of Industrial Works, Thailand
DOE	Department of Environment, Malaysia
EEE	Electrical and Electronic Equipment
EEI	Electrical Electronics Institute
EHWM	Center of Excellence for Environmental and Hazardous Waste Management
EIA	Environmental Impact Assessment
EPR	Extended Producer Responsibility
ESBEC/WMS	Eastern Seaboard Environmental Complex/Waste Management Siam
EPU	Economic Planning Unit
ESM	Environmentally Sound Management
EU	European Union
E-waste	Electrical and Electronic Waste
F/S	Feasibility Study
FMM	Federation of Malaysian Manufacturers
FRF	Full Recovery Facility
FTA	Free Trade Agreement
FXEM	Fuji Xerox Eco-Manufacturing
GDP	Gross Domestic Product
GENCO	General Environmental Conservation Public Co., Ltd.
GST	Goods and Service Tax
IC	Integrated Circuit
ICT	Information and Communication Technology
ICT Group	Inforcomm and Technology Industry Group
IMF	International Monetary Fund
InSWA	Indonesia Solid Waste Association
ISNREM	Center for Natural Resources and Environmental Management (NREM) Mae Fah Luang University
ISO	International Organization for Standardization
ITB	Institut Teknologi Bandung (Bandung Institute of Technology)
ITU	International Telecommunication Union
JACTIM	The Japanese Chamber of Trade & Industry, Malaysia
JBIC	Japan Bank for International Cooperation
JCC	Japanese Chamber of Commerce, Bangkok

Abbreviations	English
JICA	Japan International Cooperation Agency
JPSPN	Jabatan Pengurusan Sisa Pepejal Negara (National Solid Waste Department) Malaysia
KL	Kuala Lumpur
KLH	Kementerian Lingkungan Hidup (Ministry Of The Environment, Indonesia)
KPBB	Komite Penghapusan Bensin Bertimbel
LCD	Liquid-crystal display
LED	Light-Emitting Diode
MEA	Multilateral Environmental Agreement
MHLG	Ministry of Housing and Local Government, Malaysia
MITI	Ministry of International Trade and Industry, Malaysia
MNRE	Ministry of Natural Resources and Environment, Thailand
MOI	Ministry of Industry, Thailand
MONRE	Ministry of Natural Resources and Environment, Malaysia
MPH	Bureau of Environmental Health, Department of Health, Ministry of Public Health, Thailand
MPPP	Municipal Council of Penang Island, Malaysia
MPSP	Seberang Perai Municipal Council, Malaysia
NGO	Non-Governmental Organization
NIES	National Institute for Environmental Studies, Japan
OECD	Organization for Economic Co-operation and Development
PACE	Partnership for Action on Computing Equipment
PC	Personal Computer
PCB	Polychlorinated biphenyl
PCB	Printed Circuit Board
PCD	Pollution Control Department, Thailand
PEWOG	Penang Environment Working Group, Malaysia
PKK	Pembinaan Kesejahteraan Keluarga (Women's Family Welfare Group, Indonesia)
PPSPPA	Perbadanan Pengurusan Sisa Pepejal dan Pembersihan Awam (Solid Waste and Public Cleansing Management Corporation, Malaysia)
PRF	Partial Recovery Facility
RKC	Home Appliances Recycling Center (Kaden Recycling Center)
RM	Malaysian Ringgit
SNS	Social Networking Service
StEP	Solving the E-waste Problem
SW	Scheduled Waste
TIPMSE	Thailand Institute of Packaging and Recycling. Management for Sustainable Environment
TPS	Tempat Pembuangan Akhir (Temporary Disposal Site, Indonesia)
TTLC	Thai Toshiba Lighting Co. Ltd.
UEEE	Used Electrical Electronic Equipment
UNIDO	United Nations Industrial Development Organization
VCD	Video Compact Disc
WEEE	Waste Electrical and Electronic Equipment
YKLI	Yayasan Lembaga Konsumen Indonesia (Indonesian Consumers Organization)

1 Background and Objectives

1.1 Background

Based on initiatives (producer responsibility, Manifest system, etc) under the Home Appliance Recycling Law (amended in 2009) of Japan, JICA carried out a project entitled “The Project for Model Development for E-waste Collection, Segregation and Transportation from Households for Recycling” from September 2011 to March 2013 in Malaysia. The project aimed to develop a collection model for waste electrical and electronic appliances generated from households (Referred to as “E-waste”, which excludes E-waste that falls under the jurisdiction of the industrial waste management law) in Malaysia and conducted a pilot project in Penang that involved the collection of E-waste generated from domestic households.

After the completion of the project, preparation of a guideline for the collection of E-waste based on the result of the pilot project and to promote the implementation of a collection system in other states was proposed.

Ministry of Natural Resources and Environment (MNRE) was supposed to prepare draft of the above mentioned guideline and is also considering the formulation of a regulation on extended producer responsibility (EPR) with the aim of preparing a draft within one year. Regarding the similar work in other states such as Perak, Johor, Melaka, Selangor and Kuala Lumpur, E-waste collection system was to be established by the first half of 2013. In Penang where the pilot project was conducted, the Malaysian government is continuing the activities and has plans to conduct an evaluation in July of the progress made during April to June.

Besides Malaysia, the need for the management of E-waste in other countries in South East Asia has also been recognized, but no appropriate management system is currently present. Hence it is expected that they need support and hence there is a need to collect basic information to determine the direction of assistance to be provided. The Malaysian experience is also expected to be beneficial to the neighboring countries. This study focused on the steps to be taken on E-waste collection after the completion of the abovementioned project and with due consideration to the difference in the relations between governmental bodies, consumers and other stakeholders in the various countries, and also collected relevant information and conducted surveys for expanding the experience gained in Japan and Malaysia to other neighboring countries.

1.2 Objective

As described below, this study focuses on establishing the results of “The Project for Model Development for E-waste Collection, Segregation and Transportation from Households for Recycling” and expanding it within Malaysia. Focus is also on collecting relevant information to expand the experience of Malaysia to Thailand and Indonesia and to propose a collection model. E-waste generated from households is targeted.

(1) To ensure the continuity of the “Waste Electrical and Electronic equipment recycling project” in Malaysia, design system considering the opinion of companies and other stakeholders, evaluate activities after the completion of the project, provide adequate recommendations where relevant, and collect information for expansion to neighboring countries.

(2) To collect information on Thailand (Thailand already has a system in place) and Indonesia (the need for E-waste management system is high) and propose an E-waste collection model in order to implement the project experience of Malaysia to other countries.

(3) To prepare a draft of collaborative expansion strategy when extending the support to other ASEAN countries in the field of E-waste management and propose a collaborative policy, and to summarize the challenges in the area of E-waste management.

1.3 Fundamental Issues Relating to the Study

1.3.1 Study Area

The study area comprises of Malaysia, Thailand and Indonesia. In addition to these three countries, Singapore was also added as the covered country. This is because many manufacturers place Asia-Pacific regional environment officers who set the common regional policy for the E-waste management.

1.3.2 Related Authorities of the Counterpart Countries

Related stakeholders are government agencies involved in E-waste, private companies and civil society organizations. MNRE is the governmental agency with jurisdictions of E-waste in Malaysia and ministries involved with industries and companies are also important stakeholders.

Table 1-1 Government agencies of the target countries

Target countries	Government department to be surveyed
Malaysia	· DOE: Department of Environment under MNRE · MHLG: Ministry of Housing and Local Government
Thailand	· PCD: Pollution Control Board under Ministry of Natural Resources and Environment · DIW: Department of Industrial Works under Ministry of Industry · Bureau of Environmental Health, Department of Health, Ministry of Public Health
Indonesia	· KLH: Ministry of Environment

In addition, other stakeholders involved in E-waste management like consumer electronics production companies, recycling companies and dismantling companies will also be subject of this study.

1.3.3 Survey Items

Following items are surveyed in the targeted countries.

Table 1-2 Survey items to understand the state of E-waste management

Survey subject	Survey content
Law/regulation, policy and institution	· Law and regulation as well as national policies · Responsible government agency and organization
E-waste flow	· Generated amount of E-waste flow from its generation to the final disposal / export · Scale and technical level of stakeholders involved in the flow · Monetary flow
Activities by stakeholders	· Voluntary activities · Cooperative work from retailers and NGOs and others · Involvement of citizen group and community environment activity leader (possible collaborative partners) · Collection campaign by local government units (LGUs) · Willingness to pay for E-waste treatment cost

Survey subject	Survey content
Technology level	· Infrastructure for collection and recycling of E-waste · Final disposal sit
Economic aspect	· Capacity to bear the cost for recycling and treatment of E-waste · System by which investment can be recovered
Social aspect	· Public awareness of the discard and treatment of E-waste · Level of understanding of environment conscious companies and products among consumer and their purchasing behavior · Incentives for promoting E-waste collection · Academic resources for promoting relevant policy and technological development

2 Survey Work Description

Following survey have been conducted as described in the table and by the team members.

Table 2-1 Schedule of the Field Survey

Country	Period of Field Survey	Number of Trips
Malaysia	October 15, 2013 – October 22, 2013 November 27, 2013 – December 4, 2013 November 17, 2013 – December 19, 2013 January 15, 2014 – January 22, 2014 February 10, 2014 – February 12, April 20, 2014 – April 26, 2014	6
Thailand	November 3, 2013 – November 9, 2013 November 24, 2013 – November 28, 2013 June 3, 2014 – June 7, 2014	3
Indonesia	October 23, 2013 - October 26, 2013 November 11, 2013 - November 16, 2013 January 12, 2014 - January 14, 2014 April 27, 2013 - May 1, 2014	4
Singapore	November 24, 2014 - November 26, 2014	1

Table 2-2 Consultant Team Members

Name	Assignment	Company
Junya Kikuhara	Team Leader/Project Strategy (1)	EX Research Institute Ltd.
Makoto Yamashita	Project Strategy (2)	EX Research Institute Ltd.
Osamu Sakamoto	E-waste management planning (1)	EX Research Institute Ltd.
Theng Lee Chong	E-waste management planning (2)	EX Research Institute Ltd. (local expert in Malaysia)

Table 2-3 List of Government Agencies and Organizations Visited During the Field Survey

Country	National/Local Government Agencies	Research Institutes, Private Sector, and Others
Malaysia	● Ministry of Natural Resources and Environment, Department of Environment, Headquarters (DOE HQ) ● Ministry of Natural Resources and Environment, Department of Environment, Penang (DOE Penang) ● Municipal Council of Penang Island (MPPP) ● Ministry of Natural Resources and	● Shan Poornam (E-waste recycler) ● TES-AMM Malaysia (E-waste recycler) ● Victory Recycling (E-waste recycler in Malaka) ● Estalco (E-waste recycler in Johor Bahru) ● LSS (Retailer) ● Ban Hin Bee (Retailer) ● Company C (Japanese electrical and electronic equipment manufacturer)

	Environment, Department of Environment, (DOE Johor Bahru) ● National Solid Waste Management Department (JPSPN) ● Majlis Perbandaran Subang Jaya (MPSJ)	● Company D (Japanese electrical and electronic equipment manufacturer) ● Tan Boo Meng (Retailer) ● Senheng(Retailer) ● Jaring metal (E-waste recycler) ● Company K (Japanese electrical and electronic equipment manufacturer)
Thailand	● Ministry of Natural Resources and Environment, Pollution Control Department (PCD) ● Ministry of Industry, Department of Industrial Works (DIW) ● Bangkok Metropolitan Administration (BMA) ● Bureau of Environmental Health, Public Department of Health, Ministry of Public Health (MPH)	● EEI(Electrical Electronic Institute) ● Japanese Chamber of Commerce, Bangkok (JCC) ● Thailand Institute of Packaging and Recycling Management for Sustainable Environment (TIPMSE:NGO) ● Tesco Lotus (Retailer) ● Green Market Exhibition ● Company F (Japanese OA equipment manufacturer)
Indonesia	● Ministry of Environment (KLH) Regional Environmental Management Department (BPLHD) and City Cleansing Department of DKI Jakarta Province.	● Basel Convention Regional Centre for South-East Asia (BCRC-SEA) ● Asosiasi Rekanan Pengadaan Barang & Distribusi Indonesia (ARDIN) ● KPBB (environmental NGO) ● Indonesian Electronic Producers Association (GABEL) ● PT. Mukti Mandiri Lestari (E-waste recycler) ● PT. Citra Asia Raya(E-waste recycler) ● Electronic Solutions (Retailer)
Singapore	—	● TES-AMM Singapore (E-waste recycler) ● Company C (Japanese electrical and electronic equipment manufacturer) ● Company D (Japanese electrical and electronic equipment manufacturer) ● Company G (Japanese electrical and electronic equipment manufacturer)

3 Current State of E-waste Management in the Targeted Countries

3.1 Malaysia

3.1.1 Regulations, Policy and Institutions

The established legal system in Malaysia, its national policy and the status of development are as follows.

a. Rules and Regulations, National Policy

Environmental Quality Act 1974

The Environmental Quality Act (EQA) which is the basic law on waste and recycling in Malaysia was established in 1974. Various regulations have been established under the Act. For waste requiring special management like hazardous waste, "Environmental Quality (Scheduled Wastes) Regulation" has been enacted in 1989 (revised in 2005 and 2007).

Regulations under the EQA and orders have been established concerning the treatment of scheduled waste, disposal facilities, transportation, license (license pertaining to processing, recycling facilities), environmental impact assessment, import and export as summarized below.

Table 3-1 Laws and Regulations on Hazardous Waste in Malaysia

Name	Summary
Environmental Quality Act 127	Enacted in 1974, came into force in 1975, Revised in 1985, 1996, 2000 and 2001 Actors responsible for implementing the law and implementing structure Definition of scheduled waste Facilities and transportation companies requiring license Import, export and transit of waste
Environmental Quality (Scheduled Wastes) Regulations 2005 P.U (. A)294	Enacted in 1989. Amended version came into force in August 15, 2005 Provisions for classification of scheduled waste (including E-waste), naming, storage, transportation, processing, disposal, labeling, responsibility of waste generator
Environmental (Scheduled Waste) Regulations 2005 (amendment in 2007)	Amendment of classification of scheduled waste, naming, storage, transportation, processing, disposal, labeling, responsibility of waste generator
Environmental Quality (Prescribed Premises) (Scheduled Wastes Treatment And Disposal Facilities) Regulations 1989 - P.U (A) 141/89	Enacted in 1989 Procedure to obtain license for owners (companies) of specified facilities (treatment, disposal facility) Obligation to report (storage, treatment, disposal, recycle of scheduled waste)
Environmental Quality (Prescribed Premises) (Schedules Wastes Treatment And Disposal Facilities) Order 1989 - P.U (. A) 140/89	Enacted in 1989 Types of specified facilities (6 types) Obligation to obtain license
Environmental Quality (Prescribed Conveyance) (Scheduled Wastes) Order 2005 - P.U (. A) 293/2005	Enacted in 2005 Definition of transportation activity
Environmental Quality (Licensing) Regulations 1977 - (P.U (. A) 198/77)	Enacted in 1977 License to operate treatment facility for scheduled

Name	Summary
	waste Format of application documents
Environmental Quality (Clean Air) Regulations 1978 - P.U (. A) 280/78	Enacted in 1978 and amended in 2000 Incineration of scheduled waste
Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 1987 - P.U (. A) 362/87	Enacted in 1987 Target businesses and facilities (includes hazardous waste incineration, treatment, disposal facilities)
Customs (Prohibition of Export) Order	Enacted in 1993 and amended in 1998 (came into force on June 1st) Procedures of export, export restrictions
Customs (Prohibition of Import) Order	Enacted in 1993 and a Amended in 1998(came into force on June 1st) Procedures of import, import restrictions

Source: Department of Environment[1] and documents from Basel Convention Secretariat

Hazardous waste has been defined and classified in article 51 of the EQA. In the first schedule of the Scheduled Waste Regulation, 77 types of waste according to the following 5 classifications have been specified.

- SW1 Metal and metal-bearing waste
- SW2 Wastes containing principally inorganic constituents which may contain metals and organic materials
- SW3 Wastes containing principally organic constituents which may contain metals and inorganic materials
- SW4 Wastes which may contain either inorganic or organic constituents
- SW5 Other wastes

Environmental (Scheduled Waste) Regulations 2005 is the amendment of the 1989 regulation. This amendment excluded rubber, effluent from textile industries, leachate from landfills and iron and steel slag from the definition of scheduled waste and in turn added the following.

- SW105 Galvanic sludge
- SW108 Leaching residues from zinc processing in dust and sludge form
- SW110 Waste from electrical and electronic assemblies
- SW205 Waste gypsum arising from chemical industry or power plant
- SW326 Waste of organic phosphorus compound
- SW407 Waste containing dioxins or furans
- SW429 Chemicals that are discarded or off-specification
- SW430 Obsolete laboratory chemicals
- SW501 Any residues from treatment or recovery of scheduled wastes

SW110, “Waste from electrical and electronic assemblies (or E-waste)” includes acid batteries, mercury switches, CRT glass, activated glass and equipments containing PCB capacitors or materials containing cadmium, mercury, lead, nickel, chromium, copper, lithium, silver, manganese or PCB.

[1] English translated version is available in the DOE website (http://www.doe.gov.my/webportal/en/perundangan-peraturan)

Article 12 of Environmental (Scheduled Waste) Regulations 2005 has incorporated the manifest system (referred to as Consignment Note in Malaysia) for recording the movement of scheduled waste from the generator to the transporter and to the treatment plant. The article specifies the information to be provided by waste generator, contractor and occupier of prescribed premises, stipulates their responsibility as follows and the sixth schedule also lists the format of the consignment note.

1. A waste generator, contractor and occupier of the prescribed premises shall provide information in accordance with the Sixth Schedule in the manner provided in this regulation or Director General shall determine other method as he thinks fit.
2. A waste generator shall complete Part I of the Sixth Schedule in six copies and hand over the six copies of the Schedule to the contractor when the scheduled wastes are delivered to him. Part I includes details of the generator (contact person details), type of scheduled waste, container used, amount , destination disposal landfill name and address, treatment unit cost.
3. The contractor shall, upon receiving scheduled wastes from a waste generator, complete Part II of the Sixth Schedule in the six copies given to him by the waste generator and shall thereafter immediately hand over two copies of the Schedule to the waste generator who in turn shall submit a copy to the Director General within 30 days from the date of transportation of the scheduled wastes.
4. The contractor shall within 10 days from the date of receipt of the scheduled wastes deliver the scheduled wastes to the occupier of any prescribed premises and hand over the remaining four copies of the Sixth Schedule to the occupier.
5. The occupier of any prescribed premises shall, upon receiving scheduled wastes from the contractor, complete Part III of all the remaining four copies of the Sixth Schedule handed over to him by the contractor and shall, upon completion, retain one copy and return a copy each to the contractor, the waste generator and the Director General, within 20 days from the date of receipt of the scheduled wastes.
6. If the waste generator fails to receive his copy of the Sixth Schedule from the occupier of the prescribed premises referred to in sub regulation (5) within 30 days from the date of delivery of the scheduled wastes to the contractor referred to in sub regulation (2), he shall notify the Director General immediately and shall investigate and inform the Director General of the result of his investigation.
7. The waste generator, contractor or occupier of the prescribed premises shall each keep a signed copy of the Sixth Schedule which shall be retained as a record for at least three years from the date the scheduled wastes are received by the occupier of the prescribed premises.

Electronic manifest system has been introduced in January 2006 which has made it possible for generators, collectors and transporters, storage owners, treatment and disposal plants to submit information online. However, when transporting toxic waste, it is necessary to make a print out of the information submitted online and carry a hard copy.

6 types of facilities are specified by “Environmental Quality (Prescribed Premises) (Schedules Wastes Treatment and Disposal Facilities) Order” as treatment facilities for scheduled waste. It is necessary to obtain license for the treatment (excluding storage, incineration or disposal) of waste from one’s own facilities. However, to operate a facility that carries out storage, treatment or recycling of scheduled waste generated by a third party (offsite facility), it is necessary to obtain a license from the Director General (environment). The license is issued for a period of 1 year for 6 facility types as shown in the following table and need to be renewed before the end of the licensure period.

Table 3-2 Outline of Treatment and Recycling Facilities for Scheduled waste and the Number of Licensed Facilities

Facility type	Outline
Offsite storage facility	Storage facility for scheduled waste (generated by others)
Offsite treatment facility	Facility carrying out treatment of scheduled waste(stabilization, solidification) generated by others
Offsite recovery facility	Facility carrying out recycling and reclamation of scheduled waste generated by others
Waste incinerator	Facilities carrying out thermal destruction of scheduled waste
Secured landfill	Final disposal facility for scheduled waste (land based)
Land treatment*	Facilities that carry out land treatment of scheduled waste(e.g. biological treatment of oil sludge)

Number of facilities sourced from DOE website. Information obtained on March 24, 2007. The numbers of facilities that have license to accept and treat multiple products are overlapped.
(http://www.doe.gov.my/index.php?option=com_content&task=view&id=106&Itemid=614&lang=en)
* Land treatment is a concept not practiced in Japan but indicates bio remediation of waste sludge

Guidelines for the Classification of Used Electrical and Electronic Equipment

The "Guidelines for the Classification of Used Electrical and Electronic Equipment in Malaysia" presents the criteria and workflow to determine whether a particular used electrical/electronic equipment falls under the category of scheduled waste. This guideline targets the handlers (generators, transporters, importers and exporters, authorities engaged in their management) of used electrical and electronic equipments (EEEs). In Malaysia, when importing/exporting E-waste (Basel convention annex VIII'A1180 and A2010) classified as scheduled waste (SW110), it is necessary to follow the procedures determined by the Convention.

This guideline presents the determining criteria to establish whether a particular waste is a scheduled waste (SW110). When importing used EEEs that are manufactured within 3 years for the purpose of reuse, the importer need to submit document that the EEEs are not classified as scheduled waste (SW110) and apply to the DOE prior to import. For those who violate the procedures laid out in the Basel convention, provisions for punishment including imprisonment will be applied.

National Strategy

In Malaysia, "*National Strategic Plan for Solid Waste Management*" exists but there is no national strategy present that targets the management of E-waste. However, according to the information publicized by DOE, the following items are targeted as important policy issues.[2]

[2] Excerpt from "Policy update from Malaysia" presented by the director of the DOE Hazardous Substances division at the "Third Annual International E-waste Management Network Meeting" organized by USEPA on July 2013. Similar information has also been presented at JICA pilot project workshop held on February 2013.

Source: DOE, Policy update from Malaysia

Figure 3-1 Policy Challenges of E-waste Management

It is evident that DOE, who is responsible for industrial E-waste, has also identified household E-waste as an important issue.

b. Responsible Bodies and Administrative Structure

Department of Environment (DOE)

In Malaysia, as per the EQA, the Department of Environment (DOE) under the Ministry of Natural Resources and Environment (MNRE) has the jurisdiction for hazardous waste from industrial activities.

Hazardous Substances Division of the DOE is responsible for scheduled waste including E-waste. This division handles activities related to the treatment of scheduled waste, licensing of recycling business, procedures relating to import/export of scheduled waste based on the Basel Convention, examination of related documents. Various offices of DOE handle the application, but the final license approval is given by the Director General.

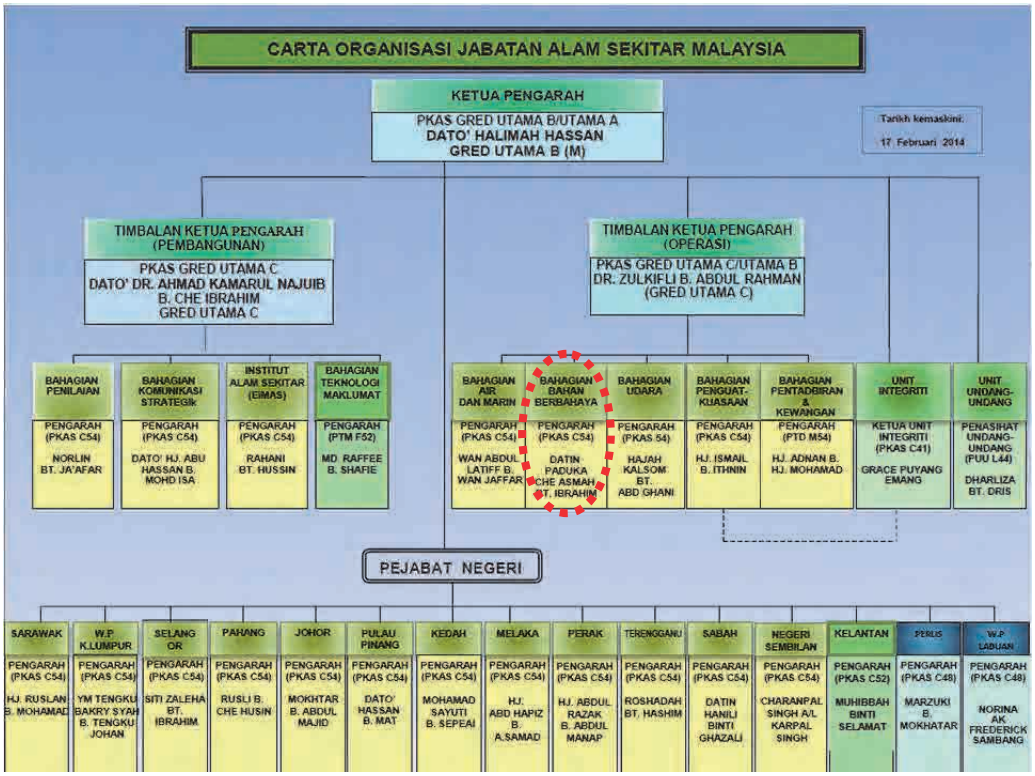


Figure 3-2 Organizational Chart of DOE[3]

(circled part indicates the Hazardous Substance division)

E-waste recycling law is now being drafted resulting in E-waste being managed within the restrictions of the existing EQA. E-waste from households, although regarded as hazardous waste, falls in a “grey area” as per legal point of view.

Ministry of Housing and Local Government (MHLG)

Municipal solid waste, along with non-hazardous industrial waste, is managed by the MHLG. National Solid Waste Management Department (JPSPN: Jabatan Pengurusan Sisa Pepejal Negara) is responsible for the management of non-hazardous solid waste. MHLG has the following policy regarding the management of solid waste.

- Formation of a comprehensive, integrated and economical structure for solid waste management
- Focus on environmental protection and health
- Introduction of economical and proven technology
- Prioritizing of 3R

It should be noted that in Malaysia 2 different waste collection systems are present. In accordance with Solid Waste and Public Cleansing Management Act 2007 (Act 672), JPSPN has been established to propose policies relating to environment and sanitation (e.g. waste treatment, road cleaning, treatment of pruned branches) under the jurisdiction of MHLG, Solid Waste and Public Cleansing Management Corporation (PPSPPA: Perbadanan Pengurusan Sisa Pepejal dan Pembersihan Awam), which is a waste management public corporation was also established to provide administrative services. The collection, transportation, transfer and disposal work is contracted out to businesses (e.g. Alam Flora) by JPSPN as a concession contract.

[3] Organizational structure as per February 2014 (http://www.doe.gov.my/webportal/en/pengenalan/carta-organisasi/)

JPSPN and PPSPPA, being part of the federal government, control the local government bodies. However, whether the local government bodies comply with Act 672 or whether they fall under the umbrella of the federal government is left up to the local government bodies to decide. For example, the State of Penang does not follow the system under the law and follows its own system with the Municipal Council of Penang Island (MPPP) and Seberang Perai Municipal Council (MPSP) being the responsible parties. The collection of waste is undertaken either by the local government or by contracting out (different from concession contract).

DOE manages E-waste generated from industries and has the regulatory power over generators and treatment plants. For E-waste from households, the jurisdiction of the emitter lies with MHLG but the jurisdiction of the waste itself belongs to DOE. Discussions are being held for future activities to manage the dual jurisdictions.

Act 672 does not specify that E-waste from households fall under the jurisdiction of JPSPN. Further, as DOE only handles E-waste from industries in accordance with the Environmental regulation, the issue of jurisdiction is unclear. DOE is trying to formulate a new Act and ensure that E-waste from households falls under its jurisdiction. However, only JPSPN has the functionality to carry out the actual waste collection work. Hence, discussions are being carried out to evaluate the possibility of carrying out a 2+1 collection of E-waste, determine how the cost burden is to be allocated and where the collected waste is to be taken.

Nevertheless, the reality is that only JPSPN has the ability to collect household E-waste from house to house along with their MSW collection, that is what the plan about 2+1 collection, but JPSPN and DOE has to negotiate and discuss many issues pending, especially who to pay, where to go. Also it is the fact that, most of the household E-waste are entering informal sectors rather than collected by any concessionaire or JPSPN.

3.1.2 Current status of Developing Household Generated E-waste Management Regulations

Household generated E-waste regulation based on EPR (Extend Producers Responsibilities) is currently discussed and developed. In the following sections, survey result about the current status is described.

a. Background

A law concerning E-waste generated from households was drafted around the year 2008. It requires manufacturers to be responsible for collection and recycling of used products based on the principle of EPR; however, it was challenging to build a consensus among stakeholders due to a lack of social measures to share the responsibilities, so the draft has not been finalized.

The government started developing a system using the Japanese Home Appliance Recycling Law as a reference. They have requested the Japanese government for cooperation, and launched a project, called “WEEE Recycling Project (the Penang Pilot Project)”, which was conducted from September 26th 2011 to March 30th 2013.

b. Challenges of Activities Conducted so far

Current State after the Completion of Penang Project

As mentioned above, the Penang Pilot Project includes all the activities from a household, which is a source of waste generation, to a recycling facility. There are voluntary activities that are experimented at the Penang Pilot Project and initiated by stakeholders such as providing vouchers to promote E-waste collection, simplifying procedures, and discussing other possible activities. Nevertheless, the recycling facilities that are supposed to collect E-waste are not functioning properly, so currently none of those activities are performed.

c. Continued Project at Penang

There are limitations to voluntary activities at a local level without developing guidelines and criteria in relation to E-waste recycling and treatment. Also there are not enough budgets for the local DOEs to mandate requirements for E-waste management. In addition, ESM of E-waste is not ensured since collected E-wastes end up in informal sectors and a lack of infrastructure for disposal and treatment of white goods. Stakeholders also recognize that the establishment of a regal framework is essential for sustainable E-waste management.

d. Expansion to Other States

The recycling project is to be expanded to the other states, taking lessons learnt from the Penang Pilot Project, Senheng ,[4] one of the major retailers in Malaysia, is voluntary taking over the project, utilizing their branch stores and using the same collection method introduced in the Penang Pilot Project.

DOE are trying to launch improved projects at a local level in other states including Penang and Johor Bahru, but these projects will be voluntary. Since there is no legal framework and regulation, collected E-waste ends up in the informal sector instead of licensed recycling facilities. In order to improve this situation, the federal government should indicate a direction and promote activities in line with laws and regulations.

One of the challenges is to collect those old products stored in household when replacing them with new products. In addition, there are many cases where collected E-waste is sent to the informal sector, therefore it is essential to clarify that retailers are legally obligated to collect E-waste from their customers.

Even though DOE is heavily relying on Senheng in conducting and expanding the project, Senheng is not working in close contact with DOE, so there is not enough up-to-date information on collection data shared with DOE. Furthermore, even though it is important to identify issues and to discuss alternative solutions or effective measures that could be develop to further the project, Senheng and DOE have not had any active discussion on this matter as well.

e. Opinion of the Local Authorities (Others)

The municipalities that are responsible for collecting wastes from households have agreed to the idea to utilize dealers as E-waste collection hub from consumers. Also, the municipalities are in the position to issue licenses to dealers and they are expressing readiness to encourage dealers to register as E-waste collection hub. On the other hand, they presented their perception that national government should indicate policy direction for E-waste management by law.

In conclusion, this follow-up survey of the E-waste collection pilot project showed that municipalities, dealers, electrical and electronic equipment manufacturers, and concerned individuals for recycling facilities valued their voluntary initiatives while they emphasized the importance of ensuring various kinds of policy measures into law. This is because they recognize, without appropriate regulation, voluntarily collected E-waste ends up flowing out to informal sector leading to environmental hazard due to the emission of harmful materials included in the E-waste. Also the opportunity for valuable resource recovery is being lost. Therefore, consolidation of systematical legal system is necessary.

f. Ongoing activity for developing household E-waste management Law

In Malaysia where its nominal GDP per capita is more than 10,000 dollars, it is expected that more popularization and consumption of electrical and electronic equipment will be progressed and increased. Thus, there will be a large amount of E-waste generation from household in near future.

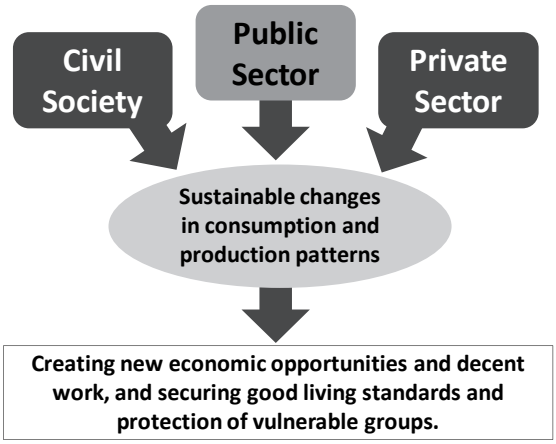
[4] Website of Senheng (http://www.senheng.com.my/)

While valuable metals can be recovered from E-waste, inappropriate recycling will cause environmental pollution and human health hazard. To prevent the negative impact from E-waste recycling, DOE came to the point to develop a new law for the purpose of the promotion of environmentally sound recycling of E-waste along with prevention of possible pollution.

g. Current Status of Development

In regards to establishment of laws concerning E-waste management, the importance of involvement of all stakeholders to work together based on the following principles is indicated by DOE.

- In line with the concept of Shared Responsibility and Environmental Citizenship, responsibilities related to waste management should be shared among government, private sectors, and consumers.
- Private sectors with environmentally sound treatment technology, know-how, and capacity to invest should actively be involved in the E-waste management initiatives as their Corporate Social Responsibility (CSR) actions.
- The government is responsible for establishing laws and regulations, implementing the laws, increasing public awareness.
- Consumers are required to alter their consumption behaviors and attitudes to discard their E-waste in an environmentally sound way.



Source: Way forward in managing household E-waste in Malaysia

Figure 3-3 Importance of Cooperation in E-waste Management[5]

While the basic concept of the law was expressed, DOE, the organization playing the central roles for the law development, had stated that specific contents of the law will be open at the end of 2013 or beginning of 2014. JICA Study Team conducted follow-up interviews to DOE and DOE Penang office on the status of law development but the complete picture of the law was not clarified although partial concept of the law was stated by them.

Therefore JICA Study Team offered an opportunity of a workshop where interactive discussion can be held with the aim of understanding the current status of law development as well as making proposal on measures to be taken for more effective enforcement of the law, and DOE accepted the offer. The workshop titled “Sustainable Mechanism for Environmentally Sound Management of E-waste in Malaysia” was held on January 16, 2014. The agenda of the workshop is shown in Annex, that includes legislative framework, the purpose, system, stakeholders, target products, and Japanese E-waste management model introduction, as well as the discussion towards sustainable E-waste management and proposal making.

[5] Launching and Wrap-up workshop of the pilot project for E-waste, collection, segregation and transportation from households for recycling

In the workshop, roles and responsibilities of each stakeholder in the legal framework, E-waste collection system, charging system, the background and purpose of the law making were explained. JICA Study Team explained overall relevant elements that should be included to promote sustainable E-waste collection and environmentally sound recycling before going into detail discussion with participants on the sustainable E-waste management in Malaysia.

In the beginning of the workshop, the Director Datin Paduka Che Asmah Ibrahim who is in charge of hazardous waste management in DOE explained the E-waste collection status after the Penang Pilot Project and the overview of the draft legal framework shown in the figure below. In the draft plan, staleholders like consumer, retailer, manufacturer, and recycling facility have respective responsibilities for E-waste management including paying necessary fee for environmentally sound recycling of E-waste and reporting necessary E-waste transaction data to designated authority.

Source: Proposed Draft Framework for Household E-waste regulation

Figure 3-4 Conceptual Diagram of the E-waste Management Legal Framework

The detail of the E-waste management is described below.

- **Target products**

Target products are 8 types of E-wastes: refrigerators wash machines, TVs (CRT and LC), air conditioners, mobile phones, PCs (desktop and laptop), rechargeable batteries, and fluorescent tubes. Most of the target products are too bulky to carry by hands of consumer or revenue recovered by selling recycled materials from E-waste cannot be ample enough therefore environmentally sound treatment at the voluntary level cannot be financially feasible.

- **Hand-over to collection centers from the E-waste generation points**

- Consumers or collection companies should bring E-waste before dismantling to collection companies or collection centers. Basically buy-back system should be introduced at the collection centers and the purchase price would be market price.
- Collection centers are required to obtain permissions from DOE and all the collected E-waste should be handed over to the licensed recycling facilities.

- **Responsibility of recycling facility**

- All recycling facilities should obtain license from DOE.
- Recycling facilities should provide a method of collecting and transporting E-waste and cover the cost associated with these activitiesof the collection and transport should be provided by recyclers.
- Recycling facilities should establish E-waste dismantling and recycling system compliant with the ESM (Environmentally Sound Management) guideline developed by DOE.
- Recycling facilities should submit a report to DOE every 90 days.
- Recycling facilities should conduct E-waste collection and transport in cooperation with collectors.
- Recycling facilities should reimburse the collection and transport fees to collectors. (the fees are paid by collectors in advance).
- Recycling facilities should construct operation system compliant with, meet requirements, and report inventory every 90 days.

- **Responsibilities of manufacturers**

- Manufacturers should make efforts to establish flow of collected E-waste to collection centers and recycling facilities licensed by DOE.
- Manufacturers should implement efforts to reduce hazardous material use.

- **Responsibilities of the E-waste collectors**

- E-waste collectors should be registered with DOE and ensure that E-waste is handed over to recycling facilitiews licensed by DOE (Delivery responsibility).
- E-waste collectors should not cause pollution during transport.
- Collection centers should send E-waste to recycling facilities licensed by DOE
- Collection centers should prevent damage when transporting E-waste.

- **Responsibilities of consumers**

- Consumers should pay recycling fees.
- Consumers should hand-over their E-waste to collection centers or collectors licensed/registered by DOE.

- **Cost sharing between stakeholders**

- To promote environmentally sound treatment of E-waste from the point of view of shared responsibility, subsidy provided to recycling facilities is shared between consumers, manufacturers, and recycling facilities as follows.
  - Recycling fee paid when consumer purchase products
  - EPR fee from manufacturers and importers
  - Registration fee from recyclers
- The collected fees will be used to cover the costs associated with environmentally sound treatment facilities and promotion to raise public awareness.
- Collected fees will be managed and controlled by a newly-established recycle fund .
- Dealers first collect recycling fees from consumers, then the dealers pay to manufacturers and importers, then the manufacturers and the importers pay to the recycling fund.

- **Registration and reporting requirements**

- Manufacturers and importers should be registered with DOE annually.
- Manufacturers and importers should submit sales records data and a recycling report to DOE every 90 days.
- Manufacturers and importers should report information on hazardous substances used in their products.

- **Labeling requirement**

- Labels should be placed in plain view on the product so that manufacturers and importers can notice when disposed.
- Labels should include information of materials used in the product such as types of the plastics.

Highlights of the workshop:

Overall regulatory framework:

- Regulatory framework was determined that involves stakeholders such as retailers, collectors, manufacturers, recycling facilities (dismantling facilities), and DOE.
- Requirements for collectors, recyclers, and recycling facilities as well as ESM criteria of E-waste for recyclers and recovery facilities need to be stipulated by DOE and documented in the form of guidelines.

Collection element:

- A collection center is to be set up for collecting E-wastes from consumers and collectors.
- E-waste collectors can be retailers, concessionaires, charity organizations, NGOs, and small collectors as long as they are registered based on the requirements which will be set by DOE.
- Small-scale collectors will continue the E-waste collection activity; however, they are not allowed to dismantle E-waste. They are only allowed to sell them to formal recycling facilities (dismantling facilities).
- Reuse or reconditioning of the discarded E-waste is considered no issue as long as they do not cause secondary pollution.

Financial element:

- In the view of shared responsibility, all consumers, manufacturers and recyclers will bear the overall recycling cost required (Recycling fees from consumers, EPR fees from manufacturers and registration fees from collectors and recyclers).

  - It is necessary to examine precisely how much these fees should be.

- A recycling fund will be set up with the fees collected from the above three parties, then provide subsidy to licensed recyclers (mainly doing dismantling work).

  -It is necessary to consider how to set up such a fund, by referring to some other existing fund structure available in Malaysia (such as the Employee Provident Fund)

- No refund to consumers is planned; however, some incentives to consumers are necessary, up to the market players such as retailers and collectors.

Recording/reporting element:

- Manufacturers have to provide the sales data regularly and information on hazardous substance contents and sales volume.
- Recycling facilities (dismantling facility) have to report what items, which brand, how many items have been received and recycled.
- Recycling facilities have to report the inventory of processed E-waste covered under the regulation.

Timeline:

- Formulate the first draft of the principle law by the first quarter of 2014, and to be submitted to Attorney General Chamber office for review.
- Supporting work such as guidelines development and cost analysis is preferably to be conducted in parallel for further brush up of the details before going to public comments and actual implementation.

Requiring assistance:

- Various activities such as guidelines development and analysis for appropriate E-waste recycling and transportation costs are some of the important and key activities which require the assistance, preferably from JICA.
- In order to apply for JICA's assistance, it is advisable for DOE to consult and notify both environment and international sections of Economic Planning Unit (EPU) in advance to facilitate prompt consideration and necessary action taken for the request for technical cooperation for the fiscal year 2014.
- Due to the budgetary constraint, the request may not be fully accepted and therefore prioritizing activities and the planning strategically on how the request to be made should be well considered.

Other matters:

- Involvements of other ministries, such as JPSPN, Ministry of International Trade and Industry, Ministry of Finance are necessary to establish the regulatory framework with EPR model, which ensures a sustainable mechanism for ESM of E-waste.
- In order to notify the industries, DOE will arrange informative meetings with representatives from industries, such as FMM (Federation of Malaysian Manufacturers) and JACTIM (Japanese Chamber of Trade & Industry, Malaysia).

In the wrap up session, following items are agreed as the activities way forward. The summary of the workshop agreed with DOE participants are listed in the Annex.

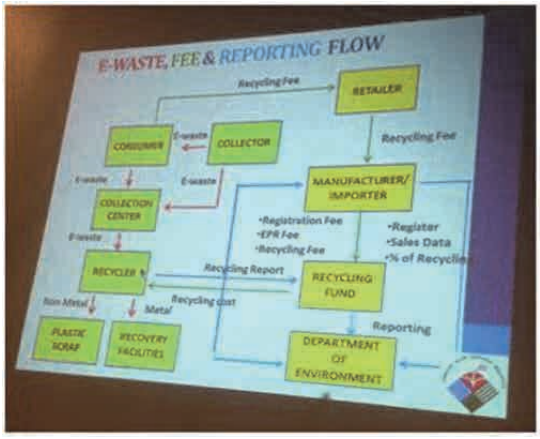
- Brushing up the proposed system framework diagram
- Conducting supporting work, such as cost analysis for developing feasible regulation
- Developing guidelines for sustainable and environmentally sound collection, recycling and recovery of the E-waste
- Developing activity plan along with the regulatory framework development which includes;

    -Identifying responsibilities for all the stakeholders

    -Requirements for various activities

    -Establishing reporting and monitoring procedures

- Having stakeholder informal consultation meeting with manufacturers and others (can be happened now on)
- Studying how to manage the proposed recycling fund



Presentation by DOE participant


Discussion in the workshop

In the workshop, important matters that cannot be obtained through a brief discussion such as the purpose, intention, and direction of the law development were clarified. Moreover, the desirable system of E-waste management is lively discussed among the parties concerned. Through the discussion, several challenges from the viewpoints of sustainability of the system itself, effective E-waste collection, and promotion of environmentally sound recycling were identified.

The following is the conceivable challenges proposed by DOE on the E-waste management framework development.

- If the primary collection was left to market mechanism too much, E-waste flow out to the informal sector where inappropriate E-waste handling is rampant cannot be cut off. Challenges that considered to be surfaced due to E-waste collection based on the buy-back system, or adverse effect of leaving the E-waste sales for the collection center to market mechanism should be studied more.
- If ‘an invisible flow’, E-waste flow to informal sector, it is difficult to expect the amount of E-waste collected and transported to recycling facilities. This toughens recycling business planning due to the difficulty in the investment decision.
- DOE have tried to make registration mandatory even for informal sectors, but there are no incentives for them to be registered. Formalization of informal sector cannot be conducted only by registration, but also more holistic approach including penalty enforcement is needed. Also the feasibility of formalization of informal sector has not been studied yet.
- Delivery responsibility to hand-over collected E-waste to registered center/facility appropriately is not stipulated in the draft regulation.
- It is proposed that manufacturers should make efforts to establish a flow of collected E-waste to collection centers/recycling facilities; however, there is a limitation in the role played by manufacturers
- Although it is necessary that convenient collection services are provided for consumers by dealers, they are not imposed to do it as mandatory.
- It is important to establish operation system that meets the ESM standards for the recycling facilities, but the specific requirements are not clear.
- The fee collection standards, management body and methods, and fund use are not clarified in respect with recycling cost, EPR fee and registration fee. Also regarding the reporting of sales data as a responsibility of the dealers, the purpose of this activity as well as how this improve recycle scheme as a whole is unclear.

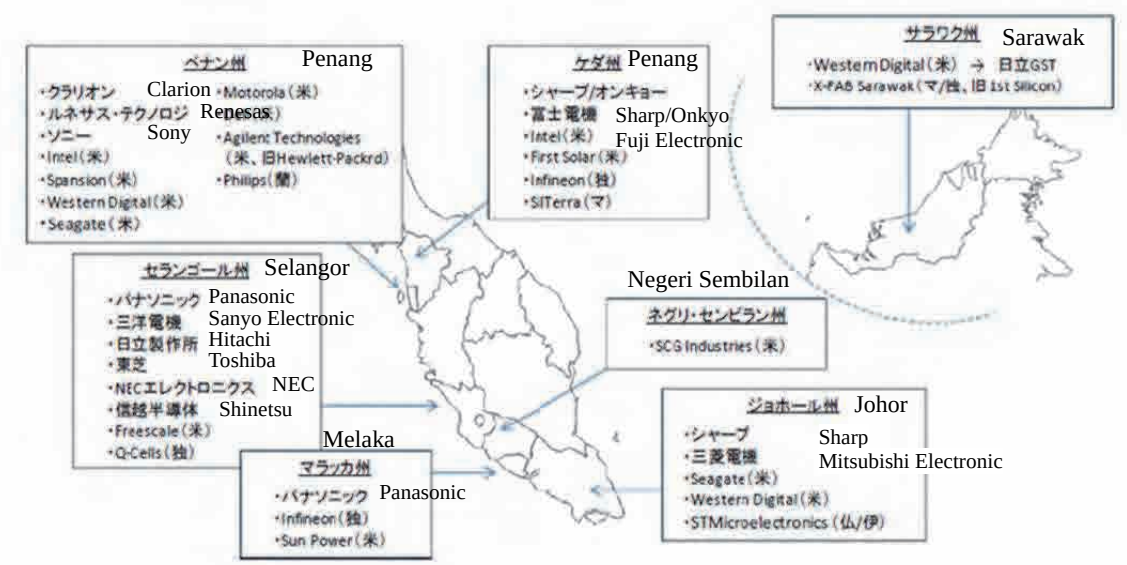
- There is no stipulation of recommendation, prohibition and responsibility for stakeholders such as delivery responsibility of consumers and dealers to licensed recyclers/registered collectors, fee payment responsibility, and environmental responsibility of the recycling facilities.
- Examination of viability of roles and responsibilities of stakeholders including dealers, collectors, recyclers, manufacturers, consumers and public sectors are not conducted.
- Requirements for the stakeholders such as recycling requirements for the recycling facilities are not fully analyzed. In particular, the recycling requirements are closely related to the price of recycling fee, therefore the analysis looking at the both is needed.
- Analyses on the management body which manage whole mechanism and promote sustainable recycling policy are not fully conducted.
- The definition of collectors and collection centers are unclear.
- Competition principle between different recycling schemes is not introduced. There is no space where manufacturers can voluntarily organize and conduct initiatives.
- There are no specific methods stipulated for labeling.
- Despite the fact that the contained amount of valued metals, treatment methods, and recycling fees are different according to the product types, 8 types of products are targeted from the point of the law enforcement. This is not realistic.
- No specific standard fee for recycling and the targeted products has been set..
- The existence of treatment facilities and their capacities as well as the E-waste generation in the each region are unclear. Quantitative analysis on the appropriate scale of the infrastructure has not been conducted; therefore, there is a possibility that surplus or deficiency of the treatment facilities could occur.

3.1.3 Material Flow

The E-waste generation amount in Malaysia and its material flow is summarized below.

a. EEE Manufactures

Most of the manufacturers are concentrated in Penang State, Selangor State, and Johor State. In particular, Penang State is free trade zone and called Malaysian Silicon Valley therefore American semiconductor manufacturers are concentrated. In Selangor State, measure infrastructure such as Kuala Lumpur International Airport, Port Klan, and Shah Alam Industrial Park is developed. In Johor State proximate to Singapore, some corporations with main Asian branch or design center in Singapore place their manufacturing core in Johor.



Source: Investment Environment in Malaysia (June, 2009) JBIC

Figure 3-5 Location of Leading Electric and Electronic Equipment Manufacturers in Malaysia

In the past 10 years of electric and electronic equipment (EEE) production, the white goods including compact appliances are in the declining trend. One of the reasons is because the assembly process of home appliances were concentrating in China, Thailand and Vietnam where labor cost is relatively cheaper in 2000s. Another reason is considered that import levies in ASEAN 6 countries were reduced from 0 to 5%.

In the trends of the each product, production of computer devices (including printers) has been declining since financial crisis in 2008. In 1990s, Japanese manufacturers placed their production core in Malaysia for importing the products for neighboring Asia-Oceania and Europe countries. But nowadays the business scale has been shrinking.

Air conditioners (including for households, car, freezer and refrigerator for professional use) production is in the increasing tendency and exported for ASEAN and Middle East countries. Some of the local manufacturers export 50% of their production to Europe, the United States, Australia, Middle East, and Africa.[6]

[6] Malaysia External Trade Development Corp. “Malaysia Exporters of Electrical and Electronic Directory 2011-2013” (http://www.matrade.gov.my/documents/ebook/pdf/electrical.pdf)

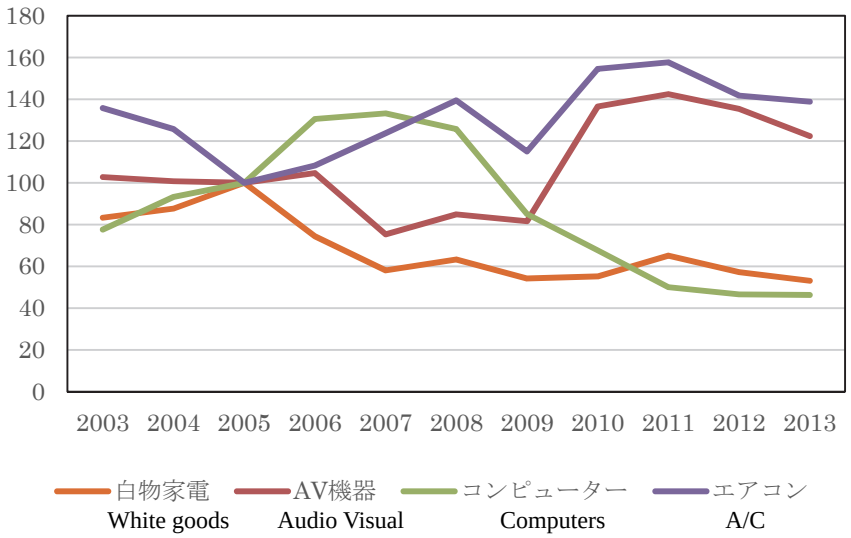
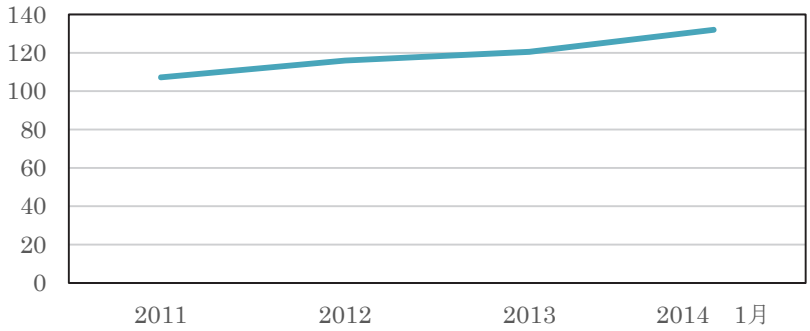


Figure 3-6 Production of Electric and Electronic Equipment in Malaysia (Production in 2005=100)

The production of telecommunication equipment such as mobile phones is also increasing.



Source: Created from Index of industrial production (Dec, 2013), Department of Statistics Malaysia

Figure 3-7 Production of Communication Devices in Malaysia (Production in 2010=100)

b. E-waste Generation Amount

E-waste generation estimate by E-waste project under Basel Convention

Previous statistical data for the generation of household E-waste exists. Estimation of generation of E-waste for Malaysia (Inventory) has been carried out in 2006 as a part of "Environmentally Sound Management of E-waste (E-waste project)" carried out under the Basel convention. This inventory was prepared by a Malaysian consultant under the management of DOE with cooperation from Ministry of the Environment, Japan.

In the inventory, calculation of E-waste is carried out by differentiating the potential generation amount of used electrical and electronic appliances (UEEE) from households and the amount that actually is generated and comes out of the household (WEEE).

During the calculation phase interviews were carried out with households, companies that use electrical and electronic appliances, importer and exporters, collectors, dismantlers and processers, second hand vendors. The final estimation hence was carried out using the data collected from these interviews along with previous statistical data.

In determining the generation amount of UEEE and WEEE, methodology developed and used in "An Evaluation of Actual Effectiveness of the Recycling Law for Electrical Home Appliances " has been adopted.[7] In this, yearly production amount of EEE, length of owning and using as well as discarding time of EEE was surveyed to calculate the remaining amount of EEE.

The domestic shipping amount is obtained by adding the domestic production amount with import amount and subtracting the export amount. When calculating the manufacture year-wise stock amount, for new products the year of purchase is considered as the year of manufacture. For used products, manufacture year is estimated by using data of year of purchase and number of years from manufacture since the used product is traded in the market.

Table 3-3 Amount of Generation of UEEE and WEEE

Data	Content	Detail
Data used for estimation	Purchase, mode of purchase	Income bracket wise purchase, utilization (item, number owned, ratio of new and old, average number of year used, method of disposal) (For companies, number of employee-wise)
	Future generation amount	Item wise WEEE generation amount
Data used for estimation	Future export, repair, reassembly , dismantling amount	Item wise generation amount
	Residue generated from repair, reassembly, dismantling	Amount and ratio of residue resulting from repair, reassembly and dismantling (item wise)
	Purchase, mode of purchase	Income bracket wise purchase, utilization (item, number owned, ratio of new and old, average number of year used, method of disposal) (For companies, number of employee-wise)

In the above-mentioned E-waste project, along with the preparation of the inventory to predict the generation amount, information collection has been done by conducting interviews with related governmental stakeholders, manufacturers and business and obtained qualitative information such as the state of environmentally sound management and the state of collection of UEEE, dismantling, fabrication/regeneration, reuse, recycling and disposal.

For the preparation of the inventory, a questionnaire survey was conducted for households (income class wise), businesses (business type wise) and public facilities regarding the number of years of usage of EEEs (Conducted during June/2007 to November/2007).[8] The survey collected data on number of years of usage for new purchases and purchase of used items. However, as the purchase of new items was 88% for households, 81% for businesses and 71% for public bodies indicating a high ratio, discussion is being done for new purchases[9].

[7] Tomohiro Tasaki Research Report from the National Institute for Environmental Studies, Japan, No.191, 2006

[8] Department of Environment Malaysia, E-waste Inventory Project in Malaysia 2008
http://www.env.go.jp/en/recycle/asian_net/Project_N_Research/Asia_E-waste_Project.html

[9] The number of years of usage for low income households for PC is 1.3 and lower than other groups. However for purchase of used PC, the number was 5 years. Further, for mid-level income group, A/C is used for only 1 year, but for used A/C the number is not available.

Table 3-4 Average Years of EEE Usage in Households (2007)

Item	High income	Mid- level income	Low income
TV	10.8	9.2	9.9
Refrigerator	8.2	8.1	10.8
Washing machine	8.7	5.7	7.6
Air conditioner	9.2	5.2	5.7
PC	5.2	4.7	1.3
Cell phones	2.9	3.1	3.1

Note : High income: Monthly income over or equal to RM5000,Mid level income : RM1200～RM4999, Low income: Less than or equal to RM1999
Source: Department of Environment Malaysia, E-waste Inventory Project in Malaysia, 2008

Table 3-5 Average Years of EEE Usage by Companies and Organizations (2007)

Item	Public bodies	Small scale	Mid scale	Large scale
TV	5.9	6.8	5.5	3
Refrigerator	5.2	6.4	7	8
Washing machine	11	7.3	11	4.5
A/C	2.8	6.1	1	5.3
PC	5.3	5.4	4.6	6.2
Cell phones	4.3	3.8	5.5	3

Note: Small scale – employees 5-50, Mid scale – employees, 51-150, Large scale – employees over 150
Source: Department of Environment Malaysia, E-waste Inventory Project in Malaysia, 2008

The following conditions have been set for TVs, air conditioners, refrigerators, washing machines, PCs, cell phones, and cell phone charges.

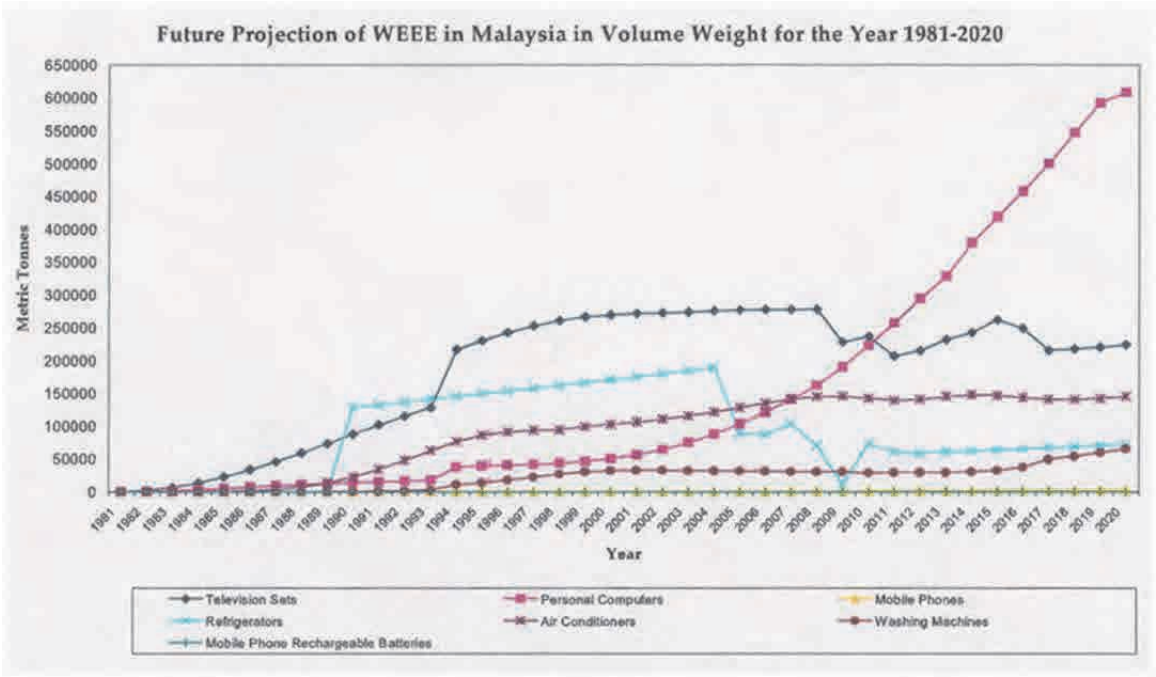
- Estimation based on sale amount for 1995-2004 and population growth rate
- Assume that 80% of domestically produced EEEs are sold domestically with the remaining 20% being stored for some reason (does not meet the need of owners, price is too high, etc)
- For previous sale estimations (1891-1994), the population growth rate of 2.6% for that period is used.
- For future sale estimations (2005-2020), the population growth rate of 2.2% for the period 2003-2005 is used.
- Data on the amount of waste for used products is absent. Hence, it is included in the E-waste generation amount from 1985
- Generation amount is estimated based on the product wise ratio of the owners (households, businesses, public bodies)
- Average product weight set for each product (TV=35kg, PC=30kg, Cell phones = 0.1kg, Refrigerators = 70kg, A/C= 60kg, Washing machines = 50kg, Chargers for cell phones = 0.01kg)

As a result, the amount of E-waste generation based on weight, as shown below, is predicted to be 797,000 tons in 2013 and 1,120,000 tons in 2020.

Table 3-6 Estimated Amount of E-waste Generation in Malaysia (Weight Base)

Year	TV	PC	Cell phones	Refrigerator	A/C	Washing Machine	Rechargeable batteries	Total
2010	236,817	222,820	795	73,457	142,982	29,299	125	706,295
2011	206,739	256,981	1,030	60,900	139,516	29,710	146	695,022
2012	215,176	294,339	1,276	59,057	140,935	29,633	169	740,585
2013	231,750	328,479	1,514	60,889	145,559	29,497	191	797,879
2014	242,320	379,142	1,726	62,554	148,226	31,205	211	865,384
2015	261,837	418,897	1,892	64,100	146,878	33,153	229	926,986
2016	249,030	457,581	2,004	65,756	143,483	37,805	242	955,901
2017	215,387	500,212	2,078	67,465	140,810	49,818	253	976,023
2018	217,758	546,937	2,136	69,219	140,501	54,362	262	1,031,175
2019	220,712	592,359	2,192	71,019	142,402	59,847	269	1,088,800
2020	224,226	608,191	2,249	72,866	145,495	65,853	275	1,119,155

Source: Department of Environment Malaysia, E-waste Inventory Project in Malaysia, 2008



Source: Department of Environment Malaysia, E-waste Inventory Project in Malaysia, 2008

Figure 3-8 Estimated Amount of E-waste Generation in Malaysia (Weight Base)

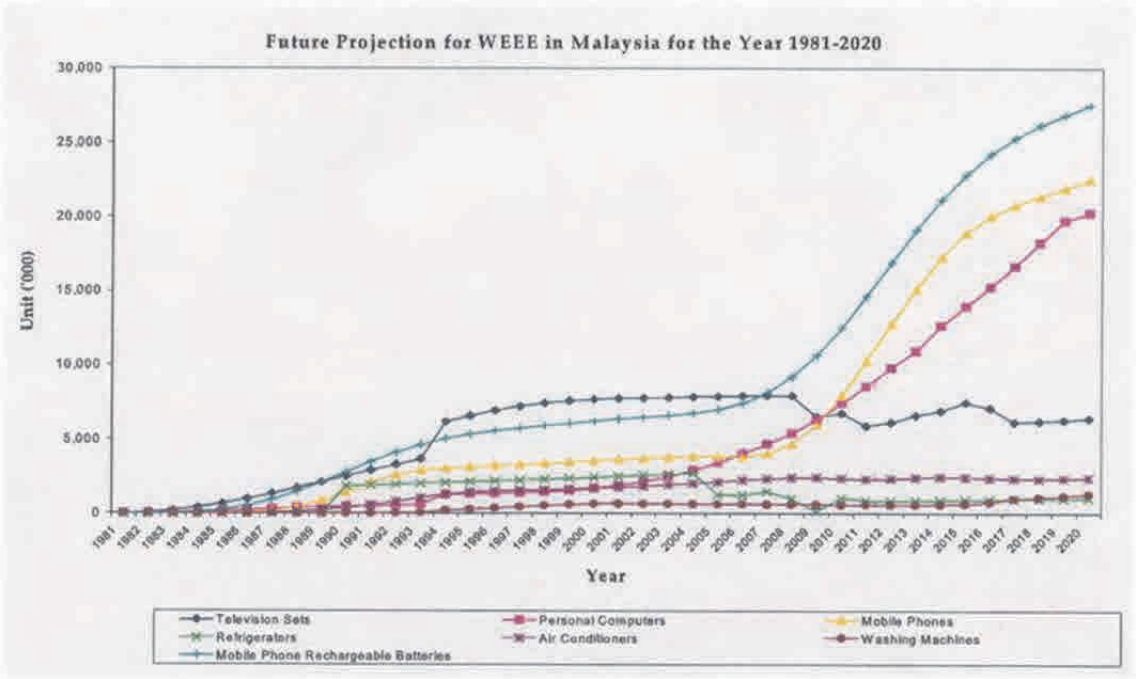
The generation of E-waste, (number of units based) is estimated below. The number for 2013 is estimated to be 17,130,000 for 2013.

Table 3-7 Estimated Amount of E-waste Generation in Malaysia (Number of Unit Base)

Unit: 1000 units

Year	TV	PC	Cell phones	Refrigerator	A/C	Washing machine	rechargeable battery
2010	6,766	7,427	7,948	1,049	2,383	586	12,510
2011	5,907	8,566	10,300	871	2,325	594	14,635
2012	6,148	9,811	12,764	844	2,349	593	16,898
2013	6,621	10,949	15,140	870	2,426	590	19,123
2014	6,923	12,638	17,256	894	2,470	624	21,149
2015	7,481	13,963	18,915	916	2,448	663	22,868
2016	7,115	15,253	20,040	939	2,391	756	24,245
2017	6,154	16,674	20,779	964	2,347	996	25,316
2018	6,222	18,231	21,363	989	2,342	1,087	26,161
2019	6,306	19,745	21,922	1,015	2,373	1,197	26,870
2020	6,406	20,273	22,492	1,041	2,425	1,317	27,513

Source: Department of Environment Malaysia, E-waste Inventory Project in Malaysia, 2008



Source: Department of Environment Malaysia, E-waste Inventory Project in Malaysia, 2008

Figure 3-9 Estimated Amount of E-waste Generation in Malaysia (Number of Unit Base)

The data presented is based on the survey of 2007 and hence its renewal is recommended.

The survey for the preparation of the inventory (interviews, questionnaires) and the method of estimation is summarized in the "Guideline on Development of E-waste Inventory" and this methodology can be used for the estimation of future generation amount in this study too.

E-waste generation estimate by UNU

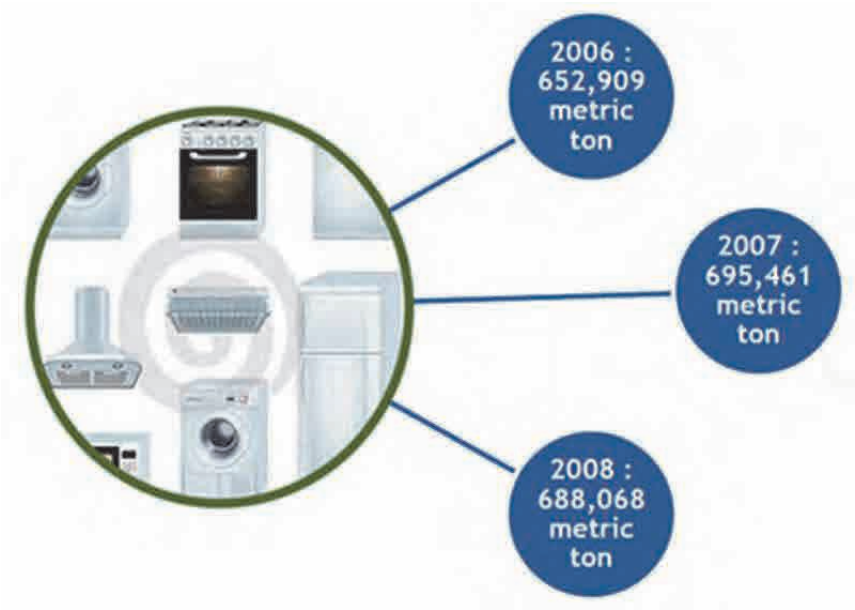
The StEP (Solving the E-waste Problem) organized by the United Nation University (UNU) in December 2013 has published data of StEP E-waste World Map. Annual data from 184 countries have been collected and a country wise E-waste generation amount has been reported.[10] The amount

[10] StEP, World E-waste Map Reveals National Volumes, International Flows Dec. 21 2013
http://step-initiative.org/index.php/newsdetails/items/world-e-waste-map-reveals-national-volumes-international-flows.html

of generation of E-waste in Malaysia for 2012 is 289,320 tons. Further, the amount of EEEs manufactured in the same year is 415,050 tons.

Electrical and electronic waste that falls under the WEEE regulations of EU is included as the target along with small household electric appliances (e.g. vacuum cleaners), toys, leisure goods, sports/games (video games etc). Only the E-waste produced domestically is included and the import/export amount is excluded. The StEP indicates that in the countries where the market for EEEs is not saturated, the amount of waste is being over estimated. The country wise data is being calculated by referring to the correlation with global data.[11]

As various differing numbers exist, it is necessary to estimate the generation amount based on the latest data. There are different estimations for the E-waste generation data. The figure below is E-waste generation data from households issued by DOE. It shows that the E-waste generation in 2008 is 688,000 ton.



Source: Presentation by DOE[12]

Figure 3-10 Generation of E-waste from Household in Malaysia

The table below summarizes the several currently available data of E-waste generation estimation. Although some of the data do not clarified target products therefore it cannot be compared simply, 688,000 ton in 2008 (not limited to white goods) is generated, 289,000 ton and 465,000 ton in 2012-13 respectively, and 740,000t in 2019 is expected. The estimated data are mixed in this way, newly estimated value based on the updated data is necessary by examining and clarifying target products, estimation methods, and referenced data. It is expected that the estimation values could be different according to various condition settings, but it is important to analyze E-waste generation for the necessary policy intervention and related infrastructure planning such as future estimation of amount of collected E-waste and recycling facility scale determination.

[11] StEP, E-waste World Map, Malaysia, http://step-initiative.org/index.php/Overview_Malaysia.html
[12] Policy update from Malaysia (Director of DOE Hazardous Substances division)

Table 3-8 E-waste Generation Estimation in Malaysia

Data source	Year	E-waste generation amount
E-waste project	2010 2013 2019	10,784,000 units (480,000t) 10,507,000units (465,000t) 10,888,000units(492,000t)
METI survey	2019	19,093,000units (740,000t)
United Nations University	2012	289,000t
DOE	2008	688,000t

Note: Underlined figure means all type of E-waste including white goods

c. E-waste Flow from its Generation to Material Recovery

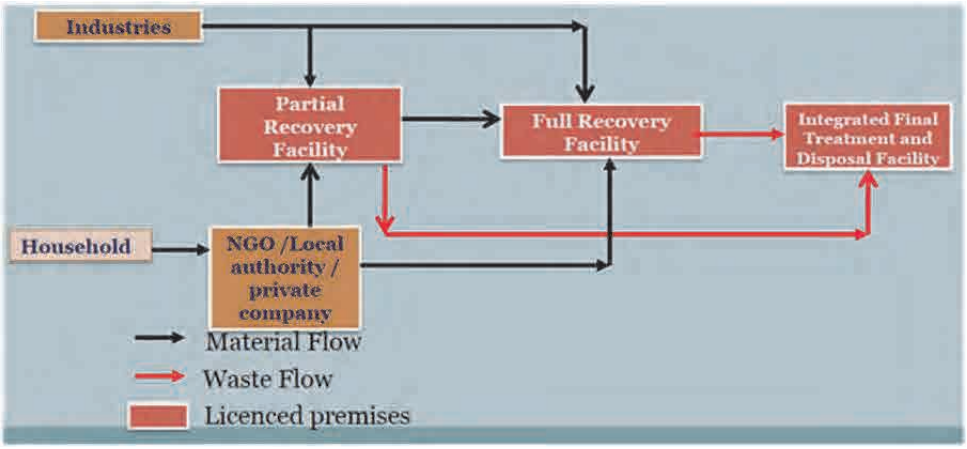
E-waste flow from its generation to material recovery is as follows.

Flow from its generation to treatment (material recovery) facilities

E-waste generated from industrial process and households is received by collectors with/without payments, then transported to material recovery facilities and dismantled and separated into plastic, steel, electronic substrate, etc at the material recovery facilities.

There are 2 types of material recovery facilities[13] including partial recovery facility (PRF) and full recovery facility (FRF) in Malaysia where E-waste is registered as SW110 for more efficient recycling. The PRF conduct only pretreatment on the other hand the FRF conduct whole process including pretreatment and precious metal recovery. This kind of categorization of treatment facilities is unique to Malaysia.

The primary collection from the E-waste generation points is conducted by several channels including dealers and municipalities. There are two cases in ways of they do; 1) a generator brings E-waste to a collector; and 2) a collector come to a generator to pick up E-waste.



Source: DOE presentation by Norazlina Bintiti Ab Halim

Figure 3-11 E-waste Flow in Malaysia

In case of large size E-wastes, a staff of retailers takes the E-waste when delivering purchased products to household, or some of the informal sector visits households to pick up large size E-waste. Although some informal sectors obtain license of PRF or license of collector/transporter to collect

[13] According to the presentation by DOE made in July, 2013, Partial recovery is defined as small and medium size operators engaged in physical or manual segregation of E-wastes for further processing while Full recovery is defined as which can process the E-wastes to recover the precious metals. (http://www.epa.gov/oita/regions/Asia/taiwan/iemn-pdfs/malaysia.pdf)

E-waste registered as SW110 legally, in most of the cases, their environmental countermeasure in their pretreatment process is not adequate. Furthermore, many collectors/transporters in the informal sector are not specialized for E-waste, but usually dismantle E-waste generated from industry by hands and sell them to the FRF or illegally export to China.

d. Scale of Concerned Parties and Technological Level in Each Stage of the Flow

Collectors

Although there are many unclear sides in the scale of collectors for E-waste collection from households, current status in E-waste collection in Malaysia is as follows.

Among E-waste from households, large size E-waste is collected by staffs of dealers or informal sector that visit households and collect. In other cases, collection is being done by SW110-licensed collector/transporter.

There are 98 businesses that obtained PRF license nationwide, but some individuals/businesses conduct E-waste collection and treatment without license. Most of the PRF and informal sector do simple dismantlement by hands, separate valuable resources such as steel, plastic, and electronic substrate, and then sell these to FRF. Although some of the PRF have aluminum compactor or copper cable stripper, most of them do not have this type of equipment, therefore the amount of E-waste treated in this process is considered to be several tons per day [14].

Recycling facilities and final disposal

According to DOEs information issued in July 2013, there are 146 E-waste recycling facilities in Malaysia and the amount of E-waste that can be treated is 24,000 ton[15]. As described above, E-waste are dismantled and separated in PRF/FRF. Parts separated in each recovery facilities are homogenized and foreign body are removed to the level at which could be used as recycled material, then steel, aluminum, plastics are sold to users. Among the parts collected from E-waste dismantling and separation, electronic substrates go through precious metal recovery process in most cases, many FRF have this process and extract precious metal to the extent economically viable.

Precious metal recovery in FRF in Malaysia are conducted through hydrometallurgy process in most cases therefore metals able to be recovered are limited to copper and gold and are of low purity as much as 99%. Most commonly found metals in the international market are of high purity as 99.999%, so-called triple 9 and it is necessary to introduce smelting process but there is no smelting furnace currently exists in Malaysia. Also technology to recover various metals from residue after the process has not been established yet[16]. Therefore, for obtaining the sufficient purity, segregated metal fraction originated from E-waste is mostly exported to overseas such as Belgium, Germany and Japan.

The metal recovery process from electronic substrates generates residues that need environmentally sound final disposal. The final disposal site licensed by DOE for the hazardous waste is operated by Kualiti Alam Sdn Bhd. Kualiti Alam owns incinerator and landfill site for final disposal. Although the specific data on how much of E-waste is treated and disposed by them is not available, epoxy resin generated after shredding and separation of electronic substrates are being treated and disposed by them.

[14] An unlicensed recycler in Johor is treating two tons of E-waste daily. A junk shop is accepting 50 pieces of E-waste daily in other case.

[15] Policy update from Malaysia" presented at USEPA organized workshop in July 2013says E-waste recovery facilities in Malaysia with the total capacity to handle more than 24,000 metric ton of E-waste per month. Official statement regarding treating scale in fist mentioned in this document.

[16] "E-WASTE MANAGEMENT IN MALAYSIA" presented in the UNEP/IETC and Global Environment Center(GEC) organized Regional Workshop on WEEE / E-waste Management in Osaka, Japan, on 6-9 July 2010 mentioned "the main technology employed to recover E-wastes in terms of precious metals in Malaysia is still limited to wet chemical processes and electrolysis."

e. Monetary flow

At present, the monetary flow relating to trade of E-waste is based on market principle in Malaysia. The majority of E-waste generated from households is purchased either by the informal sector, collection and transportation companies or the partial recovery facilities that have license from the DOE. The purchase of E-waste is also being carried out at buy back centers operated by concessionaires (e.g. Alam Flora) that are licensed to collect municipal solid waste.

Buy-back center

Buy back center in KL Putrajaya area is accepting various recyclable items including E-waste and offering the prices as shown in the table below. Basically almost same prices are offered both to white goods and ICT equipments.

Table 3-9 E-Waste Purchasing Price at Buy-back Center in Putrajaya

Item	Purchasing price
TV(CRT)	
TV(flat)	4RM
Refrigerators	5RM
Washing machines	—
A/C	—
PC(CPU)	5.5RM
Monitors for PC	4.5RM
PC (notebook)	3.5RM
Cell phone	—

Retailer

When E-waste is brought in by customer, voucher equivalent to the following prices are offered. Basically almost same prices are offered both to white goods and ICT equipments. It can be considered that this is done for aiming at the recovering the required cost by attracting equally valuable ICT equipments and less valuable white goods.

Table 3-10 Purchasing Price Offered in Pilot Project Penang

Item	Purchasing price	Voucher amount	Portion born by recycling facility
TV(CRT)	5 RM	3 RM	8R M
TV(flat)	15 RM	5 RM	20 RM
Refrigerators	15 RM	5 RM	20 RM
Washing machines	15 RM	10 RM	25 RM
Air conditioner	15 RM	10 RM	25 RM
PC (desktop)	10 RM	10 RM	20 RM
PC (notebook)	10 RM	10 RM	20 RM

Pilot project

In the Pilot project, higher prices were offered to the white goods than ICT equipment.

Table 3-11　Purchasing Price Offered in Pilot Project Penang

Table. Expected participation rate to the Pilot Project

	Price in the Pilot Project (RM/unit)	Price of the conventional recyclers (RM/unit)	Expected participation rate to the Pilot Project (%)
Television (CRT)	12	10	59
Television (Non-CRT)	15	10	74
Refrigerator	10	15	33
Washing machine	10	15	34
Air-conditioner	20	62	16
PC (Desktop/ CRT)	5	11	23
PC (Desktop/ Non-CRT)	5	11	23
PC (Notebook)	5	12	21
Mobile phone	4	0	100
Printer	1	ND	ND
DVD player, etc.	2	ND	ND
Others	0	ND	ND

(Summarize based on survey of the purchase price by the informal sector)

Junkshop

Junkshops handling scrap materials including E-waste were surveyed in Penang. Most of the junkshops do not have the proper license. But the activity they normally do is similar to what Partial Recovery Facility conducts like dismantling E-waste and segregating metal and plastic fraction.

At junkshop, about 50 pieces of E-waste is normally collected by a junkshop per one month.

Table 3-12　Selling Prices of Separated Parts or Other Material by Junkshop in Penang

Item	**Purchasing price**			
	Example 1	Example 2	Example 3	Example 4
TV (Large)	8-10RM	5-10 RM	5RM	3-10 RM
TV (Medium)	5RM			
TV(Small)	3-4RM			
Refrigerator	15-20 RM	20 RM	10-15 RM	10-15 RM
Washing Machine	10-15 RM	20 RM	10RM	10-15 RM
A/C	1.8 RM/kg	60-80 RM (2.4-3.2RM/kg)	50RM (2.5RM/kg)	2 RM /kg

Selling prices of separated parts or other material by junkshop are shown in the table below. Most of the junkshop are dismantling manually and segregating metal and plasstic parts without any special equipments or proper guard.

Table 3-13　Selling Prices of Separated Parts or Other Material by Junkshop in Penang

	Selling prices of separated parts or other material
Example 1	・Print circuit board : 0.9-1.0 RM /kg ・Plastic: 0.7 RM/kg ・Iron:0.7-0.8 RM/kg
Example 2	・Plastic: 0.6-0.7 RM/kg (About 300 kg sold in a week) ・Iron:0.7 RM/kg (About 500kg sold in a week) ・Aluminum: 4 RM/kg ・Cable: 10 RM/kg ・Print circuit board : Not sold
Example 3	・Print circuit board : 1RM/kg ・Plastic: 0.7 RM/kg ・Iron:0.5 RM/kg
Example 4	・Print circuit board:8 RM/kg ・Coil board:0.8 RM/kg

Junkshop 1

Junkshop 1

Junkshop 2

Junkshop 2

Junkshop 2

Junkshop 2

Having surveyed some junkshop, it became clear that in most of the cases junkshop are purchasing E-waste regardless any type with mostly same prices. After the purchase, they only segregate the precious parts and sell to the market to earn the revenue and basically other non sellable parts like CFC and lead glass are simply stored or somehow disposed. This purchasing base activity shows only valuable E-waste and its valuable fraction are targeted and sold to the market and other non valuable parts are left aside which might eventually cause some pollution or hazard to the human health.

Relation between profits from selling recovered materials from recycling and treatment costs

There are 3 types of money transaction involved with E-wastes: 1) the money paid by households for removing E-wastes away, 2) the money paid by collectors for purchasing E-wastes from households, and 3) the money paid by recycling facilities and others to collectors for receiving E-wastes originated from households.

These moneys are basically for the labor cost for collection and the values of metals inside of E-wastes but are not the money paid for environmentally sound treatment. As described above, white goods that contain very few precious metals and basic metals can earn very little profit from segregating and selling themselves. In addition, they require more costs when chlorofluorocarbons (CFCs), waste oils, and lead-containing glasses are treated properly. Since the owners of E-wastes still receive money, it indicated that environmental protection measures are not taken and not been paid.

An example is shown below.

A refrigerator contains 53% of iron and 10% of aluminum weight wise. If a refrigerator weighs 58kg per piece, iron is 30kg and aluminum is 5.8kg, and sold at the prices below.

・Iron scrap (Excellent quality H2) = approximately 29 yen/kg (record high in a month)

・Aluminum scrap (mechanical cast) = approximately 115 yen/kg (record high in a month)

Even though the sales profit fluctuates, roughly 875 yen from iron and 66.7 yen from aluminum, total of 942 yen can be earned from selling one piece of refrigerator. On the other hand, there is a need for properly treating unsalable parts and items. One study estimated that 1,669 yen is required to properly treat refrigerator's CFCs for coolant and insulations. [17] Since 0.95 kg of CFCs is used for one piece of refrigerator, the treatment cost of CFC is estimated to be 1,585 yen.[18] Additionally, proper treatment of waste oil (freezer oil), transportation cost, dismantling and segregation costs or

[17] Ministry of the Environment of Japan technical consultation working group meeting

[18] Collection records of CFCs, Recycling records of Home Appliances, Association for Electric Home Appliances, http://www.aeha.or.jp/recycling_report/03.html

fixed costs for treatment facilities are still needed; simply put, their proper treatment cost is much higher than their sales profit. Therefore, it is very difficult to cover transportation and environmental protection costs by profit from selling recovered materials.

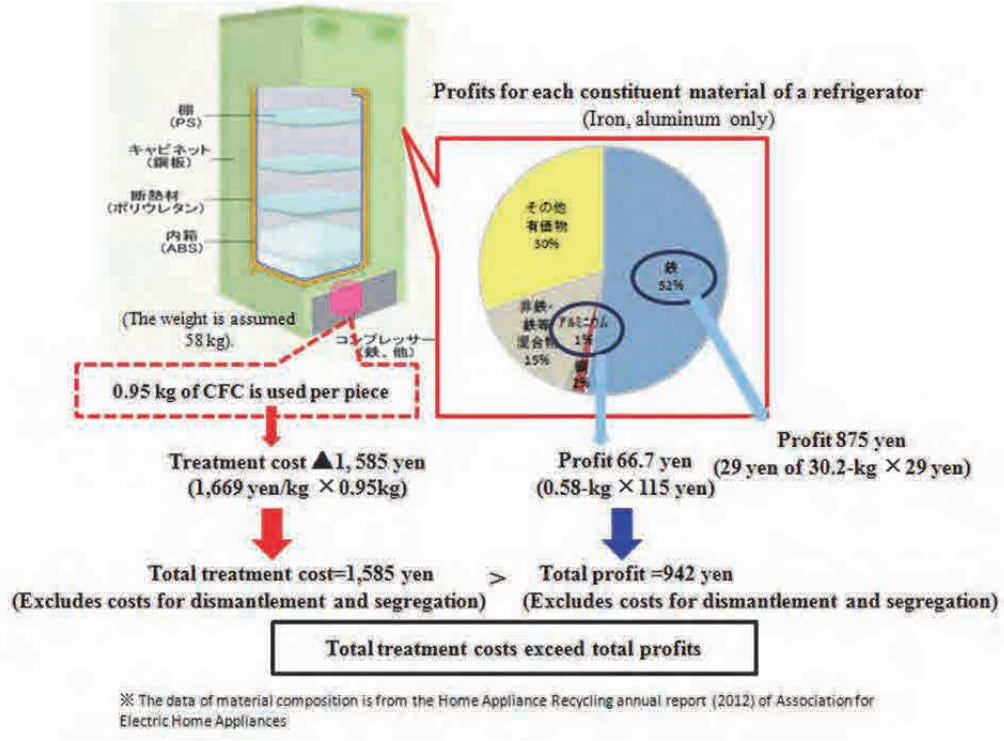


Figure 3-12 Relationship between Treatment Costs and Profits from Selling Recovered Materials from White Goods (Refrigerator as an Example)

3.1.4 Efforts of Stakeholders

Activities of stakeholders relating to collection and treatment of E-wastes are summarized below. These stakeholders include manufacturers of electric and electronic appliances, retail stores, other private enterprises, environmentally active citizen groups and leaders in the region.

a. Voluntary Activities of Private Companies

In Malaysia, manufacturers of electrical and electronic appliances conduct several activities in coordination with vendors and supermarkets for collection.

Case 1 (activities by Toshiba)

Toshiba has started its own Toshiba Voluntary E-waste Take-back Scheme from February 5, 2013 before JICA's pilot project has ended, and ended it at the end of July 2013.

This scheme selected 14 retailers as primary collection points (12 retailers' information appears at the website) in Johor Bahru, Penang, and Klan Valley (KL Capital region), and Shan Poornam as a recycler as JICA pilot project has selected.

Table 3-14 List of Retailers Cooperative to Toshiba's Voluntary Collection

Toshiba Notebook, HDD & Projector Takeback Points

Penang

Shop Name	Address
Gadgetzone Prangin Mall	33-04-57, Prangin Mall, Jalan Dr Lim Chwee Leong, Georgetown, 10100, Penang
NC Computer Nanyang	33-04-92A, Prangin Mall, Jalan Dr Lim Chwee Leong, Georgetown, 10100, Penang
Gadgetzone One Stop	488B-G-17 &18, One Stop Centre, Midlands Park, 10350, Penang
Mindmaker Sg. Dua	65-G-08, Jalan Sungai Dua, Gelugor, 11700, Penang
E Tech Bukit Jambul	3A, 4-157, 164 & 165, Kompleks Bukit Jambul, Jalan Rumbia, 11900, Penang
Tele Dynamics Sdn Bhd (Penang)	Wisma Perkeso Pulau Pinang, Level 2 (Left Wing), Block B, No.269, Jalan Burma (Pulau Tikus) 10538, Georgetown, Penang

Selangor

Shop Name	Address
Fosa Marketing Sdn Bhd	G10, Ground Floor, Digital Mall, Petaling Jaya, Selangor
Tele Dynamics Sdn Bhd (HQ)	No.4, Jalan Saudagar U1/16, Seksyen U1, Hicom Glenmarie Industrial Park, 40150, Shah Alam, Selangor

Wilayah Persekutuan

Shop Name	Address
Fosa Marketing Sdn Bhd	Lot G17, Ground Floor, Low Yat Plaza, Jalan Bukit Bintang, 55100, Kuala Lumpur
Tele Dynamics Sdn Bhd (Low Yat)	Lot 4-20, 4th Floor, Low Yat Plaza, Jalan Bukit Bintang, 55100, Kuala Lumpur

Johor

Shop Name	Address
Grex Multimedia	IT-S3-1, Level 3, IT Plaza, Skudai Parade Shopping Complex, 81300, Skudai, Johor
Tele Dynamics Sdn Bhd (JB)	Suite 16-04, Level 16, Menara MAA, No.15, Jalan Dato' Abdullah Tahir, 80300, Johor Bahru, Johor

Source: Toshiba website[19]

Basic scheme was that vouchers are provided by retailer as Pilot Project in Penang as a financial incentive to consumers. When they take in E-wastes to the stores, received voucher for it. On the other hand, when E-wastes are collected by the pick-up service provided by retailer to the customer house on call, no voucher is given. The collected E-waste is to be sent to recycling facilities. Targeted items are personal computers, white goods, such as TVs, washing machines, and refrigerators as targeted by the Pilot Project. The vouchers were simplified based on the experience and lessons learnt from the Pilot Project.

[19] http://www.teledynamics.com.my/about-us/go-green-program/toshiba-voluntary-e-waste-takeback-scheme

Table 3-15　Explanation of Targeted Items and Collection Method

List of Electronic Waste Accepted		
Product Category	Product Accepted	Takeback Scheme
Consumer Electrical and Electronics	Television, refrigerator and washing machines 	Free collection of old appliances upon delivery of purchase of new home appliances only (Refrigerator, TV & WM)
IT and Telecommunication Equipment	Notebook , tablet, portable hdd, project	Carry-in only by customers

Source: Toshiba Voluntary E-waste Take-back Scheme Introduction leaflet

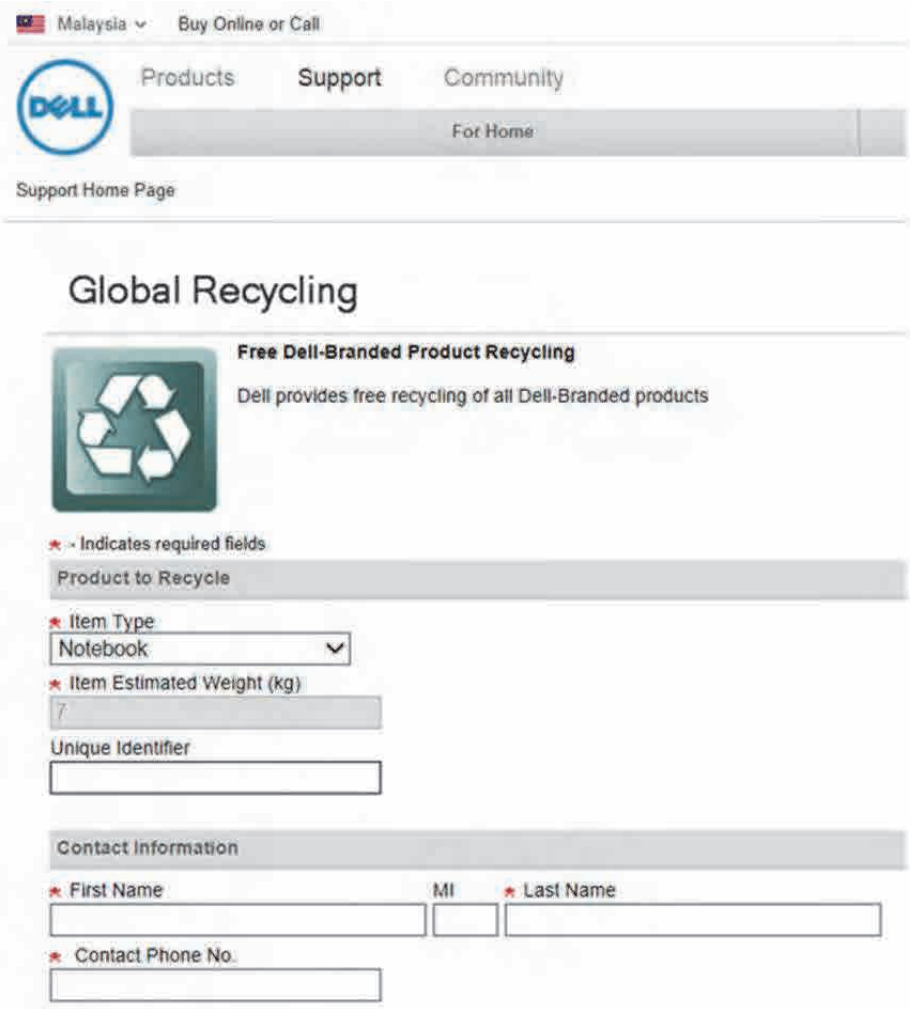
According to an interview with Toshiba, as the result of 5 months collection activity, even though retailers as primary collection points were quite effective, it was evaluated that the number of collected items were far less than originally expected. The reasons are that there is no incentives for retailers to actively participate in the scheme since it was voluntary not legally obligated, that the amount to be collected was quite limited, and that the number of items collected by recycling facilities are limited due to the fact that there is no obligation to transfer collected E-wastes to recycling facilities.

Case 2 (Activities by Dell)

As a U.S. PC manufacturer, Dell provides service to collect used PCs when consumers purchased their products and received their delivery. Since April 2007, Dell Malaysia started collecting monitors, printers, and other accessories in addition to used desk-top and notebook PCs. Since November 2012, they are in cooperation with Penang State government (MPPP) at Penang Island to rollout “Computer Recycling Program.”

Dell also has service to take back old PCs through their website, called “Dell's free Mail-Back Recycling program.” Consumers only need to fill in names, addresses, types of PCs, model numbers, or desirable collection dates at their website and can receive collection service which uses free home pick-ups.

It should be noted that such free collection service is possible since PCs are small in size and contain useful precious metals inside.



Source: Dell website, Global Recycling

Figure 3-13 Information Entering Page of Dell's Free Mail-Back Recycling Program

It should be noted that such free collection service is possible since PCs are small in size and contain useful precious metals inside.

b. Cooperation with Retailers

Activities by Senheng

Senheng, the largest electronic and electric appliances retailer in Malaysia, started E-waste collection activity from December 2013 through 136 stores nation-wide. Targeted items are small size E-wastes, such as mobile phones including smart phones, PCs, tablet PCs, LCD monitors, DVD/VCD players, printers, and projectors as category A, and large and heavy items, such as TVs (CRT, LCD, LED, Plasma), refrigerators, washing machines, and air conditioners, as category B.

As shown below, if a product from the category A is taken back to a store, consumer receives a voucher; if a product from the category B is asked to be taken away from the consumer on a request at home for free of charge, consumer will not receive any voucher.

Source: leaflet made by Senheng

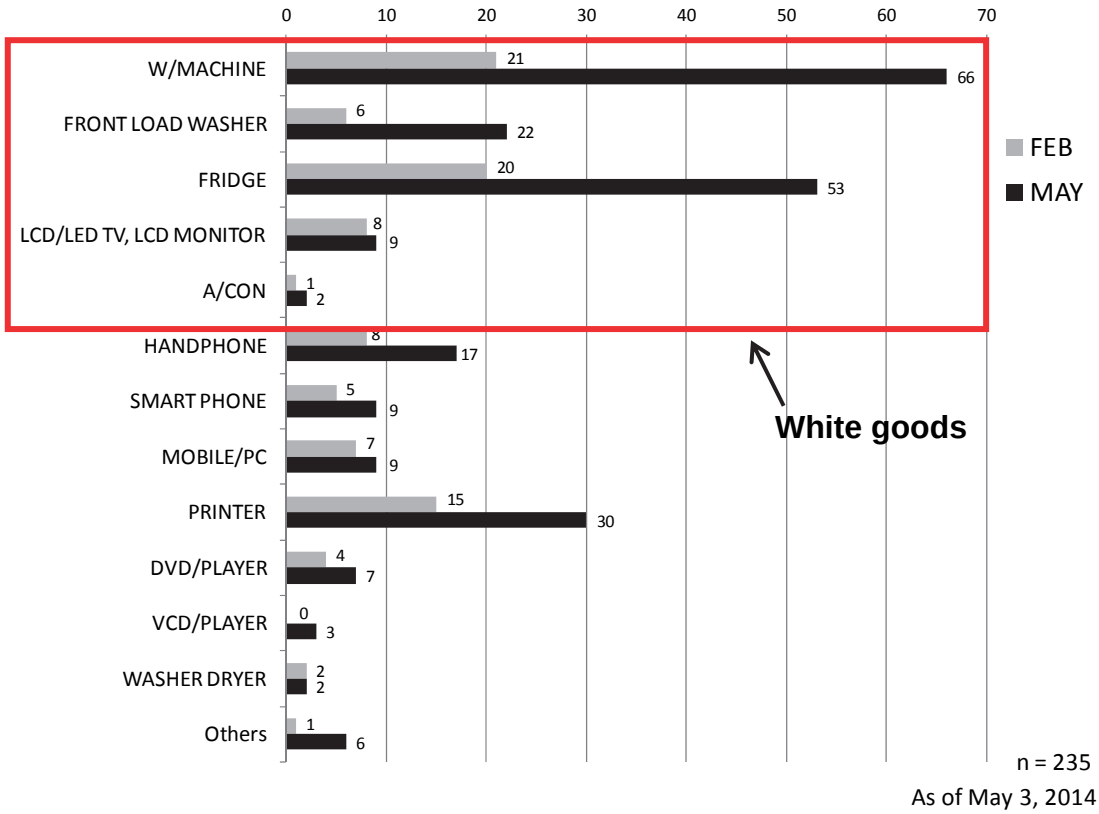
Figure 3-14 E-waste Collection Method by Senheng

The number of E-wastes collected since December 2013 is shown in the figure below. 235 pieces of E-wastes are collected in 5 months, and more than 60% of them were white goods. Washing machines are collected most, next to refrigerators. There is no CRT TV, and slim LCD TVs are relatively small in numbers. Items other than white goods, such as PCs and mobile phones are around 10 to 20 pieces.

Possible reasons for these trends are as follows.

- When white goods become unwanted but not being able to sell off, the service to take away these items immediately is considered very useful for creating space and for keeping house clean.
- The service to take away white goods for free can be incentives for consumers to disregard.
- In general, since telecommunication equipments, such as mobile phones and PCs, are already traded in used product markets at relatively high prices, there was no incentive to bring in these items.

While there are consumers who wish to sell at the time of E-waste's discard, there are also other consumers who hand over E-wastes for free. Also, it is clear from this activity that primary collection by retailers is very effective.



Note: The number in May includes the volume in February. For example, the total collection is 66 pieces for washing machines.
Source: Summary based on the data provided by Senheng

Figure 3-15 Numbers of E-wastes Collected by Senheng (in Feb and May 2014)

c. Involvement of Citizen Groups and Environmental Leaders

In Malaysia, there are examples of cases whereby the public has carried out voluntary activities to promote collection of E-wastes, or religious groups have been involved in the collection of recyclable resources including E-wastes for philanthropic purposes. These activities are limited to some parts of the country; however, there is a good possibility that these activities might spread across the country. There are many primary collection activities through many different channels, such as these activities led by NGOs, retailers and other private enterprises.

According to the draft E-waste management regulation, DOE examines possibility of use of multiple channels collection, including collection by NGOs, charity organizations, in addition to retailers and municipalities, for the primary collection. DOE also plans to develop a measure to register formal collectors by introducing relevant requirements. Since NGOs such as PEWOG and other Buddhist organizations have experience in E-waste collection, it is possible that they match DOE's regulating requirements, and become cooperative to E-waste collection activities.

d. Record of Collection Campaigns Carried Out by the Local Governmental Bodies

By MPPP(Municipal Council of Penang island) initiatives for the recycling of PC has started from 2004. This is being carried out with cooperation from computer manufacturer (Dell), shopping centers (Sunshine) and recycler (IRM). MPPP is acting as the project proponent. PCs (including monitors) that do not belong to Dell are also collected. The generator brings the PCs to a community collection facility where it is weighed and a gift voucher (which can be redeemed at Sunshine) corresponding to the weight is provided. The voucher can be used at the shopping centre. From 2004 to 2010, a total of 120 tons of PC have been collected.

Source: Digest from the presentation "WEEE RECYCLING TECHNOLOGY IN MALAYSIA" by Reclaimtek[20]

Figure 3-16 Scene at E-waste Collection by MPPP

The role of MPPP is to support collectors by promoting and subsiding activities. Collection activity by ICT mall, which is a local shopping mall specialized in PC equipments in Penang, is one of the examples other than activities led by PEWOG as seen above.

Announcement of E-waste buy-back activity

A poster which introduces activities posted inside the store

3.1.5 Introduction of Technologies and Infrastructure Development

This section summarizes the technology and infrastcture for collection, treatment and disposal of E-waste currently introduced in Malaysia.

a. Recycling and Collection Infrastructures

In Malaysia there are cases where E-waste is collected with the proper license from the government and cases where collection activity is done informally (without license). In this section, only the licensed cases are discussed.

[20] Presentation used at "Asian Electrical and Electronics Green Society 2009" held in Bangkok on Oct. 8th, 2009.

Buy back collection facilities

If waste collection by municipality is covered by the central government, concessioners contracted by the central government establish buy-back centers for recyclable resources including E-wastes.

Buy-back center operated by a concessioner[21]

Basically, the recyclable resources brought into buy-back centers are purchased. Received items are different at each center; however, centers take in items including E-waste, such as PCs (desktop and notebook), PC monitors, and even TVs, refrigerators, and microwave ovens. Purchasing prices are that CPUs are 5.5 RM (approx. 170 yen), monitors are 4.5RM (approx. 140 yen), and notebook PCs are 3.5 RM (approx. 109 yen).

Purchase price list of E-wastes (excerpt of PCs)

Purchase price list (item-wise)

At the website of the DOE, in addition to buy-back centers above, 71locations of collection centers for household E-wastes are listed publically. There is also information of locations, operating hours, accepted items by the states. At the same website, mobile phones, mobile's batteries, PCs and accessories, and TVs are listed as acceptable items[22].

[21] Regulation for Recycling E-waste/ WEEE Sept, 2010, Michikazu KOJIMA (http://www.unep.or.jp/ietc/spc/news-jul10/JETRO_(Dr.%20Kojima).pdf)
[22] Website of DOE

Table 3-16 List of Collection Points (Partial Excerpt from DOE's Website)

LAMPIRAN A

Senarai Pusat Pengumpulan E-Waste

No.	Negeri	Pengendali	Lokasi Pusat Pengumpulan E-Waste	Waktu Operasi	Adakah Menerima Buangan E-Waste?	Jenis E-Waste Yang Diterima
1	PULAU PINANG	MAJLIS PERBANDARAN PULAU PINANG	Sunshine Jelutong, 9-27, Jalan Lenggong, 11600 Jelutong	Setiap Selasa kecuali hari cuti umum 7.00 ptg– 10.00 ptg	Ya	TV, komputer, Radio, barangan elektronik
2			Sunshine Farlim Hypermarket, No.1, Lintang Kg. Melayu, Bandar Baru Ayer Itam (Farlim)	Setiap Khamis kecuali hari cuti umum 7.00 ptg– 10.00 ptg	Ya	TV, komputer, Radio, barangan elektronik
3			Stor Pembersihan Kg. Jawa Baru, MPPP Stor, Jalan Kg. Jawa Baru	Setiap Jumaat kecuali hari cuti umum 3.00 ptg – 5.00 ptg	Ya	TV, komputer, Radio, barangan elektronik
4			Bahagian Perkhidmatan Perbandaran, MPPP, Jalan Padang Kota Lama	Setiap Jumaat kecuali hari cuti umum 3.00 ptg – 5.00 ptg	Ya	TV, komputer, Radio, barangan elektronik

In the case that the federal government does not cover waste collection service, local municipalities establish their own collection points (drop off centers[23]) for collecting recyclables.

One of the examples is the case of Subang Jaya in Selangor state. The municipality has established approximately 20 collection points as their own; E-waste from household are also included in the target items. The city of Subang Jaya only provides the facility and commissions to resident associations for operation of the facility. It is also possible for resident association to further commission to third-party as actually done by some municipalities.

Usually they do not buy back resources including E-wastes; however, there are cases in which municipality or resident association buy back on their own decision. In such cases, the profit belongs to resident associations.

At the collection points in Subang Jaya City, there are 4 components such as papers, plastics, glasses, and metals, and E-wastes are collected along with batteries as others. If citizens take in E-wastes during its operational hours (9:00 to 17:00), they can receive benefits. If citizens take in E-wastes after its operational hours, they will not receive any benefits.

The buyers of the collected resources are determined by resident associations. Since it directly affects association's income, they try to sell to the buyer with a highest price. Whether the buyer possesses E-waste recycling license, nor do they have facilities with environmental protections are not taken into account at the time of sales.

The collection record of 2013 is as follows.

- 26,033 tons of E-wastes as a whole (2,070 pieces of PC monitors, 165 pieces of other E-wastes)
- 5,841 kg of waste batteries are collected.

(http://www.doe.gov.my/webportal/en/info-untuk-industri/pengumpulan-dan-kitar-semula-e-waste-barangan-rumah/)

[23] It is called drop-off centers since people drop off resources. They are sometimes called recycling centers; however, they do not engage in manual dismantling but only segregation.

Model of drop-off center in Subang Jaya

Model of drop-off center in Subang Jaya

In fact, there is no plan to actively collect florescent lamps and mobile batteries as a municipality. DOE has distributed collection boxes to all cities for collection of batteries; however, since the obligation to transport collected lamps and batteries to Kualiti Alam for treatment is placed on each municipality at their own cost, there are no collection boxes these days due to the difficulty to fund such activity by municipalities.

Recycling facilities

In Malaysia, recycling facilities for scheduled wastes are required to acquire licenses for each treated items. There are 6 types as described in the above section and recycling facilities are the largest in amount. Since E-waste was added into scheduled wastes in 2005, the number of E-waste related recycling facilities increased.

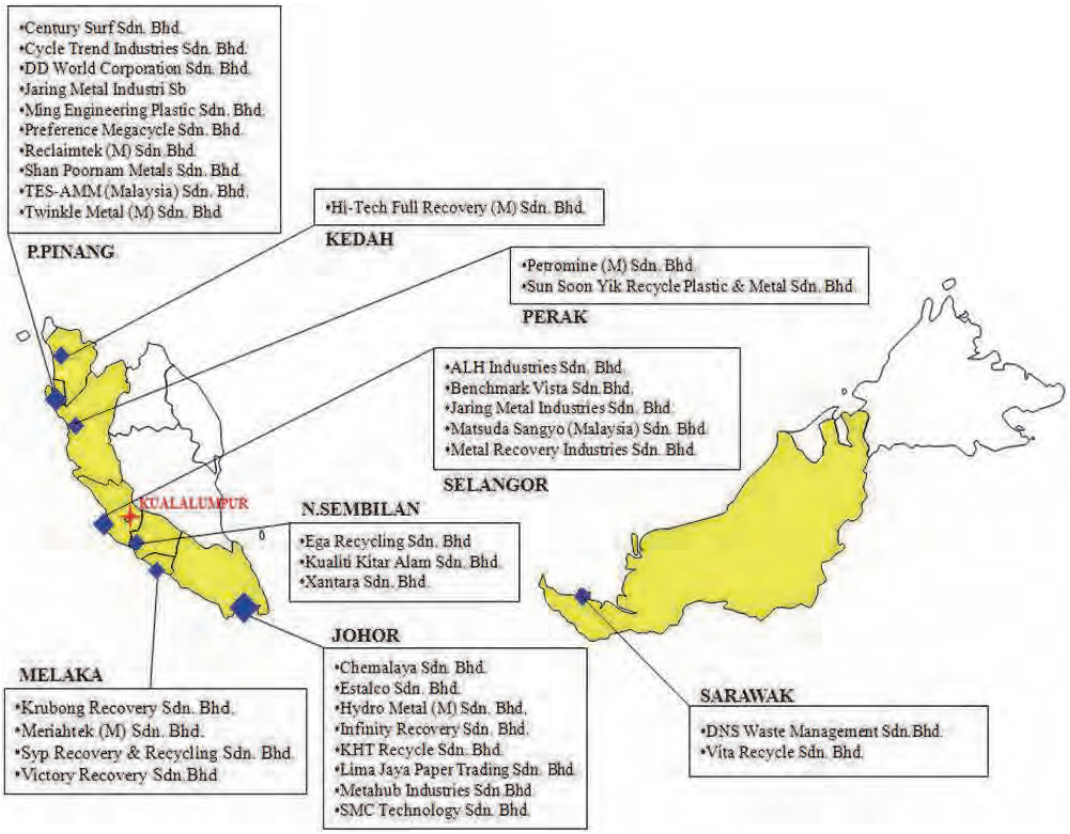
The number of licensed E-waste recycling facilities by states is show in the table below. There are 35 full recovery facilities (FRF) nationwide, and there are many facilities in Penang, Selangor, and Johor. These facilities mainly treat E-wastes from factories, and they are established in the areas where there are many manufactures since they are main sources of E-wastes.

Table 3-17 Companies licensed for SW110 (E-waste) in Malaysia

State	Partial recovery	Full recovery
JOHOR	12	8
KEDAH	13	1
MELAKA	11	4
NEGERI SEMBILAN	2	3
PERAK	2	2
PULAU PINANG	**21**	**10**
SARAWAK	6	2
SELANGOR	24	5
PAHANG	1	0
KUALA LUMPUR	6	0
TOTAL	**98**	**35**

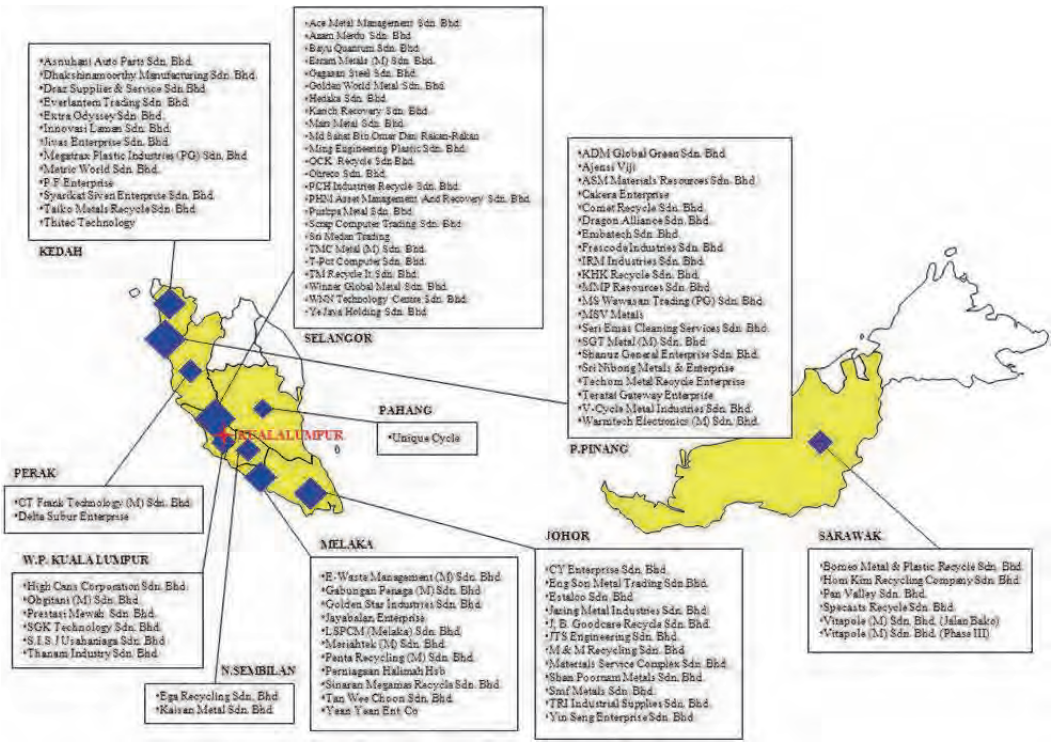
Source: DOE documents (May 2014)

The locations of full and partial recovery facilities are shown in the drawing below.



Source: Drawn based on the document provided by DOE (As of May 2014)

Figure 3-17 Locations of Full Recovery Facilities



Source: Drawn based on the document provided by DOE (As of May 2014)

Figure 3-18 Locations of Partial Recovery Facilities

Each FRF is different in terms of treatment process, capacity, or received items. Some facilities with high capability have accepted many factory wastes from manufacturers including Japanese manufacturers. On the other hand, there are also some FRF which only conduct simple manual dismantling and segregation, and selling irons, plastics, aluminum parts, or printed circuit boards. The level of treatment is the same with partial recovery facilities (PRF).

In fact, all the recovery facilities do not treat white goods from households on a daily basis with few exceptions. Therefore, necessary treatment infrastructures for white goods have not been developed. There are cases in which some FRF conducted feasibility studies for establishing treatment infrastructures for white goods to examine technical and financial aspects.

Moreover, DOE consigned a benchmark study targeting FRF to an external research organization and summarized the outcome of the study in February 2014.[24] The study was conducted for the reasons below.

- To determine the standards regarding environmentally sound management (ESM) of E-waste recovery facilities in Malaysia
- To identify appropriate technologies and methods to promote ESM in Malaysia
- To identify policies to promote ESM during operation at E-waste recovery facilities in Malaysia

DOE already learned the treatment capacities and technical levels of 35 FRF (the list is shown in Annex) from the study above and identified facilities capable of environmentally sound recycling.[25] Some of the features existing facilities have are shown in the table below.

Table 3-18 Current Status of Infrastructure for Treatment of E-waste at Full Recovery Facility

Facility	Treating process
A	• Treats E-waste generated from manufacturing process and collected from all around the country. Main item is the defect off specification hard disk. • Recovers copper, aluminum, gold, silver and palladium from the E-waste. • Owns in-house laboratory to conduct sample analysis and generator set as the back-up power.
B	• Treating printed circuit board to dismantle IC chip mounted and to be input to Pyrolysis furnace for recovering precious metal. • Large size item like server, controlling devise for telecomm industry are treated manually by ten working staff. • Print circuit board after the mounted chips are taken is crushed and shredded into 2 cm size and further shredded to smaller size to recover copper and plastic through metal separator and eddy current separator. • Shredded circuit board is treated to recover gold by cyanide and gold and silver through electroplating process as well as gold, silver, platinum and palladium through precipitation process. • Exported item to Singapore is only lithium ion battery and other fraction is treated in Malaysia.

[24] A report named “Preparation of Guideline on Environmentally Sound Management Criteria for Recovery Facility of E-waste” was prepared in February 2014.

[25] In the presentation document by a DOE officer at “The Asian Network for Prevention of Illegal Tran boundary Movement of Hazardous Wastes” in Bangkok, Nov. 2013, this study is explained as “A study on waste recovery facilities with objectives to develop ESM criteria for those facilities, to determine the best method /technology that suits Malaysian scenario E-waste quantity financial technology and to determine the future direction of E-waste management in the country”.

Facility	Treating process
	• Products through the process are gold, silver, platinum, palladium and copper purity to be recovered 99.9% and purity is relatively lower comparing with internationally accepted criteria. • In the factory, small size item dismantling, print circuit board dismantling, acid melting, cyanide stripping, electroplating equipment are installed. • Used printer, mobile phone, hard disk drive are treated and aluminum, rubber, glass, iron are segregated through the process.

b. Disposal of Final Residue

Disposal at hazardous waste final disposal site

Out of the 3 private companies involved in the disposal of scheduled waste, 1 facility is Kualiti Alam and the others mainly dispose of waste plasters. For incinerators, only three are present (if medical waste incinerators are excluded) out of which 1 is Kualiti Alam and the rest are involved in the treatment of waste oil. Besides this 6 companies are registered as cement kiln licensees. It can be seen that Kualiti Alam holds a very important position in the treatment of scheduled waste.

This company was established in 1991 and holds an unrivalled position in the Malaysian peninsula as an offsite treatment facility. In 1995 the company received the monopolistic enterprises rights for a period of 15 years from the government to dispose all types of scheduled waste. In 1998 the construction of all its facilities was completed making giving it the capability to comprehensively treat all types of scheduled waste. It owns following treating technology and capacity.

Figure 3-19 Technology and Capacity at Kualiti Alam

Facility	Capacity
Incinerator	30,000t/year, 24 hr continuous operation
Physical-chemical treatment facility	5000t/yr, 8 hour operation
Solidifying facility	20,000 t/yr, 8 hour operation
landfill	260,000 m3 or 1,600,000 tons
Leachate treatment facility	300m^3/day

The incinerator is a rotary kiln type and is equipped with quenchers, activated carbon/calcium hydroxide injector, bag filter and scrubber in order to satisfy the European standards for incinerators. Measures against Dioxins are also present and it can treat whole drums of waste directly.

The floor of the facility is completely paved with concrete. Waste is brought-in inside drums in principal and a large space is devoted for storage. The electrical and measurement apparatus are dual type and safety measures are of the same level as chemical plants.

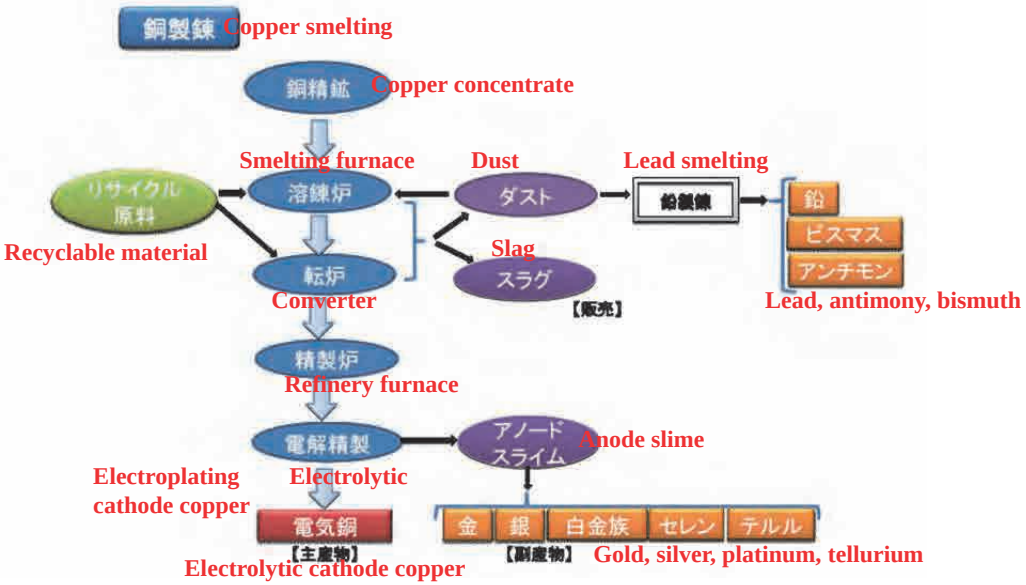
Further, operational characteristic includes the fact that the flow from waste intake to treatment is highly systematized, the facility is equipped with laboratory and the staff is highly trained. The drums that are brought in are visually inspected, sampled, managed by bar codes on drums and the result of chemical analysis for each drum is stored. The treatment is carried out after considering the lab data and the best combination for adequate treatment. The storage time is also recorded. The level of management of waste is excellent and even exceeds the standard at some Japanese industrial waste treatment facilities. The treatment cost (including transportation) differs according to the type of waste, but on average is about USD 500 per ton, a number even higher than that of Japan. Although no acceptance criteria for landfill exists in Malaysia they have their own internal criteria: inert, chemicals stabilized by metal oxides or metal hydroxides, waste is not active physically or chemically, the waste is either sludge or solid and inorganic in nature, TOC is less than 10% (dry). TCLP test is carried out for the waste that is to be landfilled.

Source: Website of Kualiti Alam

Table 3-19 Overview of Hazardous Waste Final Disposal Facility in Malaysia Called Kualiti Alam

Possible environmentally sound recycling at non ferrous smelting facility

At non ferrous smelting facility like copper smelter can accept such precious metal containing electronic scrap as used print circuit board dismantled from E-waste and use as recycling material to recover gold, silver, palladium and other type of precious metal. Residual material resulted from copper smelting furnace can also be input to lead smelter to recover such rare earth metal as lead, antimony and bismuth. Like this case, separate smelters are sometimes collaborated to maximize each capacity to recover as many type of metal as possible.



Source: Rare earth metal working group document organized by the Ministry of the Environment WG5

Figure 3-20 Case Of Copper and Lead Smelting Process[26]

In the partnership program where different stakeholders both from private and public sector are working together called Partnership for Action on Computing Equipment (PACE) under the Basel Convention, a recycling process utilizing pyrometallurgical furnace is identified as one of the most recommended environmentally sound recycling process. However Pyrometallurgical furnace

[26] http://www.env.go.jp/recycle/recycling/raremetals/conf_ruca/05/mat03.pdf

requires large amount of capital investment and ample amount of material to be fed to sustain the infrastructure. For this reason, there is no such facility operated in Malaysia and thus existing recycling facilities in Malaysia need environmentally sound management of treating E-waste and sufficient pollution controlling measures in the recycling process.

3.1.6 Economic Measures

This section summarizes the economic measures to rationalize the return or investment on recycling facilities including the capability to cover cost for collecting E-waste and treatment, level of awareness.

a. Capacity to Bear the E-waste Treatment Cost

The table below shows that the middle class, comprised of upper and lower middle class, covers 67% of the population. Upper class covers 25%, a number very large compared with other ASEAN countries. The percentage of low-class income population is only 8% and this is lower than that of other ASEAN countries.

Table 3-20 Scale of Household Income in Major ASEAN Countries (2009)

	Upper class	Upper middle	Lower middle	Lower
Indonesia	1%	2%	33%	63%
Philippines	1%	6%	35%	58%
Vietnam	1%	1%	18%	80%
Thailand	3%	15%	46%	36%
Malaysia	25%	37%	30%	8%

Note: Low income: Annual household disposable income less than USD 5000
Lower middle: Annual household disposable income over USD 5,000 and less than or equal to USD 15,000
Upper middle: Annual household disposable income over USD 15,000 and less than or equal to USD 35,000
Upper class: Annual household disposable more than USD 35,000
Source : JETRO, January, 2011

According to Malaysia Dept of Statistics household income survey of 2012[27], the monthly income in 2012 is 5,000 ringgit, 7.2% higher than 2009 figure of 4,025 ringgit. The annual increase during 2007-2009 is 4.4% and hence the increase during 2009-2012 is much larger.

Having considered the factors described above, it can be considered that general affordability for E-waste recycling cost by Malaysian is relatively high as comparing to the citizens in other ASEAN countries.

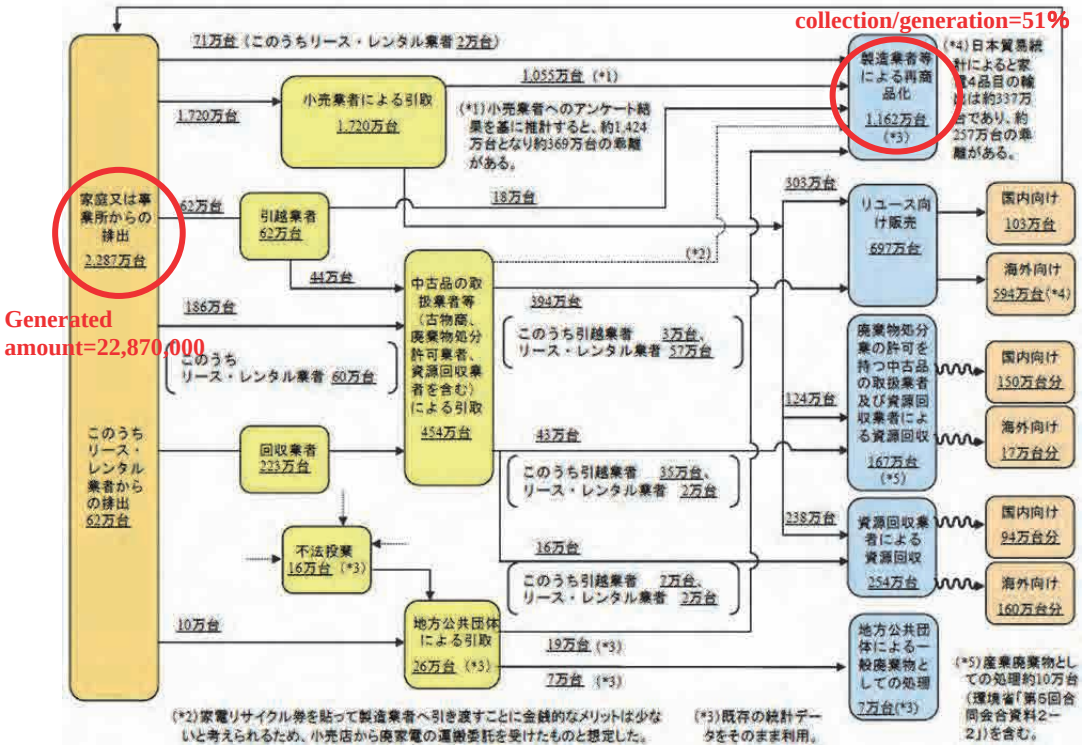
b. Systems Where Return on Investment Is Possible

In order to promote ESM of E-waste recycling, it is important to develop recycling facilities with appropriate capacity. The establishment of a collection mechanism to predict how much E-waste will be generated and the ability to recover the investment costs are important factors for identifying the sufficient capacity. This section discusses these aspects while taking into account the Japanese Law for the Recycling of Specified Kinds of Home Appliances as an example.

The figure below describes the flow of the Japanese E-waste recycling systems, the total amount of estimated E-waste generation and the collected E-waste based on the data from 2005. 22,870,000 units were generated and 11,620,000 were recycled.

[27] Malaysia dept of statistics “FINDINGS OF THE HOUSEHOLD INCOME SURVEY (HIS) 2012” http://www.statistics.gov.my/portal/images/stories/files/LatestReleases/household/HIS_2012_Eng.pdf

In Japan, there are 49 recycling facilities across the country (as of July 2013). The total treatment amount has remained stable at 1,100,000 to 1,200,000 units and the treatment amount per facility comes out to be about 224,000 to 245,000 units and the collection rate is estimated to be 51%.[28]



Source: home appliance law technical consultation meeting[29]

Figure 3-21 Flow of Used Home Appliances in Year 2005

In Malaysia, even though there is no previous statistical data available on E-waste generation or collection, the total generation of white goods (TV, refrigerator, washing machine, A/C) in 2013 is estimated to be about 10,507 units.[30] How much E-waste among them can be collected is depending on the retailers because they provide primary collection points at their stores and promote activities for consumers to participate in the proper recycling program.

Japan achieves a collection rate of 51%, and in order for Malaysia to attain the same collection rate, it is necessary to establish an effective collection mechanism and to encourage stakeholders to participate in the environmental activities. In addition, to develop facilities with appropriate capacity, it is important to be able to estimate E-waste generation and to form a systematic approach.

3.1.7 Social Responses

This section discusses social aspects like public consciousness towards E-waste generation and payment of the cost for the treatment and collection of E-waste, incentives and resources.

[28] According to the manufacturers and recyclers, recycling 200,000 units per year is considered to be the profitable line.

[29] Data comes from The Basel Convention called Environmentally Sound management E-waste in Asia Pacific

[30] According to the inventory organized based on the estimated data from the Basel Convention's project on Environmentally Sound Management of e-Waste in Asia Pacific the Basel Convention

a. Consumer Perception toward the Treatment and Generation of E-waste (Including Awareness Level towards Payment)

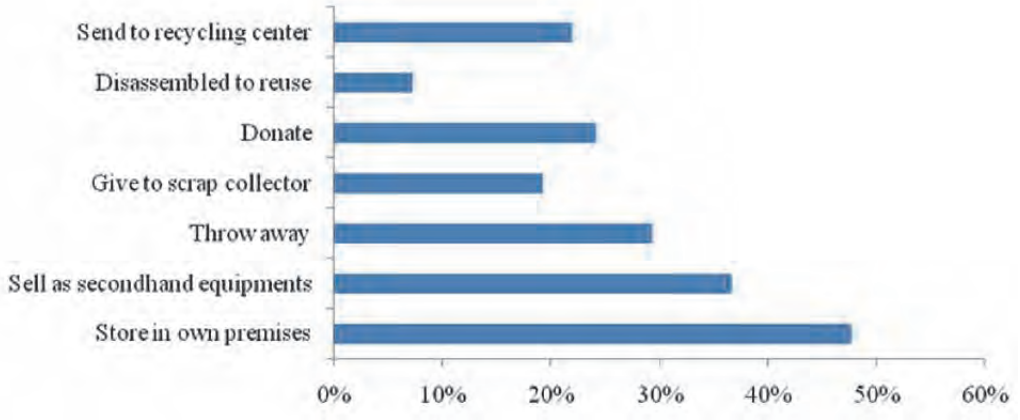
Existing survey 1

In 2010, Shah Alam City Council (MBSA) in Selangor State conducted a survey[31]on consumers' attitudes toward E-waste generation and treatment. The survey interviewed 300 consumers aged 18 to 50 years old, and the results are described blow.

When electric and electronic equipment were no longer used, 48% of the respondents answered they 'keep E-waste in their homes' and 37% of them answered they 'sell it as second-hand goods'. 25% answered 'other' including simple disposal (usage/disposal destination is unclear), donation, delivery to recycling facilities. The study suggests that many consumers keep, sell, simply dispose, or donate their unwanted electric and electronic equipment.

Regarding their knowledge of E-waste, 57% of the respondents have knowledge of E-waste issues while 43% answered they do not understand issues on E-waste. Also, many consumers answered that they do not have knowledge of appropriate E-waste treatment methods.

The study indicates that there is currently no convenient E-waste collection route existing and also there is not enough public promotion regarding appropriate handling methods of getting rid of unwanted E-waste.



Source: Junaidah Ahmad Kalana, DOE Electrical and Electronic Waste Management Practice by households in Shah Alam, Selangor, Malaysia INTERNATIONAL JOURNAL OF ENVIRONMENTAL SCIENCES Volume 1, No 2 ,2010

Figure 3-22 Treatment Method of E-waste

As for payment associated with E-waste transaction, many consumers expect to receive money when they generate E-waste. 13% of the respondents expect to receive 10 to 20% of the purchase price of them. On the other hand, 76% of the respondents answered it is alright not to receive money when they generate E-waste.

The study mainly indicates that consumers generally expect to receive a financial benefit rather than to pay money when they hand over their unwanted electric and electronic equipment to the third person. On the other hand, the study also shows that consumers have willingness to pay necessary and reasonable fees for the sake of space limitation in their home and keeping their home clean. Also, consumers expressed their concerns about environmental pollution caused by inappropriate treatment of E-waste.[32]

[31] Junaidah Ahmad Kalana Electrical and Electronic Waste Management Practice by households in Shah Alam, Selangor, Malaysia INTERNATIONAL JOURNAL OF ENVIRONMENTAL SCIENCES Volume 1, No 2 ,2010

[32] One conclusion reached in this survey is that domestic consumers prefer to get paid for getting rid of their ewaste, rather than for them to pay other parties to do so. On theother hand, households are willing to pay for the unwanted equipment to be taken away when the waste takes up space in their homes and becomes a visual disturbance to them. It seems that they are also concerned about whom they should sell the equipment to. The households would not mind

In Malaysia, consumers are allowed to sell their reusable E-waste; however, they are not fully-informed about the fact that ESM of E-waste, white goods in particular, requires additional cost and about the exact price they may need to pay. Consumers have a perception that they can simply sell their unwanted products.

As an implication of this study, it can be concluded that public promotion of the necessity of the recycling fee payment for ESM of E-waste with a careful and satisfactory explanation could raise consumers' awareness and change disposal behavior.

Existing survey 2

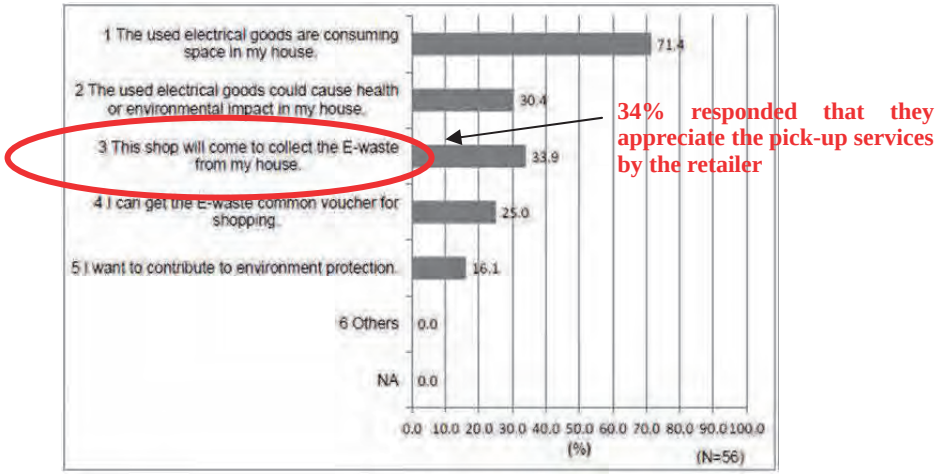
In 2013, the International Islamic University Malaysia conducted a study[33] on consumers' willingness to pay for recycling cost with the samples of 350 randomly selected households from 280,000 households living in KL, and findings from the 330 responses are presented below.

- 52.5% of the households are willing to pay the cost of recycling.
- 51.72 % of those who are not willing to pay the recycling fees prefer selling their used products to earn extra money.
- 27.6 % expressed that they cannot afford to pay the fees, and among them, 14.9% consider that "the polluter" should be responsible for bearing the recycling cost.

Among the households responded, more than half of them indicated their willingness to pay the fees, and it is considered to be a positive attitude toward establishing a sustainable recycling system.

Existing survey 3

In the Penang Pilot Project, there was a survey on consumers' awareness and many consumers found E-waste collection was satisfactory. 71 % of the consumers responded that it is beneficial to collect E-waste as WEEE are taking up a lot of room and also 34% found that the pick-up services by the retailers were helpful. Thus, the survey shows that consumers are generally appreciate the convenient pick-up services provided by retailers because it helps.



Source: Malaysia The Project for Model Development for E-waste Collection, Segregation and Transportation from Households for Recycling Final Report Annex IV

Figure 3-23 Reasons for Supporting the E-waste Collection

paying as long as the amount involved is reasonable, it can minimize wastage and help improve the environment. This shows that the respondents do have concerns or awareness on the environmental consequences of improper disposal of ewaste.

[33] Survey and analysis of public knowledge, awareness and willingness to pay in Kuala Lumpur, Malaysia e a case study on household WEEE management. Afroz, R., et al., 2013.

b. Aspirations and Understandings towards Environmentally Friendly Companies and Products

There have been a couple of studies on environmental awareness and purchasing green products.

A study on intentions to purchase environmentally friendly products[34]

Labuan School of International Business and Finance Universiti Malaysia conducted a survey research to investigate consumers' attitude towards purchasing environmentally friendly products and their environmental knowledge. The findings are presented below:

- The most significant factor to encourage purchasing of green products is to increase the consumers' knowledge of environmental issues.
- Eco-labeling is not effectively functioning since there are not many companies participated in that labeling system.
- Consumers with higher income have the ability to purchase eco-friendly products, but they do not particularly find these products are beneficial or purposely select green products as there is a lack of understanding of the eco-labeling system.

When there is sufficient information on the green products or technologies with an adequate labeling system and consumers will support purchasing of environmentally friendly products.

Consumer's environmental awareness[35]

Universiti Putra Malaysia conducted a study from Sep 2010 to March 2011on consumers' perceptions towards the environmental issues. The study targeted 1355 people living in 11 different states including Johor, Kelantan, Kedah and Melaka, and the findings are described below.

52.3% are familiar with the Green concept, and 37.7% said they have bought green products.

94% believed that eco-friendly lifestyles will contribute to the future environment, but 85.2 % think being green is expensive.

There was a strong correlation between age and education level in terms of practicing environmentally conscious lifestyle.

c. Incentives to Promote Collection

In the Pilot Project, vouchers were provided to those who cooperated with the recycling program as an incentive to encourage recycling via legitimate licensed recyclers. This approach was effective in increasing the recycling activities; however, some stakeholders pointed out that it is not a sustainable system as the recyclers are running the program at their own expense.

The E-waste management law that is currently being developed by DOE does not adopt the approach to promote collection as an incentive.

Providing convenient pick-up services could be another effective incentive for consumers. On the other hand, incentives for retailers to encourage E-waste collection should be included as they will be playing a significant role in primary collection

d. Research Resources to Enhance Policy Making and Technology Development

There have been several studies on the current status of E-waste in Malaysia and a direction of its management, and the government accumulates their results as resources in policy making. The

[34] Consumers' Intention to Purchase Green Product: Insights from Malaysia" World Applied Sciences Journal 22 (8): 1129-1134, 2013 http://www.idosi.org/wasj/wasj22(8)13/13.pdf

[35] Title of the research is Survey of Perceptions and Intentions Among Malaysian Consumers" International Business and Management Vol. 6, No. 1, 2013, pp. 104-112 and 1355 persons were interviewed. (http://www.cscanada.net/index.php/ibm/article/view/j.ibm.1923842820130601.1125/pdf)

studies are conducted by different institutes including the Department of Town and Regional Planning of Universiti Teknologi MARA (UiTM), the Universiti Putra Malaysia (UPM) and the University of Malaya. Some of these study results have been presented at the National Institute for Environmental Studies Workshop on E-waste.

Although there are not many studies related to the development of E-waste management policies, a benchmark survey was conducted by UKM Pakarunding (the National University of Malaysia). It was to evaluate the capacity of the domestic E-waste recycling facilities and the ability to ensure ESM of E-waste in Malaysia. DOE expressed that the study will support examining the establishment of new laws .

3.2 Thailand

Information on Thailand is summarized below.

3.2.1 Regulations, Policy and Institutions

The established legal system in Thailand, its national policy and the status of development are as follows.

a. Rules and Regulations, National Policy[36]

The legal system in Thailand is summarized below.

Table 3-21 Legal System in Thailand

Laws and Regulations	Contents
Act	This is the supreme legislation that undergoes Cabinet approval (Cabinet decision) and Diet approval. Collections of taxes and charges, etc. are also conducted based on acts.
Royal Decree	Royal Decrees are enacted after undergoing Cabinet approval. They establish the detailed rules concerning implementation of Acts.
Ministerial Notification	Ministerial Notifications are enacted after undergoing ministerial approval. They regulate the targets of various regulations, concrete procedures, and methods for augmenting Acts and Royal Decrees.

First, the supreme legislative systems concerning wastes in Thailand comprise the following two Acts.

Enhancement and Conservation of National Environmental Quality Act

The Enhancement and Conservation of National Environmental Quality Act B.E. 2535 was enacted in 1992 and establishes the basic legislative status of the environmental sector in Thailand today. Comprising seven chapters and 115 articles, this Act establishes provisions concerning establishment of the Environmental Fund and organizations such as National Environmental Board, Pollution Control Committee, etc., enactment of environmental standards, environmental impact assessment and so on. The main provisions related to wastes are as follows:

- Wastes are defined as all solid, liquid and gaseous wastes including urban wastes, kitchen wastes, wastewater, atmospheric pollutants, hazardous wastes, etc. (Chapter 4).
- The Environmental Fund that was established under this Act can be used to provide loans for construction of waste treatment facilities by the state, and construction of waste treatment facilities by local governments (Chapter 23).
- The Minister of Natural Resources and Environment, with the approval of the National Environmental Board, formulates environmental quality control plans that also include waste management (Chapter 36).
- Provisions related to waste management are Articles 78 and 79. Article 78 prescribes that collection, transportation, treatment and disposal of general wastes (wastes discarded from ordinary households, also referred to as municipal solid waste (MSW)) and other solid wastes being stipulated under related legislation. Article 79 grants the authority to the Minister of Natural Resources and Environment to promulgate provisions concerning identification and control of hazardous waste types while receiving advice from the Pollution Control Committee in cases where legislation is not separately established.

[36] This chapter summarized related materials in the METI's (Ministry of Economy, Trade and Industry) report, "Feasibility Study on Recycling Business of Waste Electrical and Electronic Equipments in Thailand."

Owners of pollution sources including wastes can request the government to provide support for the promotion of countermeasures. These regulations are also applicable to business operators that do not have any legal obligations (Article 94).

Public Health Act

The Public Health Act, which was enacted in 1992, targets general wastes and infectious wastes for control. It basically targets the wastes that are discarded from households.

Definitions of waste under this law comprise “waste paper, waste cloth, waste food, waste commodity, plastic bag, food container, soot, animal dung or carcass” but do not include so-called industrial wastes (hazardous wastes). This law stipulates that local governments are responsible for collecting and disposing these wastes (including non-hazardous and hazardous wastes discarded from households), and the collection and disposal of wastes are thus conducted as administrative services.

Moreover, the third revision of the Public Health Act conducted in 2007 stipulated the following:

- The definition of general wastes is changed to include hazardous wastes generated in local areas.
- Management of household hazardous wastes is made to be the responsibility of local governments.
- Local governments are permitted to consign activities to the private sector.

However, because no detailed rules are established concerning concrete methods, the Pollution Control Department (PCD) proposes the Code of Practice.

Regulations regarding E-waste

Since electrical and electronic wastes are usually regarded as hazardous wastes, the laws and regulations that pertain to hazardous waste management are shown below.

Legislation concerning hazardous waste management comprises the Hazardous Substances Act and the Factories Act as follows.

Table 3-22 Contents of Regulations regarding E-waste in Thailand

Related Laws and Regulations	Contents (summary of related parts)
Hazardous Substances Act	Hazardous Substance Lists are prescribed by notifications pertaining to the Hazardous Substances Act, and these also include E-wastes.
Factories Act	In cases where wastes including electrical and electronic equipment generated in manufacturing plants during manufacturing include hazardous substances, they are prescribed as hazardous wastes, and discharging parties are responsible for disposing them. Facilities that conduct the recycling of E-wastes are subject to the Factories Act. Accordingly, it is necessary to acquire authorization based on this Act concerning the location and operation of facilities.

Currently, based on the Factories Act, permission is granted to waste separation, landfill, reuse and recycling facilities and hazardous wastes are managed under Factory Codes 105 and 106.

WEEE, as a hazardous waste, is regarded in the same manner as other hazardous wastes; however, the requirements for authorizing WEEE recycling facilities and conducting authorization are not yet settled. Depending on the method of treatment, since WEEE, which is composed of numerous parts, can impart negative impacts on the environment and human health, it is possible that the requirements for authorization will be based on provisions of the current Factories Act while new

ministerial ordinances and notifications may be issued concerning additional pollution countermeasures .[37]

National policies regarding the management of waste electrical and electronic equipments

The first national level plan to be formulated in Thailand concerning electrical and electronic wastes was WEEE Strategy 2007.

On seeing the EU adopt the WEEE Directive and countries such as Japan, South Korea and China introduce and enact similar systems regarding the recycling of electrical and electronic wastes, the Thai Ministry of Industry formulated the National Integrated Strategic Plan for the Environmentally Sound Management of E-wastes and this received Cabinet approval. This strategic plan was the first policy to be adopted in Thailand concerning recycling of electrical and electronic wastes. An overview is given below.

Table 3-23 Overview of WEEE Strategy 2007 in Thailand

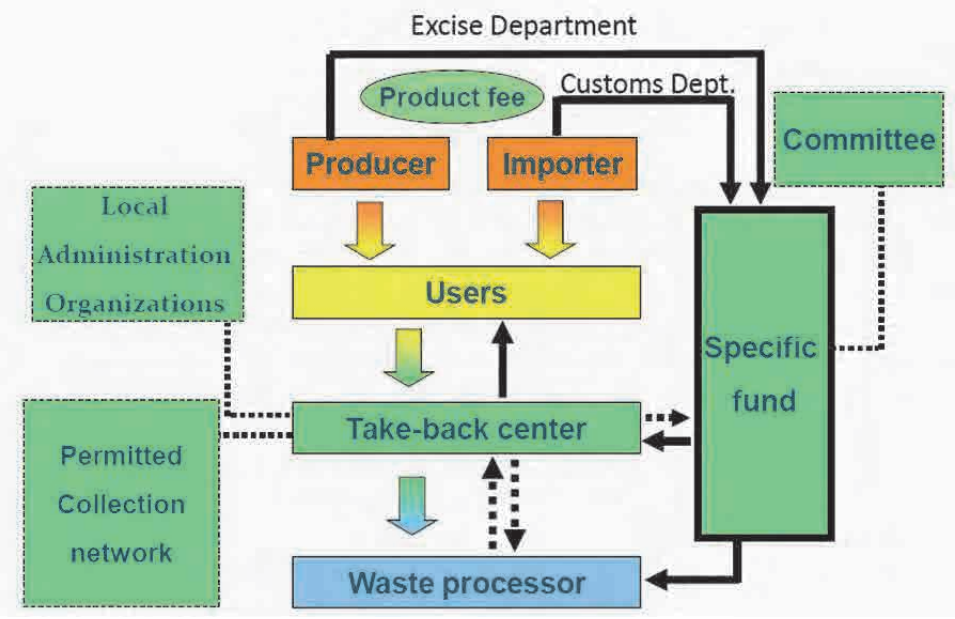
Objectives	• To manage domestic post-consumer WEEE in a scientific and systematic manner • To establish an efficient and sustainable WEEE management system with cooperation from every sector of society; • To reduce hazardous wastes from EEE at the origin and to encourage environmentally friendly design and production; • To enhance the competitiveness and negotiation power of the country in international trade; and, • To have nationwide efficient and effective integrated WEEE management by 2017
Targets	• An efficient and proper separation and collection system for priority WEEE with a collection rate no less than 50% of total WEEE arising by 2011 • An efficient recovery of resources from priority WEEE for reutilization with an average rate no less than 50% of total WEEE arising by 2011 • A WEEE treatment facility(ies) that can properly separate and recycle domestically generated WEEE • Electrical and electronic industries that adopt designs for disassembly and for recycling to improve their competitiveness in the global market • At least one hazardous waste management center that can receive HW from local governments by 2011 • An efficient and effective nationwide integrated WEEE management by 2017
Strategies	• Strategy1 : Developing appropriate technologies and practices to manage WEEE and to produce environmentally friendly products • Strategy2 : Enhancing capacity, learning and participation of stakeholders in WEEE management • Strategy3 : Strengthening law enforcement and developing a legal system for WEEE management • Strategy4 : Employing financial and fiscal measures to stimulate investments in the production of environmentally friendly products and in WEEE management • Strategy5 : Developing a comprehensive and efficient WEEE management system

According to this strategic plan, a subcommittee was established under the National Environmental Board (NEB) to deal with policy issues concerning WEEEs in Thailand. The following steps are required under this strategic plan.

Establishment of an economic regulatory mechanism: The Ministry of Finance and Ministry of Natural Resources and Environment will take the initiative in examining a mechanism for regulating

[37] An opinion expressed during the interview with PCD (Hazardous Waste Division Waste and Hazardous Substance Management Bureau) on Feb 08, 2012.

electrical and electronic wastes. They are considering establishment of a mechanism for transferring the cost of disposing waste onto product prices and using the resulting returns to set up a Government Fund for buying back WEEEs.



Source: "WEEE Management in Thailand," UNEP-IETC Workshop Presentation, July 2011

Figure 3-24 Overview of the Management Scheme on Waste Electrical and Electronic Equipments in Thailand

Listing of priority target products

When discharging waste, users sell waste products to buy-back centers operated by local governments and targeting the following product categories: 1) CRT and LCD TVs, 2) digital cameras and integrated video cameras, 3) portable media players, 4) printers and facsimiles, 5) mobile phones, 6) PCs (desktop and note), 7) air conditioners, 8) freezers and refrigerators, 9) fluorescent tubes, and 10) dry cell batteries. These categories were established in 2009.

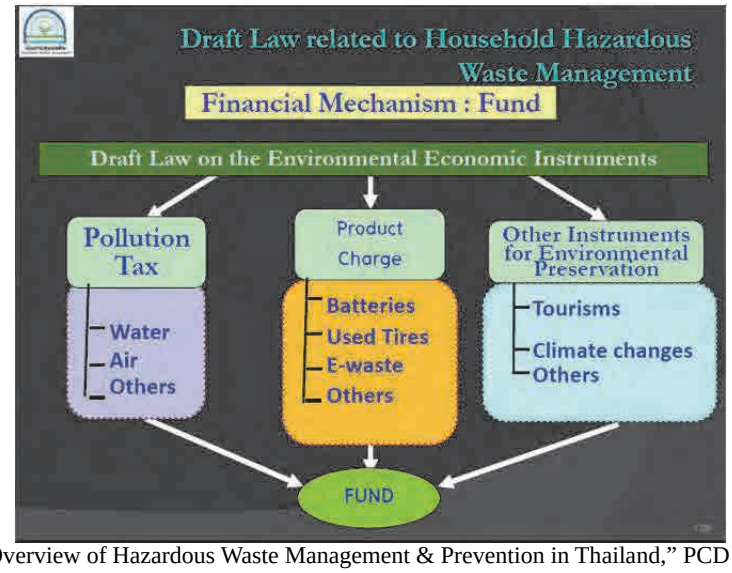
The product categories targeted for priority handling by the Subcommittee provided the base for the formulation of legislation concerning electrical and electronic waste management in Thailand, and a study regarding setting product price surcharges and recycling costs is consigned to the Pollution Control Department (PCD) and Environmental and Hazardous Wastes Management Center (EHWM) of Chulalongkorn University.

Related draft royal decree and ministerial notification

The following three bills have been drafted with a view to establish the economic regulatory mechanism, which is raised as one of the strategies in the WEEE Strategy 2007.

The superior legislation is the Draft Act on Fiscal Measures for Environment, and the legislations based on this comprises the Subordinate Laws in Accordance with the Draft Act on Fiscal Measures for Environment and the Royal Decree Prescribing Rules, Procedures, Conditions and Management of Revenue Generated from Products Fees .[38]

[38] PCD translated the Royal Decree into Thai and English.



Source: PCD, "An Overview of Hazardous Waste Management & Prevention in Thailand," PCD Website[39]

Figure 3-25 Overview of the Drafted Royal Decree prescribing Financial Mechanism

The draft version of the "Royal Decree Prescribing Rules, Procedures, Conditions and Management of Revenue Generated from Products Fees" is composed as follows.

Collection method of "product fees"

- Product fee: money collected from producer, importer or consumer of the product, part of it to be utilized in the management of the used product. (introduction)
- In case the products are manufactured in Thailand, product fee shall be paid when the products are taken out of the industrial factory. In case of imported products, product fee shall be paid simultaneity with the liability to pay the customs duty. (Chapter 1)

Buy-back centers

- The buy-back centers and buy-back center network shall be under the supervision and control of the local administrative organizations. Regulations regarding numbers of buy-back centers, set up and operation license of centers, revocation and reissuance of licenses, etc. (Chapter 8)

Management of used products

- The buy-back centers shall buy back used products at the rates established by the fund committee. The buy-back center is forbidden to dismantle parts of used products, and shall not discard or discard waste into public space or any other places. (Section111)
- The producer and importer shall have the duty to provide the information about proper treatment of used products, including the information about the parts and materials used in the production of the products and how to dismantle correctly. (Section 112)
- The entrepreneur of the factory processing used products and waste according to the factory laws shall have the duty to report to the fund on the quantity of used products obtained from the buy-back centers and used products undergoing lawful management. This shall include the quantity of used products delivered to other factories for recycling, and treatment or disposal. The report shall contain the data about the transport, separation, reuse, recycling, treatment or disposal of used products obtained from the buy back centers or from other factories. (Section 113)

[39] http://infofile.pcd.go.th/mgt/HWM_111053.pdf

The draft Royal Decree thus stipulates the identification of producers who must pay the product fees and the procedure for payment, etc. It also prescribes about the various requirements and obligations of buy-back centers. In addition, concerning the facilities that process used products (recycling facilities), it requires them to report information concerning the received and processed quantities of waste products and the destinations (downstream facilities) they send them to. Overall, because it doesn't concretely stipulate about product fee amounts and the technical requirements for recycling facilities, the specific details are expected to be established in notifications in the future.

Current status of policy implementation[40]

Enactment status of the draft E-waste laws

The Draft Act on Fiscal Measures for Environment, which is the superior legislation drafted by the Ministry of Finance, still shows no sign of enactment even in 2014. As for the economic regulatory mechanism that has been examined according to a draft bill based on the superior law, the aforementioned fund mechanism, whereby E-waste treatment costs are added to product prices and the returns are used to buy back E-wastes, has been proposed; however, its introduction appears difficult at the present time. The idea has not been completely abandoned. However, it will be necessary to conduct more detailed analysis of the recycling and management costs that need to be paid into the fund. In particular, concerning the engineering and operation costs for recycling facilities, it is hoped to obtain cooperation from producers and recyclers. In the absence of a system for granting collection licenses to the private sector and a lack of recycling facilities for handling E-waste from households, it will be difficult to introduce this scheme.

In the case where approval is not granted for the E-waste buy-back fund system, as an alternative, the PCD is considering the establishment of a WEEE recycling management system based on Royal Decree or ministerial ordinance separate from supreme legislation. In that case, since it will not be possible to levy costs, the responsibility for taking back and recycling wastes based on EPR will be placed on producers. If such a system is established, producers will have to independently implement take-back and recycling system without depending on a fund .[41]

Draft WEEE Management Strategy Phase II

Since the first WEEE Strategy targeted the period up to 2011, it is now undergoing comprehensive review and the second phase is planned. Experts of Chulalongkorn University and Mae Fah Luang University view the achievements and issues of the first WEEE Strategy as follows.

Table 3-24 Recapitulation of the WEEE Strategy Phase I in Thailand

Achievements	• Improving LCA and eco-design for Thai EE industry • Pilot projects on used FLs & capacity building of local government on HWM • Preparation for developing Thai-WEEE law ➢ Identifying 10 priority product groups ➢ Studying product fees & procedures for buy-back operation ➢ WEEE inventory (need further improvement)
Challenges	• Obstacles on the development of Thai WEEE law • Without law being enacted, several problems cannot be solved ➢ Lack of enough funding for most local governments in managing collected WEEE (esp. used FLs and dry-cell batteries)

[40] Results of the interviews with PCD, Nov. 2013, Jun. 2014.
[41] Results of the interview with PCD, Feb. 2012, and US EPA, International E-waste Management Network (IEMN), Third Annual Meeting, PCD, "WEEE Management Policy Update from Thailand," 2013

	➢ No incentives for private sector to invest in comprehensive WEEE recycling facilities (no law to guarantee supplies & have to compete with the informal sector) ➢ Existing small number of recycling facilities are located in the central & eastern regions, causing high transportation costs for most local governments. ➢ The informal sector groups continue their harmful WEEE dismantling activities

Source: "E-WASTE MANAGEMENT SYSTEM IN THAILAND: STRATEGIES AND SUGGESTIONS," THE 9TH NIES WORKSHOP ON E-WASTE, February, 2013

The contents such as below is considered under Draft WEEE Management Strategy Phase II.

Table 3-25 Overview of Draft WEEE Strategy Phase II in Thailand

Purposes	- To establish E-waste collection system; - To promote Eco design; - To promote environmentally sound dismantling and recycling facility; - To raise awareness among the public; - To protect the country from being a dump site.
Objectives	A collection of 10 priority product groups in 26 large municipalities, BMA, and Pattaya City with an average collection rate no less than 5% of total WEEE arising in the areas by 2019 A management system for 4 product groups (FL, dry-cell batteries, refrigerator, TV) operated by manufacturers and importers with an average amount of WEEE treated no less than 5% of the average sales in the previous 2 years by 2019. At least 1 recycling facility for WEEE items targeted in 2) by 2019
Strategies	Strategy 1: Strengthening of import/export control Key measure: · Registration of e-product importer · Promote import of standard-complied product · Monitor impacts from FTA /AEC/MEA Strategy 2: Promotion of eco-friendly e-products with the focus on public procurement Key measure: · Promote testing and certification of eco-product · Propose a policy on e-product rental Strategy 3: Development of E-waste database Key measure: · Develop data collection and reporting system Strategy 4: Development of E-waste segregation, collection, storage and transport for local government Key measure: · Capacity building for local government · Formulate laws on product fee and/or EPR Strategy 5: Upgrade of dismantling and recycling facility Key measure:

	· Support R&D in recycling technology · Support investment in environmentally sound recycling Strategy 6: Promotion of public awareness on E-waste Key measure: · Disseminate E-waste knowledge through formal and informal education

Source: US EPA, International E-waste Management Network (IEMN), Third Annual Meeting, PCD, "WEEE Management Policy Update from Thailand," 2013, "E-WASTE MANAGEMENT SYSTEM IN THAILAND: STRATEGIES AND SUGGESTIONS," THE 9TH NIES WORKSHOP ON E-WASTE, February 2013

b. Responsible bodies and administrative structure

In Thailand, the following government agencies are involved with waste management .[42]

Pollution Control Department (PCD), Ministry of Natural Resources and Environment (MNRE)

This agency conducts general management of wastes including urban wastes, infectious wastes, hazardous wastes and so on. It also oversees the Hazardous Substances Act; however, because the Department of Industrial Works (DIW) described below lays down provisions concerning hazardous wastes while referring to the standards of the Hazardous Substances Act via various notifications, priority is given to laws and ordinances of the DIW regarding management of industrial wastes.

Concerning hazardous wastes, for which no standards are established in current legislation, the PCD has the authority to grant licenses and conduct supervision. It has joint jurisdiction of the Basel Convention, which concerns transboundary movements of hazardous wastes, with the DIW.

Moreover, because E-waste is classified as hazardous waste, the PCD is also in charge of drafting legislation on E-waste management.

Apart from the above, the Ministry of Natural Resources and Environment has jurisdiction over environmental aspects and environmental impact assessment (EIA) of waste disposal facilities and waste management policy overall.

Department of Industrial Works (DIW), Ministry of Industry (MOI)

The DIW has licensing authority concerning factory operations in general. It also grants permission for discard of wastes from factories and drafts standards concerning hazardous wastes and non-hazardous wastes. Also, it has joint jurisdiction of the Basel Convention with the PCD, and holds authority over granting of permission for import of second-hand domestic electrical appliances. Regional offices of the DIW conduct supervision over waste disposal and recycling facilities.

In addition, concerning general wastes (urban wastes) discarded from general households, the Ministry of Health has jurisdiction over legislation. However, the Department of Provincial Administration within the Ministry of Internal Affairs is responsible for budgeting for construction of waste treatment facilities by local governments.

Bureau of Environment Health (BEH), Department of Health, Ministry of Public Health (MPH)[43]

- Concerning E-wastes discarded from households, as was mentioned above, because household E-waste is classified as hazardous waste, the MPH has supervising responsibility. However, the MPH has no associated departmental laws or rules. Accordingly, the BEH is making preparations to formulate a draft bill.

[42] This chapter summarized related materials in the METI's report, "Feasibility Study on Recycling Business of Waste Electrical and Electronic Equipments in Thailand."

[43] Results of the interview with BEH on Nov. 25, 2013.

- Household hazardous wastes are not adequately managed and they are usually mixed with other solid wastes because there are no designated containers and so on.
- General households frequently sell waste glass, old papers and waste domestic electrical appliances to waste collectors who tour neighborhoods.

Bangkok Metropolitan Administration (BMA)[44]

- Local governments that are responsible for collecting urban wastes (MSW) from households based on the Public Health Act have been collecting hazardous wastes (fluorescent tubes, dry cell batteries, spray cans, E-wastes, etc.) discarded by households in recent years. However, according to this Act, collection costs can only be levied for urban wastes and infectious wastes but not hazardous wastes. Therefore, because costs (charges) for conducting collection and disposal cannot be levied, local governments need to bear costs themselves.
- In the case of Thailand, entities other than local governments are not legally able to collect household E-wastes. As a result, free riders in the informal sector are left free to conduct activities.

3.2.2 Material Flow

a. Generation Amount

Concerning generated quantities of E-waste in Thailand, the PCD consigned the Environmental and Hazardous Wastes Management Center (EHWM) of Chulalongkorn University to conduct a survey of electrical and electronic waste recycling costs and take-back system in 2010 .[45] This survey targeted waste discards from general households and from factories. Concerning discards from factories, because generated quantities of leftover materials (cuttings and discarded materials from product and part assembly and manufacturing processes) are comparatively small and it is thought that businesses autonomously treat them, the survey targeted products found to be nonconforming in inspections, etc.

The following table shows production quantities and estimated discard quantities of E-wastes in Thailand between 2010 and 2015.

The EEI (Electrical Electronics Institute), an industrial group in the domestic electrical appliance sector, has conducted an inventory survey for the period 2007 to 2020. According to this, it is forecast that approximately 100,000 air conditioners, 700,000 TVs (CRT, liquid crystal, and plasma), 250,000 refrigerators, 350,000 washing machines, 1,300,000 PCs, and 30 million mobile phones will be generated in 2011. Also, it is forecast that approximately 2,000 factories (final product and parts factories) are producing approximately 20,000 tons of E-waste per year.[46]

[44] Results of the interview with BMA on Nov. 6, 2013.

[45] The Study Project on Rules, Procedures, and Fees of Thailand's WEEE Management Executive Summary April 2010, National Center of Excellence for Environmental and Hazardous Waste Management, Chulalongkorn University

[46] The METI's report, "Feasibility Study on Recycling Business of Waste Electrical and Electronic Equipments in Thailand."

Table 3-26 Production Quantities and Estimated WEEE Quantities by Product Type in 2010 and 2015 in Thailand

Unit: ×1,000 units

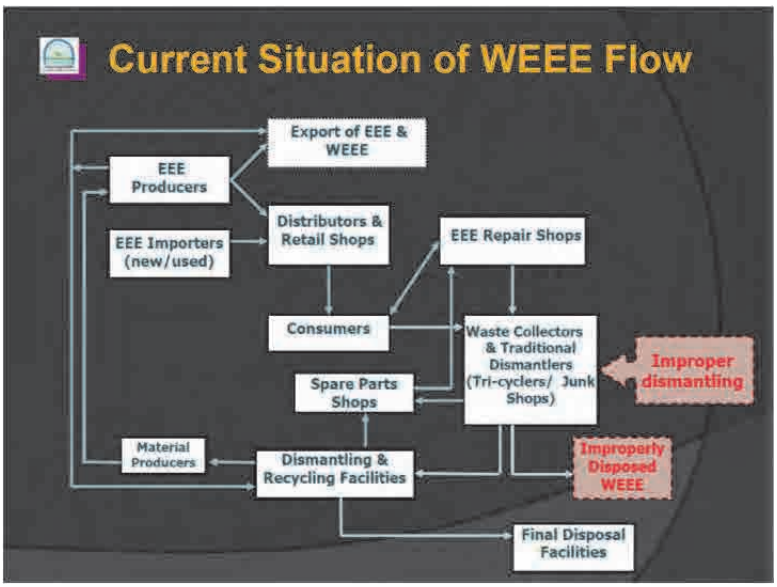
品目 Item		Production 生産量 現在 Present 2010	Production 生産量 将来 Future 2015	WEEE generation WEEE発生量 現在 Present 2010	WEEE generation WEEE発生量 将来 Future 2015
テレビ	TVs	2,538	3,212	1,315	2,034
冷蔵庫	Refrigerator	1,291	1,386	942	1,046
エアコン	A/C	859	1,228	377	587
パソコン	PC	2,382	3,521	845	1,737
プリンター	Printer	1,728	2,118	848	1,504
携帯電話	Mobile phone	11,088	13,231	4,842	9,237
デジタルカメラ	Digital camera	2,299	3,135	175	788
ビデオカメラ	Video camera	174	255	82	131
ポータブルメディアプレイヤー	Portable media player	814	1,080	263	668

Source: Feasibility Study on Recycling of Electrical and Electronic Wastes, Chulalongkorn University and the Ministry of Economy, Trade and Industry, 2012

b. Flow of E-waste from Its Generation to the Landfill/Export

Flow of E-wastes in Thailand

Figure 3-26 shows the flow of E-wastes in Thailand. Since E-wastes are basically traded at cost, they hardly gather at official E-waste recyclers but are mostly purchased by repair merchants and informal collectors and dismantlers. Most of these E-wastes are dismantled by hand into valuable iron, copper, aluminum, plastic, electronic circuit boards and so on, these valuable materials are sold off, while the worthless residues, waste liquids, waste oils, and coolant fluorocarbons are illegally disposed.



Source: Surin Aree, PCD, Regional Workshop on WEEE / E-waste Management in Osaka, Japan, on 6-9 July 2010

Figure 3-26 Flow of E-wastes in Thailand

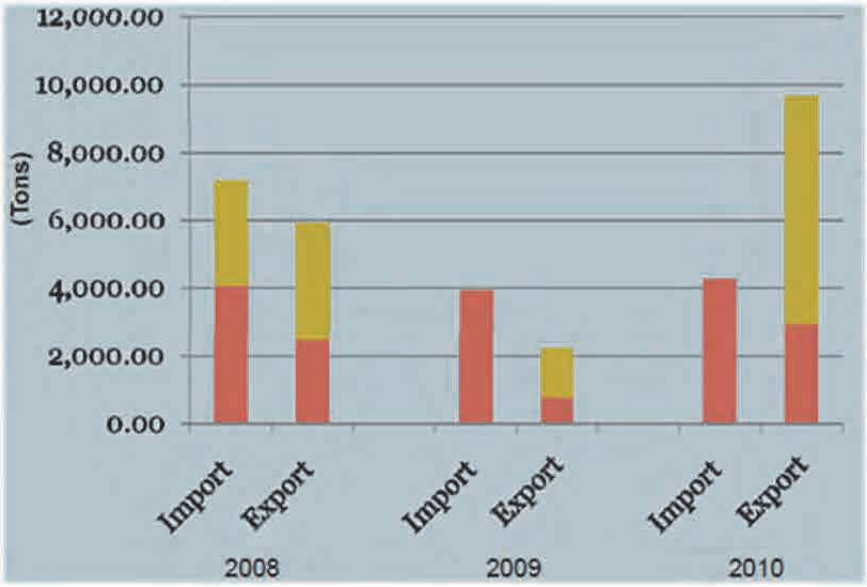
Export and import

The imported quantity of hazardous wastes in Thailand in 2010 was approximately 4,000 tons, while the quantity of exports was approximately 10,000 tons. The definition of exported/imported hazardous waste by Hazardous Substances Act is not the same with that of the Basel Convention; those wastes that fall under the Basel Convention are separated from those wastes that do not.

Exported items include plate sludge, electrical and electronic equipment components (IC scrap including cadmium, mercury, lead, etc., various components, printed circuit boards, etc.), dry cell batteries, catalytic agents, silver paste, and wastes containing heavy metals (mercury, lead, tin, etc.)), and these are exported to OECD nations such as Japan, Germany, Belgium, Sweden, etc. as well as non-OECD nations such as the Philippines, Singapore, Hong Kong (China) and so on.

It can thus be seen that Thailand has not yet gone so far to place restrictions on the export of printed circuit boards, catalytic agents and other hazardous wastes that contain heavy metals.

Another feature of Thailand is that it imports hazardous wastes. It mainly imports used toners, copiers and facsimile machines from Hong Kong, Taiwan, Malaysia, Singapore, Indonesia, the Philippines, etc. and conducts recycling domestically .[47]



Source: Update on Thai Regulations and Border Control Activities for Enforcement of the Basel Convention (DIW)[48]

Figure 3-27 Thailand's Imports/Exports of Hazardous Wastes (Quantities of imports and exports based on the Basel Convention)

c. Technological Level and the Scale of Stakeholders in the Respective Levels of the Flow

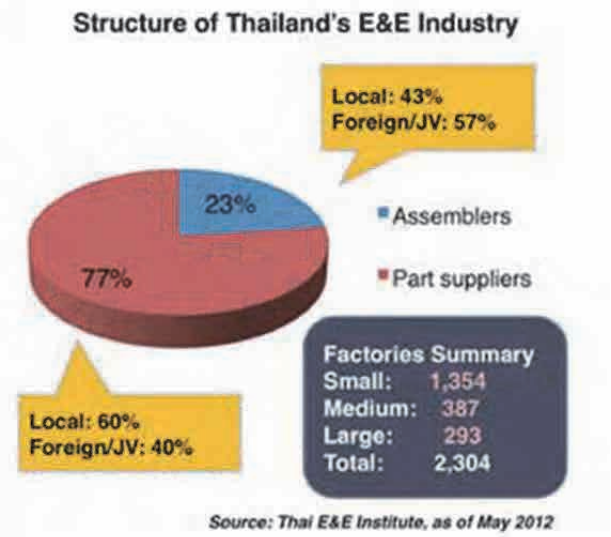
Electrical and electronic equipment producers[49]

The electrical and electronic equipment industry in Thailand comprises 2,304 factory facilities throughout the country. Less than 10% of these factories are operated by major enterprises, while the majority is small and medium facilities. Another feature about this industry in Thailand is that 23% of factories are assembly facilities, while approximately 70% are parts suppliers.

[47] It is conducted at a Fuji Xerox facility. (http://www.fujixerox.co.jp/company/public/sr2008/stakeholder/environment/reduce/overseas.html)

[48] http://www.env.go.jp/en/recycle/asian_net/Annual_Workshops/2011_PDF/D1_Session1-4_Basel_workshop2011_Thailand_update.pdf

[49] Data source is from "Feasibility Study on E-waste Management in Thailand," Ministry or Economy, Trade and Industry (METI) of Japan.



Source: EEI materials (materials published in 2012) BOI, Thailand Investment Review, Vol.22 No.8

Figure 3-28　Current Situation of the Electrical and Electronic Equipment Industry in Thailand

Focusing on manufacturing, this accounts for 39.0% of Thailand's GDP or 1.79 trillion bahts. In the manufacturing sector, the electrical and electronic equipment industry (electrical equipment, media equipment) accounts for 10.6% (1.87 trillion bahts x 10.6%) or production value of approximately 190.1 billion bahts.

Table 3-27　Thailand's Industry-separate Contribution to GDP

	実質GDP						雇用者数					
	実額(10億バーツ)			(構成比)			実数(1,000人)			(構成比)		
	01	11	(年率)	01	11	(差分)	01	11	(年率)	01	11	(差分)
合計	3,074	4,600	4.1%	(100.0%)	(100.0%)	(+0.0%)	32,104	38,465	1.8%	(100.0%)	(100.0%)	(+0.0%)
第一次産業	320	397	2.2%	(10.4%)	(8.6%)	(-1.8%)	13,612	14,883	0.9%	(42.4%)	(38.7%)	(-3.7%)
農林業	270	330	2.0%	(8.8%)	(7.2%)	(-1.6%)	13,137	n.a.	n.a.	(40.9%)	n.a.	n.a.
漁業	50	67	3.0%	(1.6%)	(1.5%)	(-0.2%)	474	n.a.	n.a.	(1.5%)	n.a.	n.a.
第二次産業	1,356	2,154	4.7%	(44.1%)	(46.8%)	(+2.7%)	6,720	7,913	1.6%	(20.9%)	(20.6%)	(-0.4%)
鉱業	65	99	4.4%	(2.1%)	(2.2%)	(+0.1%)	50	50	0.0%	(0.2%)	(0.1%)	(-0.0%)
製造業Manufacturing	1,111	1,793	4.9%	(36.2%)	(39.0%)	(+2.8%)	4,927	5,301	0.7%	(15.3%)	(13.8%)	(-1.6%)
公益業	104	164	4.7%	(3.4%)	(3.6%)	(+0.2%)	98	190	6.8%	(0.3%)	(0.5%)	(+0.2%)
建設業	76	97	2.4%	(2.5%)	(2.1%)	(-0.4%)	1,645	2,372	3.7%	(5.1%)	(6.2%)	(+1.0%)
第三次産業	1,397	2,049	3.9%	(45.5%)	(44.5%)	(-0.9%)	11,772	15,668	2.9%	(36.7%)	(40.7%)	(+4.1%)
卸売・小売	470	622	2.8%	(15.3%)	(13.5%)	(-1.8%)	4,688	6,037	2.6%	(14.6%)	(15.7%)	(+1.1%)
ホテル・レストラン	119	186	4.6%	(3.9%)	(4.1%)	(+0.2%)	1,918	2,546	2.9%	(6.0%)	(6.6%)	(+0.6%)
輸送・通信	310	442	3.6%	(10.1%)	(9.6%)	(-0.5%)	1,005	1,119	1.1%	(3.1%)	(2.9%)	(-0.2%)
金融	86	205	9.1%	(2.8%)	(4.4%)	(+1.7%)	303	395	2.7%	(0.9%)	(1.0%)	(+0.1%)
不動産	122	183	4.1%	(4.0%)	(4.0%)	(-0.0%)	495	768	4.5%	(1.5%)	(2.0%)	(+0.5%)
行政・防衛	99	127	2.6%	(3.2%)	(2.8%)	(-0.5%)	1,014	1,596	4.6%	(3.2%)	(4.2%)	(+1.0%)
教育	85	118	3.3%	(2.8%)	(2.6%)	(-0.2%)	988	1,287	2.7%	(3.1%)	(3.3%)	(+0.3%)
医療・福祉	44	58	2.6%	(1.4%)	(1.3%)	(-0.2%)	486	671	3.3%	(1.5%)	(1.7%)	(+0.2%)
その他	62	109	5.7%	(2.0%)	(2.4%)	(+0.3%)	876	1,248	3.6%	(2.7%)	(3.2%)	(+0.5%)

(出所) NESDB 及び BOT より作成

Source: Investment Environment in Thailand, October 2012, JBIC

Table 3-28　Thailand's Industry-separate Shares in the Manufacturing Sector

(暦年)	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11
実質成長率(製造業)	9.6%	11.9%	6.6%	1.4%	-10.9%	11.9%	6.1%	1.4%	7.1%	10.7%	8.2%	5.2%	5.9%	6.2%	3.9%	-6.1%	13.9%	-4.3%
(構成比)	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
食料品	18.0%	17.2%	16.8%	17.4%	18.7%	19.9%	15.9%	16.0%	16.3%	17.0%	15.5%	15.0%	15.6%	15.1%	14.8%	15.3%	n.a.	n.a.
タバコ	2.2%	1.8%	1.9%	1.7%	1.5%	1.3%	1.2%	1.1%	1.1%	1.0%	1.0%	0.9%	0.8%	0.8%	0.7%	0.7%	n.a.	n.a.
繊維	8.0%	7.4%	6.8%	6.7%	7.7%	7.1%	6.9%	6.7%	6.4%	5.9%	5.8%	5.4%	5.0%	4.6%	4.3%	4.3%	n.a.	n.a.
衣類	8.6%	7.9%	7.5%	7.5%	7.5%	6.8%	6.5%	6.3%	5.9%	5.4%	5.3%	5.3%	5.1%	4.7%	4.5%	4.5%	n.a.	n.a.
皮革	3.9%	3.6%	3.1%	3.4%	3.8%	3.7%	3.8%	4.2%	3.6%	3.3%	2.9%	3.0%	2.9%	3.0%	2.8%	2.7%	n.a.	n.a.
木材・木製品	0.7%	0.5%	0.4%	0.3%	0.2%	0.2%	0.3%	0.3%	0.3%	0.3%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	n.a.	n.a.
紙・紙製品	1.5%	1.5%	1.6%	1.8%	2.1%	2.0%	2.0%	2.1%	2.1%	1.9%	1.8%	1.8%	1.8%	1.8%	1.6%	1.7%	n.a.	n.a.
印刷・出版	1.1%	1.1%	0.9%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.7%	0.7%	0.8%	0.7%	0.7%	0.6%	0.7%	n.a.	n.a.
石油精製製品	6.5%	7.0%	8.4%	10.3%	10.9%	10.0%	9.5%	9.4%	8.9%	8.2%	7.9%	7.4%	7.0%	6.6%	5.6%	5.9%	n.a.	n.a.
化学製品	2.3%	3.5%	3.8%	4.3%	4.6%	4.6%	4.7%	4.8%	4.9%	4.8%	4.8%	4.8%	4.6%	4.8%	4.5%	5.0%	n.a.	n.a.
ゴム	2.7%	2.7%	2.8%	2.9%	3.4%	3.3%	3.6%	3.7%	3.8%	3.9%	3.8%	3.6%	3.4%	3.3%	3.2%	3.3%	n.a.	n.a.
非鉄金属	5.9%	5.7%	5.8%	5.4%	4.2%	4.3%	4.3%	4.6%	4.8%	4.7%	5.0%	5.1%	4.8%	4.4%	4.2%	4.1%	n.a.	n.a.
基金属	1.9%	1.8%	1.7%	1.6%	1.2%	1.1%	1.2%	1.3%	1.4%	1.3%	1.3%	1.1%	1.1%	1.0%	0.9%	0.8%	n.a.	n.a.
組立加工金属	2.2%	2.2%	2.4%	2.4%	2.5%	2.6%	2.6%	2.7%	2.6%	2.5%	2.7%	2.7%	2.6%	2.6%	2.4%	2.4%	n.a.	n.a.
機械	3.6%	4.1%	4.3%	4.0%	3.6%	3.6%	4.1%	4.3%	4.2%	4.3%	4.8%	5.3%	5.4%	6.0%	6.3%	5.8%	n.a.	n.a.
IT機器	3.2%	3.2%	4.2%	4.9%	6.1%	6.0%	6.5%	6.0%	5.6%	5.5%	5.5%	6.9%	8.2%	10.1%	11.7%	12.8%	n.a.	n.a.
電気機器	1.1%	1.2%	1.3%	1.5%	1.9%	1.8%	1.9%	2.0%	1.9%	2.2%	2.1%	2.0%	2.0%	2.0%	1.9%	2.0%	n.a.	n.a.
メディア機器	7.3%	7.7%	7.9%	7.8%	8.3%	8.3%	9.7%	7.2%	8.4%	9.0%	9.5%	9.1%	9.3%	9.0%	8.4%	8.6%	n.a.	n.a.
医療・光学製品	1.2%	1.3%	1.3%	1.5%	1.2%	1.2%	1.1%	1.2%	1.1%	1.0%	1.1%	1.0%	1.1%	1.0%	1.0%	1.0%	n.a.	n.a.
自動車	7.3%	7.7%	7.7%	5.4%	2.2%	4.2%	5.2%	6.7%	7.4%	9.2%	10.4%	10.5%	10.6%	10.7%	12.0%	9.6%	n.a.	n.a.
その他輸送	1.5%	1.5%	1.2%	1.4%	0.8%	0.8%	1.0%	1.0%	1.2%	1.4%	1.7%	1.8%	1.6%	1.3%	1.9%	1.8%	n.a.	n.a.
家具	9.4%	8.9%	8.3%	7.0%	6.7%	6.4%	7.2%	7.6%	7.3%	6.5%	6.2%	6.2%	6.1%	6.4%	6.5%	6.8%	n.a.	n.a.

Source: Investment Environment in Thailand, October 2012, JBIC

Concerning the electrical and electronic equipment industry, the mining industry is concentrated around Bangkok, the center, and the east of the country. In particular, there are a lot of secondary industries in the center of the country, and producers of domestic electrical appliances can be found in Ayuthaya and Samutprakarn.

Classifying the enterprises listed in the Thai Factory Almanac (570 factories in 2010) according to final products and main components , approximately 20% are final product producers, while the remaining 80% are mainly engaged in manufacturing components as suppliers or subcontractors. [50]Such enterprises comprise a lot of producers of electronic parts, printed circuit boards, wire harnesses and other power source and circuit board products.

Table 3-29　Products in the Electrical and Electronic Equipment Industry of Thailand

Category	Share Ratio (number of factories)	Features of Products and Industry, etc.
Final product producers (assembly)	Approximately 20%	Air conditioners 5%, TVs 2.4%, refrigerators 2.2%, audio 2.8%, computer-related 3.6%, others
Parts suppliers, parts producers	Approximately 80%	Motors 2.8%
		Hard Disk Drive (HDD) 3.4%
		Printed circuit boards (PCB) 8.0%
		Power supply related 4.8%
		Electronic parts 12.8%
		Wire harness 8.0%
		Others (approximately 60%)

Note: Representative products from each factory have been selected as the main products.

Home dissemination rates of electrical and electronic equipments

Table 3-30 shows dissemination rates of electrical and electronic equipments in Thai households (2009). The figure is low at 13.60% for air conditioners but high at 92.0% for TVs, 87.3% for refrigerators, and 100.81% for mobile phones. In future it is thought that dissemination rates will increase even more in line with economic growth.

[50] There are approximately 2000 EEE factories including small manufacturers (EEI document), and 600 of those are considered mid- and large size. The Almanac should have covered most of all.

Table 3-30 Home Dissemination Rates of Electrical and Electronic Equipment in Thailand

Types of electrical and electronic equipment	Home Dissemination Rates(2009)	Average weight (kg/piece)
Television	92.00%	29.07
Air conditioner	13.60%	44.1
Refrigerator	87.30%	57.9
Washing machine	50.80%	30.2
Microwave	61.00%	19.8
Personal computer	27.50%	6.75
Dish washer	1.70%	20
Dryer	2.50%	24.6
CD Player	5.60%	2.5
Camera (Digital Camera)	81.70%	0.23
Video Cam	3.10%	0.7
Video Recorder	50.60%	4.24
Telephone	28.80%	0.85
Vacuum machine	12.00%	5.21
Mobile phone	100.81%	0.1

Source: Products other than mobile phones are based on "Differences between Main ASEAN Nations in Terms of Spending" by Euromonitor, while mobile phones are based on data prepared by Daiwa Institute of Research Holdings September 6, 2011, ITU (International Telecommunication Union) statistics, and the Ministry of Economy, Trade and Industry "Feasibility Study of the Non ferrous Metals Recycling Business utilizing Copper Smelters in Indonesia", 2012

Informal sector[51]

Currently a method for discharging unwanted household E-wastes has not been established under law; however, as a result of conducting site surveys, the following three methods were found to be common:

- Provision of wastes free of charge to waste pickers
- Purchasing by the informal sector
- Donating to charity organizations and temples, etc.

A lot of E-waste goes to the informal sector. As of September 2010, Thailand has approximately 9,000 junk shops (GEC, 2011).

There is a concentration of 20~30 E-waste dismantlers around Ratchada Street in the northern part of Bangkok (the most populated city in Thailand). These collectors tour residential areas of Bangkok in pickup trucks and carts while making announcements through loud speakers, and they mainly purchase E-wastes from households, dismantle them and sell the useful parts and resources. Some collectors specialize in collection only and they sell the collected items to nearby dismantlers each day.

[51] Based on the field studies conducted on Nov. 7th, 26th and 27th, 2013.

Waste collectors' district

3-wheeled motorbike used for transportation

Exterior view of a dismantler

Dismantler's yard

Collection situation

According to a field survey of E-waste collecters and dismantlers located around Ratchada Street in Bangkok, the main items targeted for collection are TVs, washing machines, air conditioners, refrigerators, PCs, CRT monitors, mobile phones, etc., and cardboard, old papers and PET bottles are also collected. Purchase prices offered by collectors are as follows. Air conditioners, which contain a lot of copper and aluminum, are traded at a particularly high price of 1,700 bahts (approximately 5,355 yen, as of June 2014, 1 baht = approximately 3.15 yen).

Table 3-31 Examples of E-waste Purchase Prices from Households in Thailand

Item	Purchase Price
CRT TV	100 - 200 bahts/unit
Washing machine	300 bahts/unit
Refrigerator	400 - 500 bahts/unit
Air conditioner	1700 bahts/unit
Mobile phone	Offered for free in many cases

As is shown below, CRT TVs are the most commonly collected E-wastes, while competition is most intense for air conditioners, which have the highest resource value and are not easy to collect in large numbers. Some air conditioner producers conduct buy-back with the aim of recycling parts.

Table 3-32 Quantities of E-waste Collected by Collectors per Month in Thailand

Item	Quantity collected per month
CRT TV	300 - 400 units
Washing machine	200 units
Refrigerator	200 units
Air conditioner	10 units
Mobile phone	A few units

Dismantling conditions

As is shown below, the collected, TVs, washing machines, air conditioners and other E-wastes are dismantled manually into iron, copper, aluminum, circuit boards, plastics (ABS resin), etc.

There are cases of inappropriate treatment, for example, the atmospheric discard of cooling and insulating fluorocarbons from refrigerators, and discard of waste fluids from compressors. Moreover, since workers can be seen dismantling appliances in bare feet, the work environment is extremely poor and dangerous.

The informal sector is thus totally unregulated and there is no way of promoting initiatives in the absence of authorized collectors and routes.

Manual dismantling with no protection

Discarded insulating fluorocarbons

Discarded coolant fluorocarbons

Discarded residues

Selling conditions

Metal wastes are carried directly by trucks to factories, while waste circuit boards are sold to recyclers in Bangkok. Selling prices are 8 bahts/kilogram for waste circuit boards, 13 bahts/kilogram for waste plastic, 8-9 bahts/kilogram for waste iron, 200 bahts/kilogram for copper, and 50 bahts/kilogram for aluminum.

Concerning CRT TVs (14 inch and 21 inch), products that can still be used are sold to recyclers who export to China (around 20-30 units per month).

Other items that are still useable are sold to second hand dealers. Used air conditioner recyclers along Ratchada Street dismantle and sell valuable resources and also repair and sell products that can still be used.

ACs sold as used products

TVs sold to a dealer who export them to China

Household collections by waste collectors[52]

- Pickup trucks that belong to individual waste collectors slowly tour residential areas announcing that they are buying unwanted domestic electrical appliances and furniture through speakers attached to the trucks.

Times and target districts

- The individual waste collectors usually leave their Ratchada Street bases at between 6-7 o'clock in the morning and head for their intended districts for the day. They avoid the large thoroughfares but enter narrow streets and collect E-wastes in the residential districts. They usually stop collecting and return to their bases at around 13:00 in the afternoon, and they do not go out again after that.
- Each collector is free to choose the area that he operates. However, they naturally tend to establish their own territories. Since collectors are free to go anywhere, they try to beat the competition by going to familiar districts and becoming recognized by residents.
- After returning to their bases with each day's collected E-wastes, the collectors sell them to dismantlers who come to buy.

Collected quantities and collection prices

- This collector collects approximately 100 TVs, washing machines, and refrigerators each and 50 air conditioners per month on average. He gathers around 10 items on average every day.
- Waste electrical appliances are mainly discarded from households, although around 30% are discarded from retail stores. Purchase prices are higher when buying from retail stores than from households.

[52] The study was conducted on November 27, 2013 by riding with a collection pick-up truck on consent.

Trucks used for collection

E-wastes collected from households

Purchase from a middleman

Purchase from a household

Recycling facilities

When attempting to identify E-waste recycling facilities in Thailand, because there is currently no licensing system regarding E-wastes, the facilities that are classified under Factory Code 106 (reuse and recycling facilities) based on the Factories Act are first targeted. As of September 2011, as is shown below, there are 307 facilities that have acquired Factory Code 106.

Table 3-33 Number of Enterprises by Classification Code Based on the Thai's Factories Act

Classification code based on the Factories Act		Number of enterprises
Factory Code 101	Wastewater treatment	124
	Incineration	27
	Hazardous wastes landfill site	18
Factory Code 105 (separation/non-hazardous landfill)		1,003
Factory Code 106 (recycling)		307

Source: Materials provided by DIW (as of September 14, 2011)

According to a hearing held with DIW, roughly 35 of facilities that have acquired Factory Code 106 process E-wastes; however, all of these only conduct separation, while there are none that retrieve metals nor conduct final disposal.

Moreover, based on the information provided by DIW, facilities that are currently engaged in the segregation and recycling of electrical and electronic wastes in some form or other in Thailand are as follows. However, as is described later, even these official E-waste processing facilities do not handle large quantities of E-wastes and they mainly conduct manual dismantling. There are still no facilities that possess large-scale equipment.

Table 3-34 Conditions at Electrical and Electronic Waste Recycling Facilities in Thailand

Name of Company	Contents
TES-AMM (THAILAND) CO., LTD.	Mainly B to B collection and separation of PCs, and exporting to Singapore with the aim of collecting precious metals
UMICORE MARKETING SERVICES (THAILAND) CO., LTD.	Mainly B to B collection and separation of PCs, and exporting to Belgium with the aim of collecting precious metals
OSRAM (THAILAND) CO., LTD.	—
THAI TOSHIBA LIGHING CO., LTD.	Collection of waste fluorescent tubes and recycling at domestic factories in Thailand
WONGPANIT GARBAGE RECYCLE SEPARATION PLANT CO., LTD.	Collection of E-wastes via franchisees, etc. located throughout Thailand, manual dismantling and removal of major components for sale to other companies including those overseas
PHILIPS ELECTORONICS (THAILAND) CO., LTD.	Collection of waste fluorescent tubes for recycling
FUJI XEROX ECO-MANUFACTURING CO., LTD.	Collection, repair and recycling of copiers including those from own company and imports from overseas
S.A. SIAM RECOVERY CO., LTD.	—
WAX GARBAGE RECYCLE CENTER CO., LTD.	—
MATSUDA SANGYO (THAILAND) CO., LTD.	B to B collection of wastes containing nonferrous metals and implementation of nonferrous metals collection for export to Japan, etc.
UNI COPPER TRADE (EPZ) CO., LTD.	—
METECH INTERNATIONAL (THAILAND) CO., LTD.	—
HINO KINZOKU (THAILAND) CO., LTD.	—

Source: Arranged based on materials provided by DIW, Ministry of Economy, Trade and Industry, “Feasibility Study of Electrical and Electronic Waste Recycling Business in Thailand, 2012

Situation of final disposal

In Thailand, as is shown in the following figure, 87% of industrial wastes that are non-hazardous are directly used as raw materials or undergo reuse and recycling, while only 9% undergo landfill disposal. Concerning hazardous industrial wastes too, 19% are used as alternative fuels and 43% are reused and recycled. 16% of hazardous wastes undergo secured landfill, and 15% are incinerated.

Source: DIW, 2011, PCD presentation "Modernized Thailand on 3Rs," International Conference on Resource Recycling in Taiwan 2013.

Figure 3-29 Recycling and Disposal Situation regarding Industrial Wastes in Thailand

As was mentioned above, E-wastes are classified as hazardous wastes; however, concerning other hazardous household wastes such as fluorescent tubes, spray cans and dry cell batteries, discard, transportation, treatment and disposal are carried out using the following designated containers and vehicles in pioneering areas.

Source: Received document from BMA

Example of household hazardous waste

Source: Received document from BMA

Special truck for household hazardous waste

The following figure shows the flow of hazardous domestic wastes from generation to disposal.

Source: PCD "An Overview of Hazardous Waste Management & Prevention in Thailand," PCD Website

Figure 3-30 Flow chart of Household Hazardous Waste in Thailand

According to statistics of DIW, Thailand currently has three secured landfill sites for hazardous wastes, and they have a combined processing capacity of 580,000 tons per year.[53]

Table 3-35 Capacity and Number of Factory for Industrial Waste in Thailand

Type of Disposal Facilities	Number of Factory	Capacity	
		Million tons / year	%
Secured landfills	3	0.58	7
Cement Kilns and Incinerators	11	6.52	84
Recycle	299	0.67	9
Total	313	7.77	100

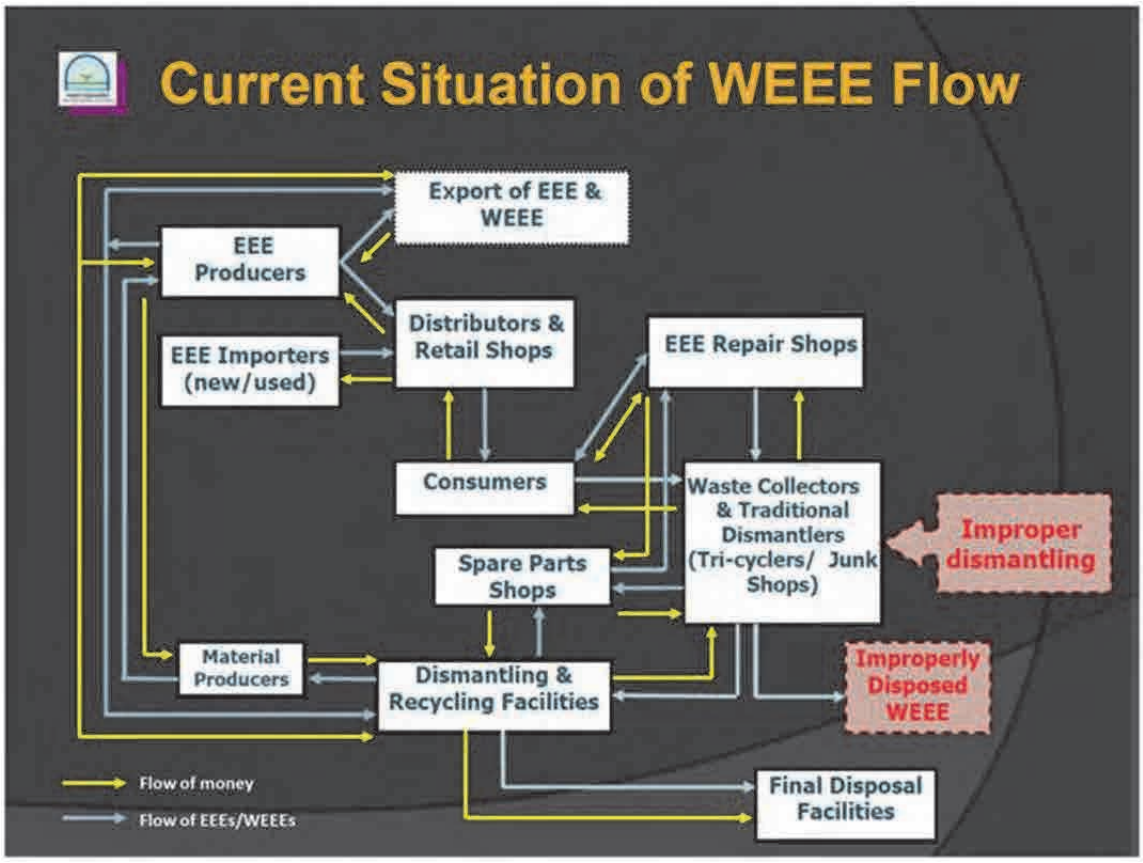
Source : Department of Industrial Works, 2010

Source: "Thailand State of Pollution Report 2011" PCD, MNRE

d. Monetary flow

In Thailand, E-wastes are basically traded at a price. When E-wastes are discarded from households, prices are determined according to operating condition, age and type of appliances, and the informal sector purchases E-wastes. While these informal sectors do not pay for any environmental measures and illegally discard residues, formal recycle/treatment facilities spend money on final treatment of residues. Since formal facilities cannot set higher price than informal sectors do, majority of E-wastes is flowing into informal sector.

[53] Details of secure landfills are explained in section 3.2.4



Source: Surin Aree, PCD, Regional Workshop on WEEE / E-waste Management in Osaka, Japan, on 6-9 July 2010
Note: The flow of money is added into the diagram.

Figure 3-31 Flow of Money regarding E-waste in Thailand

Sample transaction case 1 (survey by Chulalongkorn University)

According to the survey of electrical and electronic wastes, recycling costs and collection systems consigned by the PCD to the Environmental and Hazardous Wastes Management Center (EHWM) of Chulalongkorn University in 2010, as is shown in the following table, E-waste prices are 111 bahts for cathode tube TVs of up to 21 inches, 189 bahts for large LCD TVs, 192 bahts for desktop PCs (CRT), 683 bahts for air conditioners (small), and 227 bahts for refrigerators (small). These prices have been calculated using average values of purchase prices by existing recyclers , price information provided by small and medium waste treatment companies, and sale prices obtained from consumer surveys.[54]

[54] The data in May 2009 from Wangpanit is used.

Table 3-36 Product-separate Electrical and Electronic Waste Purchase Prices from Households by Product in Thailand[55]

WEEE Item	Mean buy-back rate (Std. Err.)	Junk shop*	The average selling prices (household survey)	Proposed buy-back rate
CRT TV Sets (S) (≤ 21")	111 (4.76)	8 / 30	100	150 (100 - 200)
CRT TV Sets (L) (> 21")	150 (7.60)	n/a	100	180 (130 – 230)
LCD/Plasma TV Sets (S) (≤ 32")	189 (10.85)	n/a	140	200 (170 – 220)
LCD/Plasma TV Sets (L) (> 32")	258 (17.64)	n/a	140	250 (220 – 300)
PC Sets-Desktop (CRT Monitor)	192 (10.72)	64	200	250 (220 – 280)
PC Sets-Desktop (LCD Monitor)	230 (11.59)	n/a	250	300 (280 – 320)
Air Conditioners (S) (≤ 12,000 BTU)	683 (17.52)	n/a	500	600 (500 – 700)
Air Conditioners (L) (> 12,000 BTU)	820 (22.93)	500 / 635	500	750 (600 – 900)
Refrigerators (S) (≤ 6 Cu.Ft.)	227 (9.31)	140 / 200	200	300 (200 – 400)
Refrigerators (L) (> 6 Cu.Ft)	300 (15.26)	n/a	500	450 (350 – 550)
Notebooks	185 (13.68)	n/a	200	300 (280 – 320)
Printers/Facsimiles	86 (4.47)	20	50	100 (70 – 130)
Digital cameras/Camcorders	62 (4.63)	n/a	n/a	60 (50 – 70)
Portable media players	23 (4.70)	0.05	50	30 (40 – 50)
Mobile phones/Handheld tranceivers	55 (6.72)	0.30	500**	60 (50 - 70)
Fluorescent lamps	1.5 (0.62)	No market price	No market price	1: short linear/ circular/compact 2: long linear
Dry-cell batteries	1.2 (0.43)	No market price	No market price	1: rechargeable 0.5: non-rechargeable

Note: * Prices listed of Wongpanit recycling company / other junk shops, the price list in baht/kg. was converted to baht/unit using the average weight of WEEE in each product type

** expected to be the selling price in second-hand markets

Source: Calculated data from field surveys

Source: The Study Project on Rules, Procedures, and Fees of Thailand's WEEE Management Executive Summary April 2010, National Center of Excellence for Environmental and Hazardous Waste Management, Chulalongkorn University METI, "Feasibility Study on Recycling Business of Waste Electrical and Electronic Equipments in Thailand."

Sample transaction case 2 (Informal sector around Ratchada Street in Bangkok)

The following table shows the results of a hearing survey of E-waste collectors and dismantlers located around Ratchada Street in Bangkok. The findings are almost the same as those obtained in the abovementioned survey by Chulalongkorn University. As a trend, air conditioners and refrigerators, which contain a lot of copper and aluminum, fetch higher prices than other products.

[55] From left, average purchasing price by existing collectors, purchasing price by junk shops, and selling price by consumers.

Table 3-37 Example of E-waste Purchasing Prices from Households in Thailand

Item	Purchasing Price
CRT TV	100-200 bahts/unit
Washing machine	300 bahts/unit
Refrigerator	400-500 bahts/unit
Air conditioner	1700 bahts/unit
Mobile phone	Offered for free in many cases

3.2.3 Efforts of the Stakeholders

a. Voluntary Activities of Private Companies

Activities concerning E-waste management in Thai private sector enterprises are described below.

Initiatives in Thai Toshiba Lighting Co. Ltd. (TTLC)[56]

Company profile

- The company was established in September 1982. Its main products are straight pipe molds, round molds, compact fluorescent lamps, stabilizers, and starters.
- It established a fluorescent lamp recycling center in 2006.

Green Lamp Project

- This conducts the collection and recycling of fluorescent lamps targeting government offices and private sector companies (office buildings and factories).
- TTLC provides designated boxes for collecting and storing fluorescent lamps, conducts education and dissemination of knowledge concerning waste fluorescent lamps, and bears all the recycling costs for the collected waste fluorescent lamps. When it takes back waste fluorescent lamps, it takes the same number as the newly purchased lights irrespective of brand.
- In cases of local governments, the local governments bear the cost of transportation to TTLC. In the case of BMA, TTLC makes collections every six months.
- This activity is ultimately intended to promote the appropriate disposal (solidification and appropriate final disposal) of used products and promote new sales rather than being an active recycling project. TTLC has sometimes gone out to local governments to pick up fluorescent lamps on request. Technically, its disposal capacity is limited and it had to turn down requests in some cases.

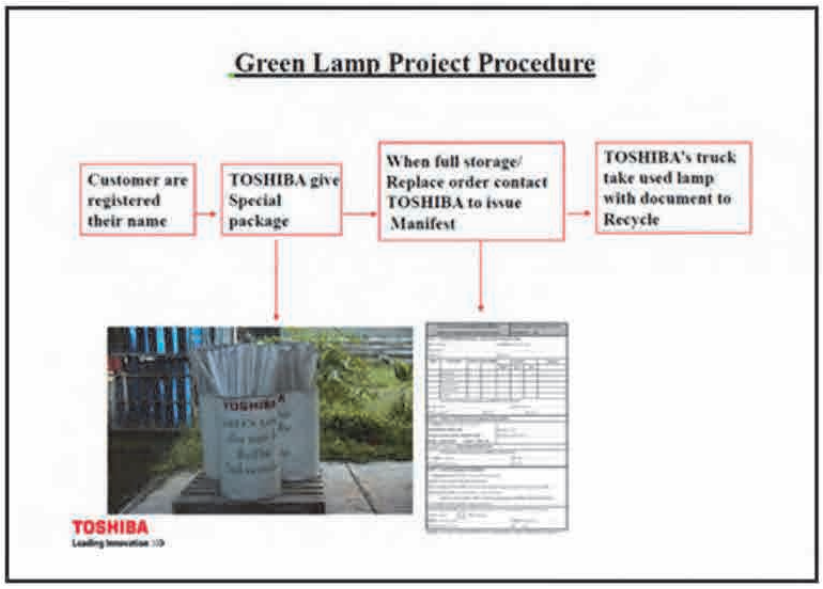
[56] Summary based on presentation and remarks at "E-waste Training Workshop for Asia and the Pacific," August 2009, Hanoi, Vietnam.

Source: "E-waste Training Workshop for Asia and the Pacific," August 2009, Hanoi, Vietnam

Figure 3-32 Logo of Green Lamp Project

Collection process

- When a private sector enterprise registers to join the Green Lamp Project with TTLC, TTLC delivers a collection and storage box. When new fluorescent lamps are delivered, the stored waste fluorescent lamps are collected and a manifest is issued.



Source: "E-waste Training Workshop for Asia and the Pacific," August 2009, Hanoi, Vietnam

Figure 3-33 Flow Diagram of Green Lamp Project

Overview of disposal

- After cutting away both metal ends (in the most common case of straight tube lights) with a cutter and crushing the glass section, fine crushing and washing are conducted, and materials are separated into glass cullet and sludge. The water used in washing is recycled.
- After disposal, the glass cullet is once more used in glass manufacture, and generated residues are sent to Better World Green Co. for secure landfill disposal as hazardous waste. Eight tons of residues were processed in 2008.

Issues

- Issues for future attention include regulating of cost burden by producers and environmental countermeasures by importers, and the formulation of legislation based on the principle of burden by polluters.

Source: "E-waste Training Workshop for Asia and the Pacific," August 2009, Hanoi, Vietnam

Figure 3-34 Overview of the Fluorescent Lamp Recycling Facility at TTLC

Activities at Fuji Xerox Eco-Manufacturing[57]

Company profile

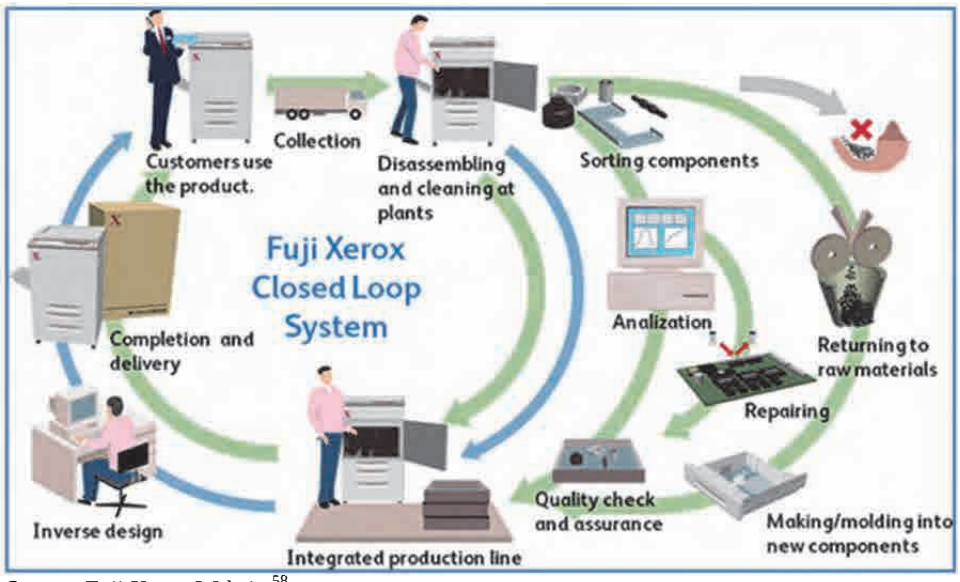
- FXEM has a Factory Code 106 license (in Thailand, based on the Factories Act, DIW confers Factory Code 106 (recycling) licenses to enterprises that process industrial wastes), and recycles unwanted copiers generated in the company. 2013 marked its tenth year of operation.
- FXEM currently collects wastes from six countries (China (Hong Kong), Thailand, Indonesia, Malaysia, Singapore, the Philippines). It imports the wastes upon making declarations according to the Basel Convention. (Following adoption of the resolution concerning interpretation of the provisions (Article 17 paragraph 5) concerning requirements for BAN amendment of the Basel Convention in 2010, the momentum for revision was strengthened. If the amendment is issued in future, since it will become impossible for wastes to be exported from the Appendix VII countries of South Korea, Australia and New Zealand to non-Appendix countries such as Thailand, subsidiaries in these three countries have decided to conduct autonomous recycling within their own borders. As a result, the quantity of disposal conducted by FXEM has been halved).
- In Thailand, FXEM has a separate retail company, which uses its sales routes to also collect waste products. Specifically, because the company's trucks carry waste products to the FXEM facilities in Chonburi, FXEM does not actually perform collection and transportation.
- Almost all Fuji Xerox Inc. products in Thailand are retailed or leased to enterprises based on contracts, while a small percentage are wholesaled to retailers. The former products are almost totally recovered; however, the latter types are sold and are very difficult to retrieve.

Treatment process

- The waste products are dismantled by hand and finely separated into plastics (more than 20 types), metals, glass, etc., and then the following processes are conducted in the following order of priority: 1) parts reuse and remanufacturing, 2) material recycling, 3) thermal recovery, and 4) incineration. There are zero wastes (landfill). Incineration is consigned to a waste treatment company rather than conduct in-house.

[57] Results of the interview on Nov. 27, 2013.

- The recycled quantity of copiers is 2,771 tons, the quantity of expendable parts (toners, etc.) remanufacturing and dismantling is 1,973 tons, and the recycling rate is 99.8%.



Source: Fuji Xerox Website[58]

Figure 3-35 Recycling Flow of FX Products

Source: Fuji Xerox Website, Sustainability Report 2013

Figure 3-36 Stream of FX's Own Products

Interview with Japanese Chamber of Commerce, Bangkok (JCC)

JCC hearing results[59]

- Producers can only handle the disposal part. In terms of environment, it is thought that illegal dumping is taking place. It is difficult for producers to bear costs. Even if producers do bear costs, because they can decide product prices, ultimately the cost is transferred to consumers.

[58] http://news.fujixerox.com/image_library/detail/_imgid_000192/
[59] Results of the interview with JCC on Nov. 8 2013.

- It should be communicated that forcing producers to bear the cost would also entail demerits.

- There are no appropriate entities for receiving E-wastes in Thailand.

b. Retailers

As was mentioned above, E-wastes are regarded as hazardous wastes and it is necessary to have a license for collecting, transporting and disposing of them. Because domestic electrical appliance retail stores are not legally permitted to collect E-wastes without a license, they do not officially buy-back or take back used products.

Large domestic electrical appliance retail store

Large-size home appliance retail stores and general retail stores shown below are common and wide spread in Thailand.

Power Buy

Tesco Lotus

Home Pro

Design Square

Tesco Lotus[60]

Company profile

- In terms of both number of outlets and sales turnover, this is the largest retailer in Thailand. Throughout the country, it operates 200 large stores, 600 medium-size stores, and 1,000 convenience-style stores. Domestic electrical appliances account for between 20~30% of sales turnover.

[60] Results of the interview on Jun. 5, 2014.

Handling of domestic electrical appliances

- People in Thailand currently have little understanding of how to correctly discard unwanted domestic electrical appliances. Correct information is not communicated to them. Accordingly, appliances are used until they break, and they are often stored at homes after they have become useless.
- As with other companies, Tesco truck drivers in charge of deliveries no doubt pick up and collect unwanted domestic electrical appliances. The company is trying to control the situation, but not with total success.

WEEE draft bill

- It is a good idea to utilize retail stores for collecting E-wastes. However, in order for this to be successful, it is necessary for educate and enlighten consumers. It may be difficult to realize this without providing incentives. The informal sector will always exist and tries to immediately repair unwanted products.
- Simply providing convenient collection services is not sufficient in order for consumers to hand over E-wastes; it is also important to conduct enlightenment activities that lead to environmentally considerate behavior, for example, communicate the real state of environmental pollution caused by utilizing the informal sector.
- The company has not yet participated in the "WEEE Can Do" project but it will if the project is conducted again.

Interview at headquarter

Tesco Lotus's voluntary activity (collection of mobile batteries)

Situation at Stores

- On visiting a typically sized store in Bangkok, the sales area was far larger compared to those stores in Japan. The domestic electrical appliance corner was located in a part of the area for selling food, clothes, shoes and other goods, and was selling all kinds of appliances including TVs, refrigerators, washing machines and driers, air conditioners, stereos, fans and so on. In particular, there were lots of refrigerators and washing machines much larger than the appliances sold in Japan.
- The store did not provide a buy-back service in tandem with product sales.

Inside Tesco Lotus' Store 1

Inside Tesco Lotus' Store 2

c. Citizen Groups and NGOs

In Thailand, local communities and temples carry out "recycle bank" activities for collecting recyclable resources. Most of the recovered resources comprise plastics, cans, cardboard and bottles, and some communities also collect E-wastes.

Wat Son Community (Chonburi)[61]

Wat Son Community in Chonburi operates the most active E-waste collection recycle bank in Chonburi City. The recycle bank is operated by volunteers including nine members of the community committee.

At the recycle bank, the volunteers sort and weigh household wastes such as plastics, bottles, cans, cardboard, etc. that have been brought by citizens, and they keep a record of cash amounts that are determined according to the categories and quantities of items. Waste articles are sold to buyers in the evening. Moreover, the recycle bank places no restrictions on received wastes but makes it a policy to accept all items that are brought in.

Price agreements are concluded with waste purchasers according to each item: 20% of the purchase price is paid to the waste generator and recorded in the ledger, and 20% is used to cover the recycle bank operating expenses. Recorded amounts can be converted into cash or saved and converted into prizes, or lump sums awarded every six months to persons who save the most.

Recycle Bank

Separation of recycling materials

[61] METI, "Study to promote cooperation between circular-society cities: Akita and Chonburi municipalities," 2012.

Registration

Bankbook

Collected resources

Collected E-wastes

Source: METI, "Study to promote cooperation between circular-society cities: Akita and Chonburi municipalities," 2012.

Activity at a temple[62]

Ton Son Temple stores the waste products that are collected when quantities at the recycle bank are too small to sell to purchasers. It separates the wastes into E-wastes, hazardous wastes, and recyclable wastes. Concerning E-wastes, the temple only conducts storage at the present time. However, it intends to consign treatment to an operator when a certain quantity is reached. It processes hazardous wastes in the same way as those collected in the designated boxes in the communities.

Ton Son Temple

Hazardous waste storage

[62] METI, "Study to promote cooperation between circular-society cities: Akita and Chonburi municipalities," 2012.

E-waste storage

Storage for recycling materials

Source: METI, "Study to promote cooperation between circular-society cities: Akita and Chonburi municipalities," 2012.

TIPMSE: Thailand Institute of Packaging and Recycling Management for Sustainable Environment (NGO)[63]

Overview of organization

- Seven years old, this organization conducts activities mainly with support from 20 container and packaging companies.
- It conducts separated discard and recycling of household wastes (mainly comprising containers and packaging). Its main activities are as follows: 1) organization of recycling, 2) dissemination of know-how, 3) building of a recycling database, and 4) PR and communications.
- Concerning 1) organization of recycling, it sets up recycling centers for individual waste collectors known as "Sa-leng" with cooperation from local police and public health centers; it registers names and contact information, stages workshops, and provides uniform work clothes. Concerning 2) dissemination of know-how, it has constructed four learning centers and is striving to spread knowledge. As for 3) building of a recycling database, it is working on unifying statistics related to recycling in cooperation with universities and related administrative agencies.

Concerning E-waste

- There are some local governments that install designated boxes for collecting hazardous wastes such as dry cell batteries and fluorescent lamps; however, most local governments conduct no waste collection at all. It is good for local governments to collect wastes; however, it costs money to have the wastes picked up, and waste treatment companies are not willing to come and collect.
- Projects such as "WEEE Can Do" are temporary, and conditions return to normal once the campaigns are finished. It is necessary to implement sustainable initiatives through instituting collection based on legislation.

[63] Results of the interview on Jun. 5, 2014.

Recycling Exchange shop


Inside Recycling Exchange shop


Collected recycling materials


Collection by buyer

Source: TIPMSE Website, http://www.tipmse.or.th/

d. Record of Collection Campaigns Carried Out by the Local Governmental Bodies

As an initiative regarding waste collection by local governments, the "WEEE Can Do" project entailing collection of small domestic electrical appliances was implemented as a pilot project all over Thailand in 2011.

"WEEE Can Do" project[64]

Background and objectives

As part of the aforementioned WEEE Strategy 2007, the "WEEE Can Do" project (pilot project for collection of small domestic electrical appliances) was implemented from June to December 2011. The objectives were as follows:

- To raise public awareness of environmental and health impacts and promote separation of WEEE from general wastes
- To process WEEE using appropriate methods with low environmental load
- To encourage local governments to establish WEEE collection points and, in the long term, to build cooperation setups with other local governments
- To collect data on the actual costs of WEEE disposal in the process of institutionalization

Target products

The project mainly targeted small domestic electrical appliances comprising mobile phones, batteries (mobile phones), fixed telephones, cordless phones, printers, facsimile machines, MP3 players, game consoles, VCD, DVD, and digital cameras.

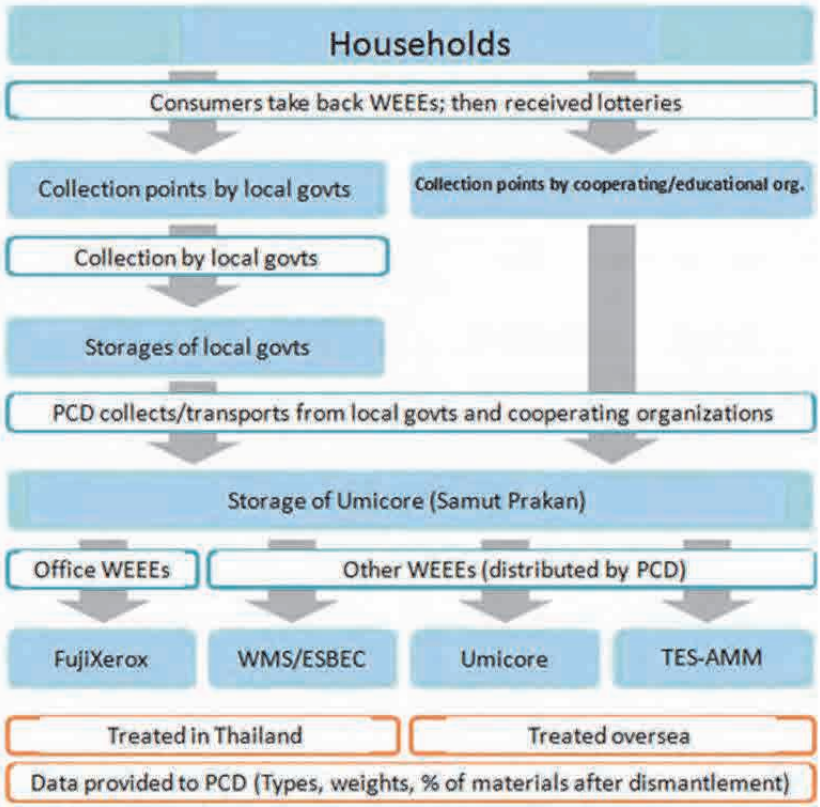
[64] METI, "Study to promote cooperation between circular-society cities: Akita and Chonburi municipalities," 2012.

Source: Provided documents from PCD, and METI, "Study to promote cooperation between circular-society cities: Akita and Chonburi municipalities," 2012.

Figure 3-37 Target Products of WEEE Can Do Project

Roles of related stakeholders

- Collection: Cooperating agencies such as local governments, enterprises, education agencies, etc. provided places for placing WEEE collection boxes. As of October 2011, there were 667 such collection points throughout the whole of Thailand.
- Transportation: The PCD collected wastes (bears costs) from each collection point, held the wastes in Umicore warehouses and later distributed them to recyclers.
- Dismantling and disposal: Dismantling work, etc. was consigned to recyclers (TES-AMM, Umicore, Fuji Xerox (OA equipment only), WMS/ESBEC) and data concerning equipment types, weights, and physical ratios following dismantling and sorting was provided to PCD (free pick-up; only WMS/ESBEC could conduct disposal in Thailand, while Umicore and TES-AMM exported wastes to Belgium and Singapore respectively for disposal).
- Producers: Lottery tickets were given to WEEE providers, and producers offered the domestic electrical appliances, etc. that were used as prizes.



Source: METI, "Study to promote cooperation between circular-society cities: Akita and Chonburi municipalities," 2012.

Figure 3-38 Overview of WEEE Can Do Project

In the "WEEE Can Do" project, the following kinds of collection boxes were placed and lotteries were held to provide an incentive for generators.

Collection box

Collected E-waste (Lottery tickets are taped)

Source: US EPA, International E-waste Management Network (IEMN), Third Annual Meeting, PCD, "WEEE Management Policy Update from Thailand," 2013

3.2.4 Introduction of Technologies and Infrastructure Development

a. Recycling and Collection Infrastructures

The well-known E-waste recycling facilities (or enterprises that collect wastes for this purpose) in Thailand are Unicopper, Wangpanit, Better World Green, etc., which are operated by tie-ups between Thai enterprises and Japanese affiliated corporations, Matsuda Industries, Ohgitani, ESBEC/WMS (DOWA Group), etc. and other foreign corporations such as Umicore, TES-AMM, and so on.

These facilities conduct dismantling, sorting and crushing (only limited facilities possess crushing processes), remove useful parts that contain valuable metals (or process them by crushing, etc.), and export them to Europe or neighboring countries including Japan. Concerning the reasons why, it is because recovery (wet) of precious metals in Thailand is only conducted by very limited facilities and there are no copper smelters that accept E-wastes in the country.

Out of the three companies that participated in the WEEE Can Do" project, i.e. ESBEC/WMS, Umicore and TES-AMM, only ESBEC/WMS processes E-wastes in Thailand, while Umicore and TES-AMM consign disposal to overseas plants.

Facilities mainly purchase computers, hard discs, mobile phones and other IT equipment that generated inside own plants or are taken back. Currently, the four major white goods are not targeted for collection and dismantling and are hardly processed at all.

It can be seen that most facilities are concentrated near Bangkok, so it will become important in future to build an efficient system for transporting E-wastes from all over the country.

The following table summarizes the individual technologies and equipment currently adopted by representative E-waste recycling facilities.

TES-AMM Thailand[65]

Company profile	• This company, established with Chinese capital, is a Singapore-based recycler of E-wastes. In addition to Singapore, it has collection, crushing, sorting, and metal recovering facilities in Southeast Asian countries such as Thailand, Indonesia, Malaysia, Vietnam, China (two locations), India and so on. Some facilities only conduct collection. • The local facility covers an area of approximately 1,000 square meters and has 27 employees who conduct sorting work.
Contents of work and introduced technologies in Thailand	• The Thai facility went into operation in 2005. After receiving wastes, it removes packing and packaging materials, separates the wastes into different items, and then exports the wastes to Singapore. Currently, because collected quantities in Thailand are small, it conducts no recycling activities locally. In Singapore, it even recovers metals. Exporting is conducted based on procedures under the Basel Convention.
Received wastes	• It purchases only factory wastes. It does not receive household wastes. Its clients include Dell, Samsung, Motorola and others that conduct voluntary take-back activities, as well as Japanese affiliated enterprises such as Toshiba and Canon, etc. It also accepts toner cartridges from Ricoh and recycles these at its facilities in Singapore.
Future developments	• It currently only receives factory E-wastes; however, it intends to expand its targets to include household wastes in the future.

Wongpanit[66]

Company profile	• Following establishment in 1974, this company increased its partner enterprises based on a franchise system. It currently has 850 franchisees in the country. • It purchases old paper, cans, bottles and other recyclable wastes from franchisees and individual generators. It has recyclable

[65] The METI's report, "Feasibility Study on Recycling Business of Waste Electrical and Electronic Equipments in Thailand."

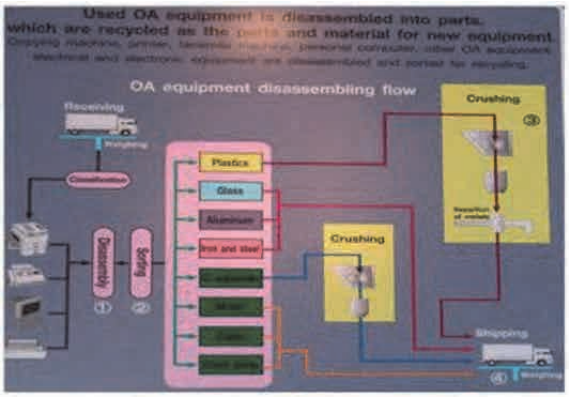
[66] The METI's report, "Feasibility Study on Recycling Business of Waste Electrical and Electronic Equipments in Thailand."

	resource consolidation centers at Phitsanulok, Ayuthaya and three other locations. The company directly manages the facilities at Phitsanulok and Ayuthaya. The facility at Ayuthaya basically only conducts sorting and compressing.
Work contents in Thailand	• At Phitsanulok, the facility conducts sorting, washing, crushing of various plastics, and treatment of scrap iron, old paper and E-wastes, etc. in two shifts. The facility is located on a site covering 3.5 acres and has 150 employees. • It basically purchases all recyclable resources. Its price list is publicly disclosed. • Sorting of plastics into different types is basically conducted in a manual sorting line. The plastics and other recyclable resources that are carried into Phitsanulok have already been sorted to an extent. The facility receives mixed plastics; however, the purchase price is set lower than for plastics.
Received wastes and introduced technologies	• The facility receives E-wastes from both factories and households. It purchases the factory E-wastes based on tender. The household wastes include white domestic electrical appliances (this is a special feature of this facility; purchasing white domestic electrical appliances acts as an incentive to households). For example, it purchases TVs at 2-3 bahts per unit and air conditioners at 1,500 bahts per unit (a price list is available for other products). • E-wastes are basically dismantled by hand into cases, circuit boards, Hard Discs, etc. Circuit boards are sold (emphasis is placed on the sale price but little priority is given to ensuring environmentally sound treatment), but the facility does not recover metals, etc. • The facilities do not process compound materials such as motors and radiators, etc. It sells these items to other recyclers. It is equipped with a machine for recovering fluorocarbons (but it isn't clear which plant this is installed at). The company personnel received training in Japan when this was installed.
Sale destinations	• Items processed in the company including components taken from E-wastes are basically sold to the buyers who offer the highest price.

Collected E-wastes


Manual dismantling line of E-waste

Recycling materials after dismantlement



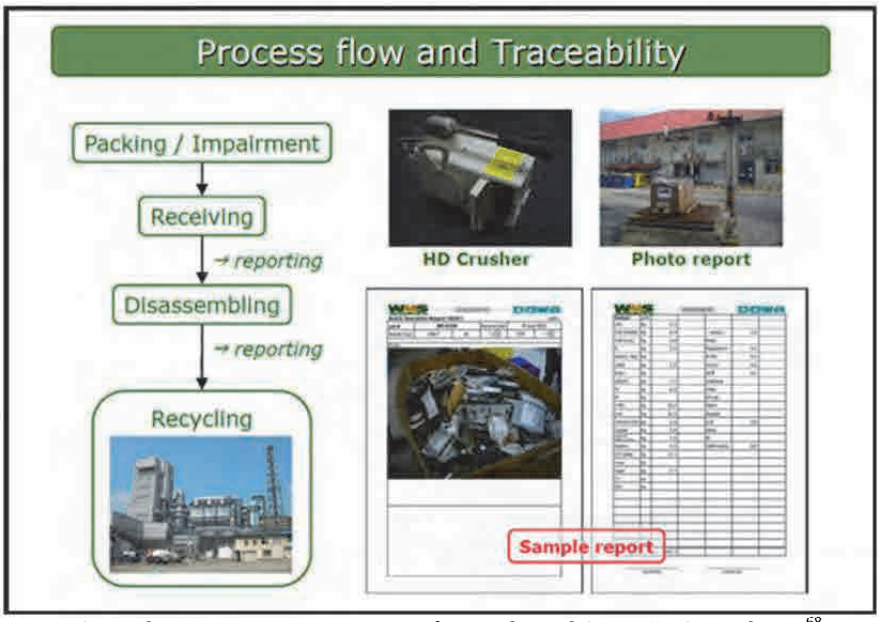
Process flow of E-waste

Source: PCD, "An Overview of Hazardous Waste Management & Prevention in Thailand," PCD Website, Wongpanit Website.

ESBEC/WMS[67]

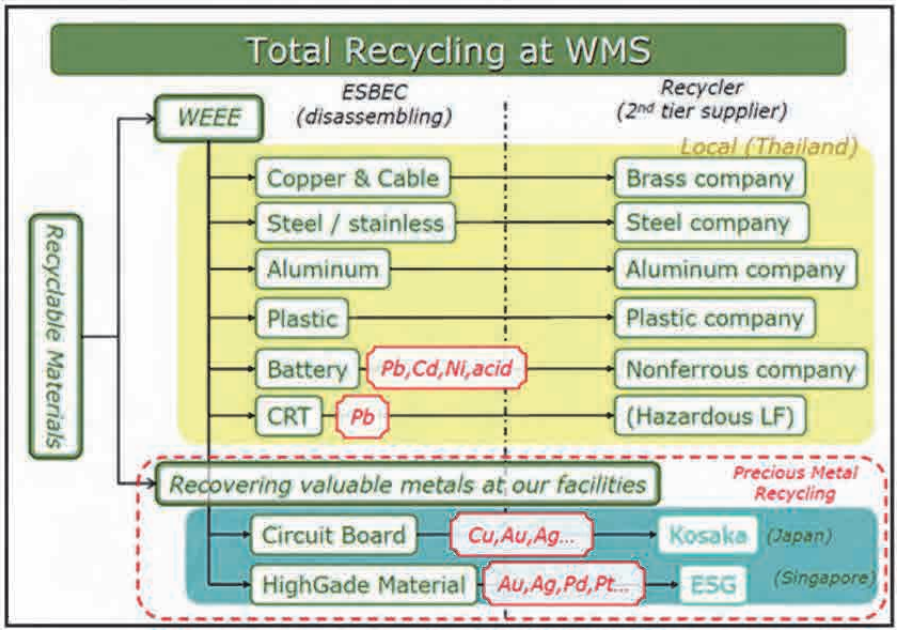
Company profile	• Eastern Seaboard Environmental Complex (ESBEC), located in Sri Racha in Chonburi province in eastern Thailand, is a landfill disposal site and recycling plant owned by Waste Management Siam (WMS) under DOWA Eco Systems.
Work contents in Thailand	• Among clients (IT producers), because there is a need for a recycling business to receive and appropriately process (dismantle and utilize the collected resources via an appropriate network) the business' used equipment (PCs, etc.), and it is possible to utilize the know-how of the DOWA Group, this company started the E-waste recycling business in 2010. • The basic policy in launching the E-waste recycling business was as follows: 1) to conduct the appropriate disposal of hazardous wastes, and 2) not to sell certain components, etc. (in order to prevent the brand image among customers suffering as a result of allowing components spread onto the market). It currently handles PCs, peripheral equipment, CRT monitors, servers and so on. • It has acquired 106 licenses pertaining to the recycling (dismantling, etc.) of E-wastes.
Received wastes and introduced technologies	• The flow of E-waste disposal is as follows: 1) packing (functional destruction before the customer's eyes if requested to prevent improper recycling), 2) recording of weight and taking photographs when receiving, 3) creation of reports of results following dismantling, and 4) subcontracting of disassembled components for recycling. Subcontractors are determined according to the type of metal, etc., and they also can be confirmed by the clients. The company aims to entirely conduct recycling within Thailand; however, for an exception, it exports PCBs because it cannot undergo appropriate disposal locally.

[67] METI, "Study to promote cooperation between circular-society cities: Akita and Chonburi municipalities," 2012.



Source: PCD, "Electronic Waste Management from Industrial Sector," PCD Website [68]

Figure 3-39 Process Flow and Traceability at ESBEC/WMS



Source: PCD, "Electronic Waste Management from Industrial Sector," PCD Website

Figure 3-40 Flow of Recyclable Materials at ESBEC/WMS

Iron, copper, aluminum and plastics are sold to recyclers in Thailand, and CRT glass that contains lead is disposed at secure landfills. Circuit boards and other items that contain precious metals are exported to Japan and Singapore following the procedures of the Basel Convention. The disposal of E-wastes is as shown in the following figure and mainly entails manual dismantling.

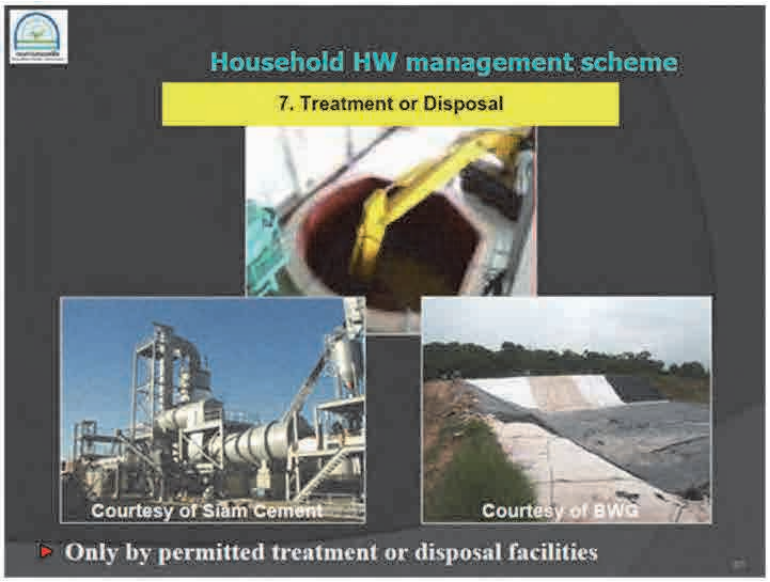
[68] http://infofile.pcd.go.th/haz/7e-waste.pdf

Source: PCD, "Electronic Waste Management from Industrial Sector," PCD Website

Figure 3-41 Manual Dismantlement at ESBEC/WMS

b. Disposal Sites for Final Residues

In Thailand, as was mentioned above, according to a report by the DIW, 19% of hazardous industrial wastes are used as alternative fuels, 43% are reused and recycled, 16% undergo final disposal in secure landfills, and 15% undergo incineration. There are three companies in Thailand that operate secure landfill sites, and of these the following sections describe General Environmental Conservation Public Co., Ltd. (GENCO) and Better World Green Co., Ltd. (BWG), which owns the only hazardous waste incineration facility in the country.



Source: PCD, "An Overview of Hazardous Waste Management & Prevention in Thailand," PCD Website

Figure 3-42 Final Treatment of Household Hazardous Waste in Thailand

GENCO：General Environmental Conservation Public Co., Ltd.[69]

Company profile

- GENCO was established in a joint venture between the Thai Ministry of Industry and private sector, and it was a monopolistic enterprise until the deregulation of waste disposal operators in 2001. It collects industrial wastes in industrial belts inside Thailand and has a workforce of 150. It properly disposes of hazardous wastes and carries them to a designated site for disposal.
- It currently owns and operates a designated hazardous waste disposal site (80 hectares) in Ratchaburi Province (120 kilometers from central Bangkok) and a disposal site specializing in fluid wastes in Samaedam District in BMA (30 kilometers from central Bangkok).

Basic information on the Samaedum disposal site

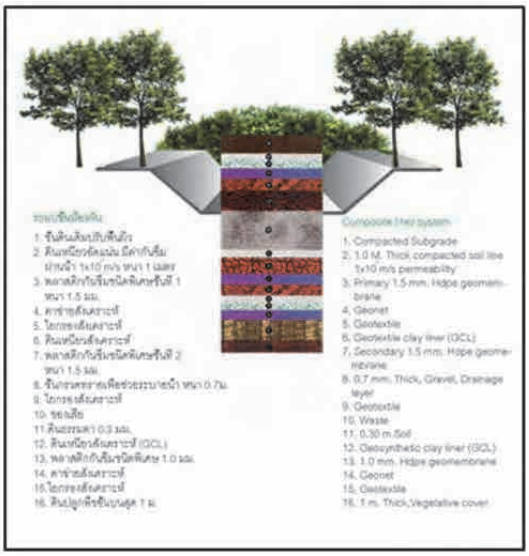
- This is the only stable disposal facility for hazardous wastes owned by GENCO in Thailand. Hazardous wastes collected from clients all over the country are brought here for disposal.
- The site currently disposes 3,000 tons per month.
- There are no fixed disposal fees or schedule. When the site receives requests from customers to dispose of wastes, it confirms the quantity and shape of wastes and conducts component analysis in the company laboratory before calculating individual disposal costs and presenting them to the customers.

Sources: GENCO Website

Figure 3-43 Over[70]view of the GENCO's Secure Landfill

[69] MOFA (Ministry of Foreign Affairs of Japan), "Thailand and Malaysia: Study to design projects regarding dissemination of treatment plants that separate and collect hazardous mercury from waste fluorescent lamps," Mar. 2014.

[70] http://www.genco.co.th/EN-Fac04.htm



Source: GENCO Website

Figure 3-44　Structure of the GENCO's Secure Landfill

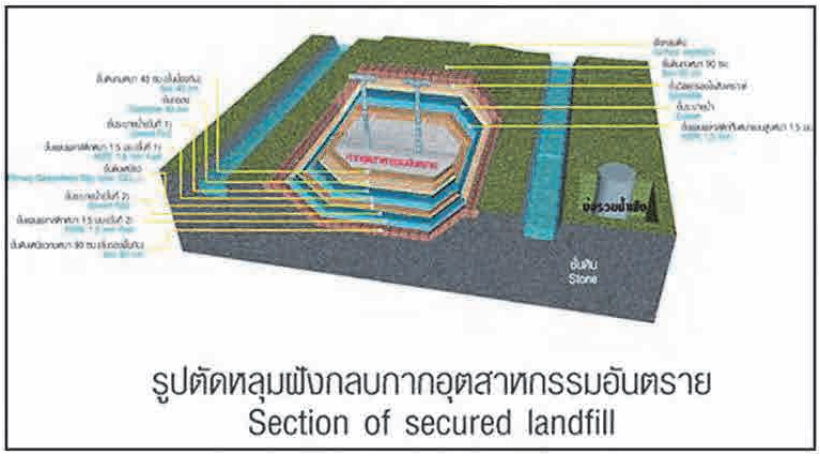
BWG：Better World Green Co., Ltd.

- The BWG Group is a private sector enterprise that entered the industry following market liberalization. Akkhie Prakarn Co. Ltd., an affiliated company of the BWG Group, acquired the rights to operate the incinerator facility constructed by the Ministry of Industry for disposing of sludge, infectious and other hazardous wastes for 20 years from February 2008 after responding to a public subscription. Moreover, this is the only such incinerator in Thailand at present.
- The incinerator uses a rotary kiln that renders wastes totally harmless by converting them into secondary fuels. This facility receives solid and fluid hazardous wastes and infectious wastes. Exhaust gases are monitored and controlled according to international standards.[71]

Source: BWG Website

Figure 3-45　Overview of the BWG's Incineration Facility

[71] BWG Website, http://www.betterworldgreen.com/



Source: BWG Website

Figure 3-46 Structure of the BWG's Secure Landfill

3.2.5 Economic Measures

a. The Ability to Bear Cost required for the Treatment of E-waste

According to the survey of household electrical and electronic waste recycling costs and take-back system conducted by Mae Fah Luang University and Chulalongkorn University in 2010 , 34% of people in Thailand have in the past elected to dispose of E-wastes without payback by either offering for charity or dumping.[72] Meanwhile, only 13% of people have selected discard methods that provide a payback either by selling or trading in.

By asking respondents which they prefer of bringing E-wastes into a center or having them picked up from home and whether or not they require payment for discard, 31% responded that they did not require any payback.

Judging from the findings of this survey, consumers in Thailand do not necessarily seek payment for discharging E-wastes.

Moreover, according to the JETRO Survey of Popular Products in Asia (January 2011) that was discussed in the preceding discussion of Malaysia, looking at the ratio of income classes in Thailand in 2009, the upper middle class accounts for 15% and lower middle for 47% (the highest share), meaning that the middle class combined accounts for 61%. The wealthy class accounts for only 3% of the population. In contrast, the low income class accounts for 36%, indicating that there is a high percentage of people in the lower middle to low income bracket.

b. System Where Return of Investment is Possible

In view of the abovementioned examination in Malaysia, the prerequisites in order for a system to make a return on investment are that the quantity of E-waste can be forecast and, judging from Japan's experience with the domestic electrical appliances recycling law that each facility needs to process at least 200,000 units per year.

Based on this estimate, in Thailand, according to the survey conducted by Chulalongkorn University, in 2010 it was estimated that E-wastes limited to the four items of TVs, refrigerators, air conditioners, and PCs accounted for 3,479,000 units.

Assuming that a collection rate of 50% is achieved, this means that 1,740,000 units will go to recycling facilities.

[72] "Buying back household waste electrical and electronic equipment: Assessing Thailand's proposed policy in light of past disposal behavior and future preferences," P. Manomaivibool, S. Vassanadumrongdee, Resources, Conservation and Recycling 68, 2012

3.2.6 Social Responses

The following sections consider the social aspects of E-waste collection and disposal in terms of the payment of costs, awareness of generators, incentives, resources and so on.

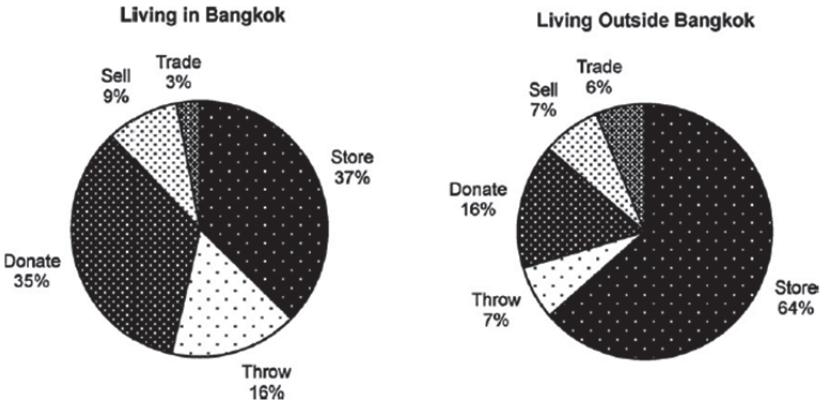
a. Consumer Perception toward the Treatment and Generation of E-waste (Including Awareness Level towards Payment)

The following paragraphs sum up about consumer awareness of E-waste discard and disposal and willingness to pay for costs.

Results of the survey of household electrical and electronic waste recycling costs and take-back system implemented by P. Manomaivibool of Mae Fah Luang University, and S.Vassanadumrongdee of Chulalongkorn University and Chulalongkorn University are described below.

Upon asking about past methods of E-waste disposal and grouping responses according to those in Bangkok and those in other areas, in Bangkok, the most common responses were “storing” with 37% and “donating” with 35%, while dumping accounted for 16%, sale for 9%, and trade-in for 3%. In areas outside of Bangkok, storing accounted for 64%, donating accounted for 16%, dumping was 7%, sale was 7%, and trade-in was 6%.

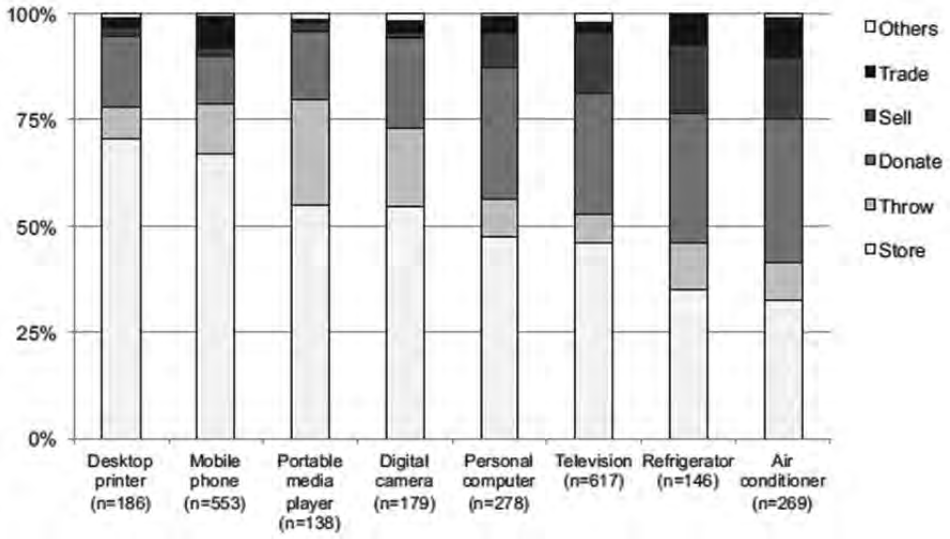
One feature of these results is that because houses in Bangkok do not have enough space to store unwanted E-wastes, the ratio of E-waste storage is roughly half of that in other areas. In Bangkok, much of the E-waste that can no longer be stored is donated to temples or charity groups or otherwise dumped. Meanwhile, the options of selling or trading-in that offer an economic return are low at 12% and 13% in both areas, so there is little desire to make a profit from E-waste disposal. However, since “donating” exceeds these two options in both areas, this shows that people do realize that E-wastes have some value. This trend will be extremely important for determining the buy-back price if establishing a take-back system in future and it is forecast that economic incentives will not have a strong influence on raising collection rates.



Source: P. Manomaivibool, S. Vassanadumrongdee, Resources, Conservation and Recycling 68, 2012

Figure 3-47 Past E-waste Disposal Methods (Bangkok and Other Areas)

The following table shows E-waste disposal methods according to each type of product.

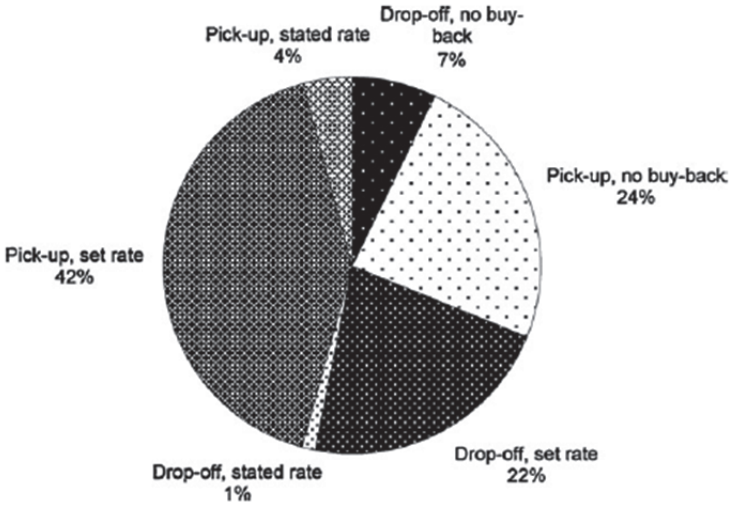


Source: P. Manomaivibool, S. Vassanadumrongdee, Resources, Conservation and Recycling 68, 2012

Figure 3-48 Past disposal methods of E-wastes by product types in Thailand

ICT (information and communications technology) items such as printers, mobile phones, music players, digital cameras and PCs tend to be stored or dumped more than white domestic electrical appliances such as TVs, refrigerators and air conditioners. This is thought to be because such items contain less valuable materials. Moreover, sale and trade-in ratios are high for white domestic electrical appliances and PCs, and these findings are consistent with the items targeted for collection by the informal sector. Accordingly, from the results of this survey it was found that countermeasures for E-wastes need to be considered separately according to the characteristics of each product.

Concerning future behavior, consumer choices regarding the combination of handover method and price for E-wastes were as follows.



Source: P. Manomaivibool, S. Vassanadumrongdee, Resources, Conservation and Recycling 68, 2012

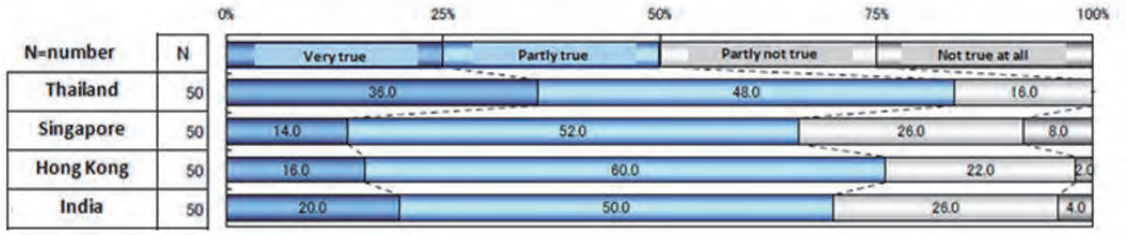
Figure 3-49 Choices concerning E-waste Handover Method an Price in Thailand

Concerning the method of handing over E-waste, 70% of consumers stated a preference for pick-up from their own home rather than dropping off at a center. Moreover, 24% indicated that they would prefer pick-up with no buy-back, indicating that the transportation of E-wastes is a problem.

b. Aspirations and Understandings towards Environmentally Friendly Companies and Products

Environmental awareness of consumers[73]

According to the Asia Trend Map Awareness Survey targeting 50 people each in Thailand, Singapore, Hong Kong and India that was implemented in 2010, in response to the question concerning "environmental awareness and everyday efforts to conduct recycling and protect the environment," 36% of respondents in Thailand, between 16~22% higher than in the other countries, said this applied to them very much, indicating a high level of environmental awareness in the country.



Source: METI, "Asia Trend Map Awareness Survey," Mar. 2010.

Figure 3-50 Survey Result of Environmental Awareness in 4 Asian Countries

Green Market

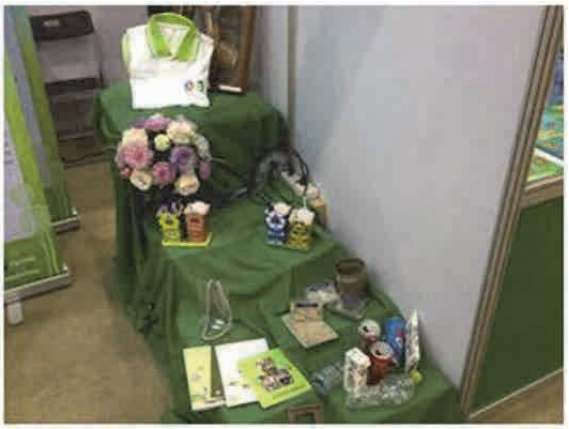
In an event marking World Environment Day on June 5, 2014, an environmental fair called "Green Market" showcasing environmentally friendly products and enterprises was staged at an exhibition center in Bangkok. Numerous companies set up booths and many eco friendly products such as soap made from waste oil and stationery made from old paper were put on display. Among the items on display were recycled synthetic wrapping materials made from aluminum, plastic and paper that is not even recycled in Japan. Recycled paper and pressed roof materials using used plastic and aluminum were also shown.

Entrance at Green Market (exhibition)

Inside the exhibition

[73] METI, "Asia Trend Map Awareness Survey," Mar. 2010, http://www.meti.go.jp/report/data/g100329aj.html

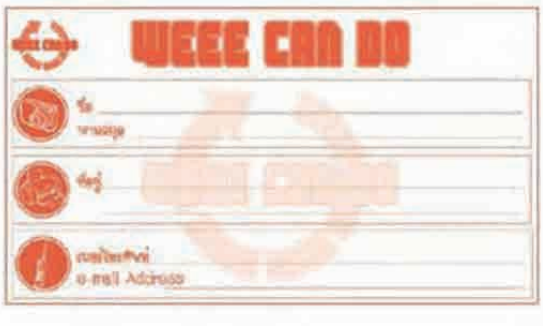
A company that recycles tetra-pak into papers



Display of recycled products

c. Incentives for Promoting Collection

In the "WEEE Can Do" project that was implemented in Thailand, generators of waste domestic electrical appliances were given lottery tickets with the chance of winning prizes (new domestic electrical appliances, etc.) as an incentive to promote collection. The domestic electrical appliances, etc. used as prizes were provided by producers.



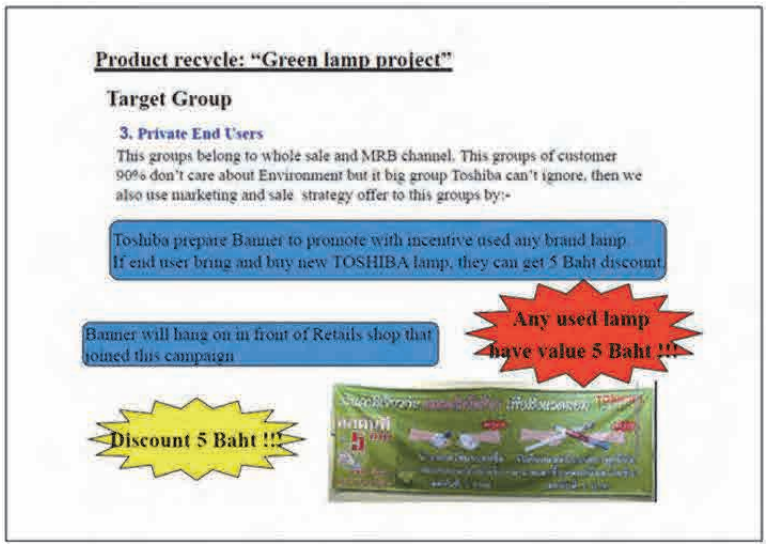
Lottery ticket (name, address, phone #, taped on E-waste like the picture on the right)

Lottery tickets taped on collected E-wastes

Source: METI, "Study to promote cooperation between circular-society cities: Akita and Chonburi municipalities," 2012.

Figure 3-51 Lottery Ticket Used in the Thailand's WEEE Can Do Project

In the Green Lamp project that is voluntarily implemented by Thai Toshiba Lighting Co., 5 bahts is offered for every waste fluorescent lamp that is carried in when buying new lights in order to promote retrieval from households.



Source: "E-waste Training Workshop for Asia and the Pacific," August 2009, Hanoi, Vietnam

Figure 3-52 Collection incentives at Green Lamp Project in Thailand

d. Collection Campaign Record

Target quantity

In the WEEE Can Do project that was implemented in Thailand, the target quantity was set at 84,000 units to commemorate the 84th birthday of King Bhumibol.

Period

The project implementation period was initial set from Environment Day (June 5) of 2011 to the birthday of King Bhumibol (December 5). Two collections of WEEE were implemented during this period, once at the end of November and the second time at the end of the campaign period.

Results

According to the PCD, approximately 20,000 WEEE units were collected in the first collection.

Collection box (lottery tickets are taped)

Collected E-wastes

Source: US EPA, International E-waste Management Network (IEMN), Third Annual Meeting, PCD, "WEEE Management Policy Update from Thailand," 2013

e. Research Resources for Promoting Related Policy Formation and Technology Development

Concerning research resources in Thailand, the Environmental and Hazardous Wastes Management Center (EHWM) of Chulalongkorn University was consigned by the PCD to implement a survey concerning calculation of product surcharges and recycling costs, while the Natural Resources and Environmental Management Institute (ISNREM) of Mae Fah Luang University, and Asia Institute of Technology (AIT) can also be pointed to.

3.3 Indonesia

3.3.1 Regulations, Policy and Institutions

The situation of the legal system and national policies for the management of hazardous waste, particularly E-waste, is described in this section.

a. Laws, Regulations and National Policies

Environmental Protection and Management Act

The Basic Environmental Act of 1982 (Law No. 4/1982) was revised in 1997 as the Environmental Management Act (Law No. 23/1997) consisting of 11 chapters and 52 articles and incorporating tougher environmental control and penal provisions, consideration of environmental disputes, settlement rules and the introduction of clear provisions on rights relating to environmental information.

This 1997 act was again revised in 2009 as the Environmental Protection and Management Act (Law No. 32/2009) which consists of 17 chapters and 127 articles. The titles of these 17 chapters are I. General Provisions, II. Principles, Goals and Scope, III. Planning, IV. Utilization, V. Control, VI. Preservation, VII. Management of Hazardous and Toxic Materials as well as Waste of Hazardous and Toxic Materials, VIII. Information System, IX. Tasks and Authority of the Government and Regional Governments, X. Rights, Obligations and Prohibitions, XI. Public Participation, XII. Supervision and Administrative Sanctions, XIII. Settlement of Environmental Disputes, XIV. Investigation and Verification, XV. Penal Provisions, XVI. Transitional Provisions and XVII. Conclusions. As indicated by the addition of the word "Protection", the new law significantly strengthens the authority of the competent bodies and penal provisions, giving Ministry of Environment (KLH: Kementrian Lingkungan Hidup)[74] the authority to arrest suspected perpetrators of environmental crimes in collaboration with the police.

The Environmental Protection and Management Act establishes the basic framework for the environmental control of hazardous waste (including E-waste) as outlined below.

- Anyone producing waste, including hazardous waste, must properly manage such waste by establishing the traceability of the original sellers of the goods.
- Hazardous waste must be properly treated and/or disposed of.
- Consumers and retailers must segregate hazardous waste.
- Hazardous waste must be delivered to designated storage sites.
- Hazardous waste must not be directly sold to anyone who does not hold a disposal permit.
- Those disposing of waste must determine storage sites in collaboration with producers and local governments.
- A mechanism to provide incentives for customers to return hazardous waste to appropriate places must be supported.
- When a producer of waste cannot manage such waste, the management of the waste may be entrusted to a business operation that holds the relevant permit.

Laws and regulations relating to waste management

There is currently no fully developed legal framework in Indonesia for the recovery and recycling of E-waste. The principal laws and regulations concerning waste and hazardous waste are listed below.

- Waste Management Act (Law No. 18/2008)
- Management of the Waste of Hazardous and Toxic Materials (Government Regulation No. 18/1999)

[74] The formal name of KLH is "Sengketa Lingkungan Kementerian Negara Lingkungan Hidup"

- Partial Revision of the Government Regulation on Hazardous Waste Management (Government Regulation No. 85/1999)
- Temporary Storage, Collection, Entrusted Treatment, Intermediate Treatment Facility, Disposal Facility and Container Labeling of Hazardous Waste (Decrees of the Environmental Impact Management Agency: Decrees No. 1 through No. 5/1995)
- Collection of Hazardous Waste at Ports and Storage Facilities (Minister of the Environment Regulation No. 3/2007)
- Hazardous Waste Utilization (Minister of Environment Regulation No. 2/2008)
- Symbols and Labeling of Hazardous Waste (Minister of Environment Regulation No. 3/2008)
- Waste Management at Ports (Minister of Environment Regulation No. 5/2009)
- Licensing Procedure for Hazardous Waste Management (Minister of Environment Regulation No. 18/2009)
- Permit Systems of Local Governments for Hazardous Waste Management (Minister of Environment Regulation No. 30/2009)
- Electronic Registration System for Hazardous Waste (Minister of Environment Regulation No. 2/2010)

Status of E-waste in the waste management framework

The Waste Management Act enacted in 2008 is designed to introduce a basic framework for waste management in Indonesia in the face of the worsening situation surrounding waste. While the containment of waste production at its source and the concept of the 3R are newly introduced, there are no concrete provisions concerning the rights and obligations of each stakeholder. Article 2 Paragraph 1 of the Act defines three types of waste as listed below.

1. Household waste
2. Household-like waste
3. Specific waste

Hazardous, harmful and toxic materials in Indonesia are collectively called the B3 and waste containing any of these is called B3 waste. In the Waste Management Act of 2008, B3, B3 waste and waste which cannot be recycled are classified in the category of "specific waste". As E-waste often contains hazardous materials, it is considered to be part of hazardous waste.

Government Regulation No. 18/1999 on the Management of the Waste of Hazardous and Toxic Materials is one government regulation which concerns the management of B3 waste and this regulation stipulates the definition of B3 waste and its management method. Pursuant to this regulation, collection, transportation, recycling and treatment of reject or off-speck products generated at factory of electrical and electronic equipments (EEEs) are required to obtain license from KLH. Article 1 of this regulation defines waste in the following manner.

1. Waste is the residue of an undertaking and/or activity.
2. The waste of hazardous and toxic materials, abbreviated as B3 waste, is the residue of an undertaking and/or activity which contains a hazardous material and/or which, owing to its nature and/or concentration and/or quantity, either directly or indirectly may contaminate and/or damage the environment and/or imperil the environment and the health as well as the survival of human beings and other living creatures.

Article 6 stipulates that B3 waste may be identified in accordance with its source and characteristics. By source, B3 waste is classified and listed in Article 7-(3) as "B3 waste from a non-specific source", "B3 waste from a specific source" and "B3 waste and expired chemicals, spilling, used packages and disposed of products which fail to meet specifications". Waste which is not included in the list in Article 7-(3) are identified as B3 waste if, after undergoing testing, the waste in question has one or more characteristics described as explosibility, inflammability, reactivity, toxicity, cause of infection and corrosivity in nature. The regulation specifies the followings with reference to E-waste.

- Electrical components/electronic equipment are listed under Waste Code D219 in the List of Hazardous Waste from Specific Sources in Table 2 of Annex I.
- Manufacturing and assembly industries as well as the waste water treatment industry are identified as pollution sources.
- The hazardous waste listed includes sludge from processes, coated glass (CRT tubes), solvents, painting waste, solder residue and flux (waste PCBs, ICs or cables) and plastic casings.

Table 2 - "List of Hazardous Waste from Specific Sources" in Annex I of this government regulation adopts the codes for E-waste shown in the following table. Its main reference to E-waste is outlined below.

Table 3-38 List of Hazardous Waste Related to E-waste in Government Regulation No. 18/1999

Code: Industrial Activity	Waste Produced	Main Hazardous Materials
D209 Finish processing of steel	Acid fluid; spent alkali; slag; sludge; spent solvents; other	Heavy metals; waste acid; waste alkali, nitrates, fluorides, cyanides (complexes)
D215 Zinc electroplating	Sludge; spent solvents; acid fluid (acid pickling); dross; slag; other	Metals and heavy metals; cyanides; ammonia compounds; fluorides; phenol; nitrate
D219 Electrical process	Sludge; spent solvents; mercury switches; mercury lamps; coated glass; etching solution for PCBs; separating material (for photo resist processing); post-soldering flux residue; paint waste; other	Metals and heavy metals; nitrates; fluorides; paint residue; organic materials; waste acid; halogen solvent; residue from the etching process (iron oxide)
D234 Aluminum metallurgy; chemical conversion coating of aluminum	Spent pot linings (cathodes); residue from filters and the distillation process; other	Heavy metals; oil residue; acid treatment residue
D235 Zinc dissolution and finish processing	Sludge; ash; slag; dross; anode slime from electrolysis	Heavy metals; acid treatment residue
D236 Non-ferrous metal processing	Oxalate solution and sludge; permanganate solution (acid pickling); residue from acid pickling; alkaline cleaning substance; emulsified oil	Heavy metals; nitrates; fluorides; borate; oxalate; waste acid; waste oil
D237 Metal processing and hardening	Sludge; spent solvent	Metals and heavy metals; cyanides
D238 Non-ferrous and metal processing	Emulsified oil (cutting fluid and cooling oil, etc.); sludge from the polishing process; spent solvent	Metals and heavy metals; emulsified oil; halogenated hydrocarbons; fluorides; nitrates
D239 All industries generating or using electricity (installation of equipment to upgrade transformers and batteries, etc.)	PCB waste	PCBs

Government Regulation No. 18/1999 stipulates that a permit for the storage, collection, utilization, treatment and/or landfill of hazardous waste must be obtained from the head of the responsible government agency. Meanwhile, there are some conditions imposed to obtain a permit for the treatment and disposal of hazardous waste. These are (1) the applicant must be a business operator and (2) the application form must conform to Regulation No. 18/2009 issued by the Minster of Environment concerning B3 waste. In order to obtain a permit for storage and collection, the supplementary documents stipulated by Regulation No. 30/2009 issued by the Minster of

Environment concerning B3 waste must be submitted.

Government Regulation No. 81/2012 stipulates that the Indonesian Ministry of the Environment (KLH) plays a central role in the development of a road map for the introduction of extended producer responsibility (EPR) in relation to the management of household waste in the coming 10 years. Deputy IV (B3 Waste and General Waste Management Division) of KLH has already begun discussions with some leading beverage manufacturers on EPR regarding collection and recycling of container and packaging waste. However, there is currently no initiative to include E-waste in the framework of Government Regulation No. 81/2012.

Import control of E-waste and second-hand goods

Indonesia ratified the Basel Convention with Presidential Decree No. 61/1993 and manages E-waste under A1080 and A1180 in List A of Annex VIII of the Convention. In addition, Article 69 Paragraph 1 of the Environmental Protection and Management Act (Law No. 32/2009) prohibits, in principle, any import of hazardous waste. Regulation of the Ministry of Trade No. 39/2009 concerning the import regulations for non-hazardous waste stipulates the following matters.

- Imports of non-hazardous waste are restricted to imports of materials to substitute domestic materials for the purpose of manufacturing and no trade of such waste is permitted.
- Non-hazardous waste to be imported must be clean and segregated and must not contain any hazardous waste or be mixed with different types of waste.
- Producers importing non-hazardous waste must meet the relevant environmental requirements and must ultimately obtain a valid import license from the Ministry of Trade based on recommendations made by the Ministry of Environment and Ministry of Industry.

Article 12 of Regulation of the Ministry of Trade No. 48/2011 concerning the import of used capital goods stipulates the following requirements for the granting of an import permit for used computers and monitors.

- Imported in a completely functional conditions (requiring an official certificate)
- Has a maximum age of five years since the date of production
- Has the latest specifications and type (the import of CRTs is prohibited)
- Imported in a complete set (import without accessories is prohibited)
- Imported in the proper packaging

Local government bylaws (Example of the DKI Jakarta)

In Jakarta, Bylaw No. 3 of 2013 defines waste in a similar manner to the Waste Management Act of 2008. While this bylaw stipulates the roles to be played by the Jakarta government in regard to waste management, it does not fully clarify the obligations and roles of each department. While the introduction of enforcement regulations and governor’s decrees is necessary, no initiative has yet been taken.

The legal system of Indonesia makes local governments responsible for the collection of household waste and the national government responsible for the management of hazardous materials (B3). This means that local governments require the guidance of the national government on the handling of E-waste they collect as they cannot independently process such waste.

Other related systems

The KLH has been implementing a program called PROPER which lists the law compliance rankings of enterprises primarily for the purpose of facilitating the implementation of environmental measures by large enterprises. At the initial stage of the program, only a river purification program called PROKASIH was available to assess the water quality improvement measures employed by the participating enterprises. At present, however, air pollution control measures and B3 waste management are also assessed. The assessment results based on the PROPER are color-coded and

range from Gold as the highest rank to Green, Blue, Blue-, Red and Red- to Black as the lowest rank. The KLH strongly urges listed enterprises as well as exporting enterprises to participate in the PROPER.

There are several related municipal and provincial programs, including the ADIPURA which ranks the environmental and pollution control measures employed by local enterprises and the ADIWIYATA which awards green schools.

b. Laws/Regulations Currently being Drafted

Ministerial decree for specific waste management

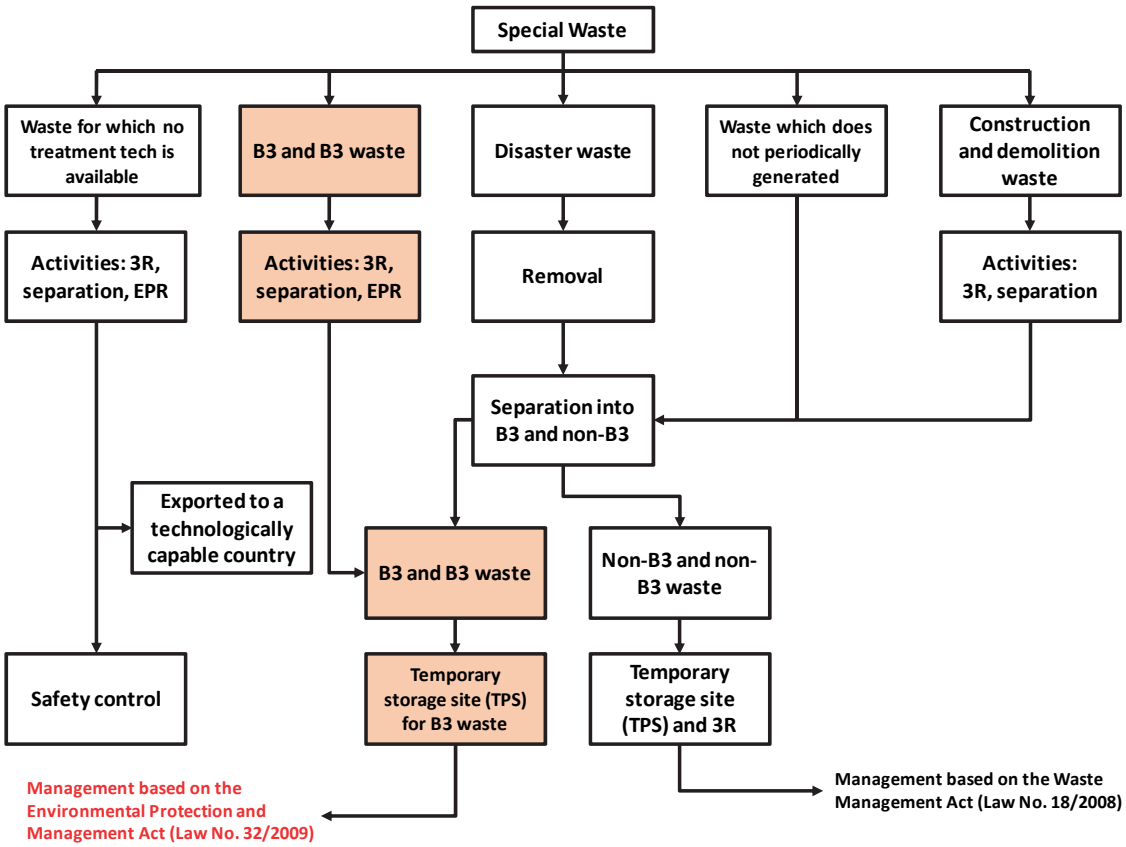
The specific waste defined in Article 2 Paragraph 1 of the Waste Management Act of 2008 is explained as "waste of which its types, concentration and/or volume are required to be managed specifically" in Article 1 Paragraph 2 of the Act. Article 23 Paragraph 1 stipulates that specific waste management shall be the responsibility of the government. Meanwhile, Article 2 Paragraph 4 stipulates the types of waste to be classified as specific waste.

a. Waste containing hazardous and toxic materials
b. Waste containing hazardous and toxic waste
c. Waste derived from a disaster
d. Construction and demolition waste
e. Waste which cannot be processed because no technology is available for its processing
f. Waste which does not periodically occur

As mentioned earlier, local governments in Indonesia are awaiting the introduction of detailed enforcement regulations for the Waste Management Act of 2008. In response, the KLH is now formulating a new ministerial decree for specific waste for the following purposes.

- Implementation of sustainable and environment-oriented specific waste management
- Realization of community services relating to specific waste management
- Secured protection of human health and the environment
- Utilization of specific waste as a resource

The specific waste management framework under the new decree is shown in Figure 3 53 below. Under the new arrangement, waste containing B3 materials and waste containing B3 waste, including E-waste, must be managed not in accordance with the Waste Management Act but in accordance with the provisions of the Environmental Protection and Management Act.



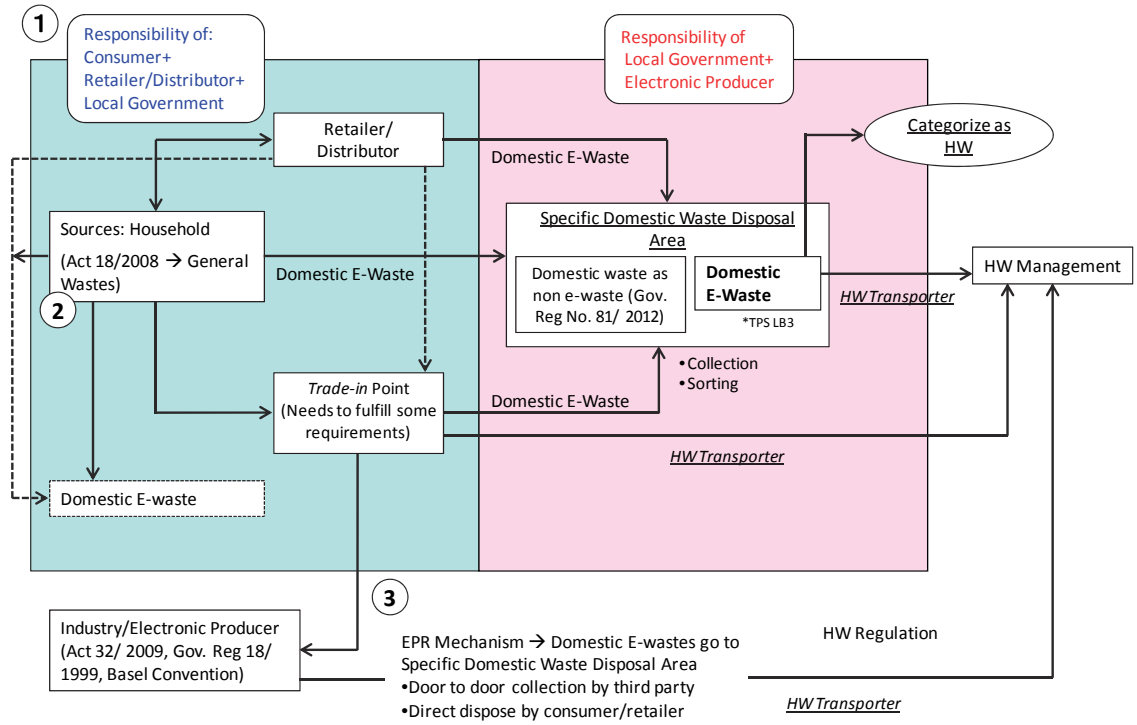
Source: Prepared by the Study Team using the presentation by Mr. Agus Saefudin (KLH) at the Workshop on E-waste Management Framework in Indonesia.

Figure 3-53 Management Scheme for Special Waste

A draft version of the new decree is currently being internally discussed at Deputy IV of the KLH and will be discussed by technical and legal experts on waste management in due course. A modified version will then be reviewed by the experts again. Once approved by the head of Deputy IV after the expert review, the draft will be submitted to the legal department of the KLH for further consultations with various stakeholders.

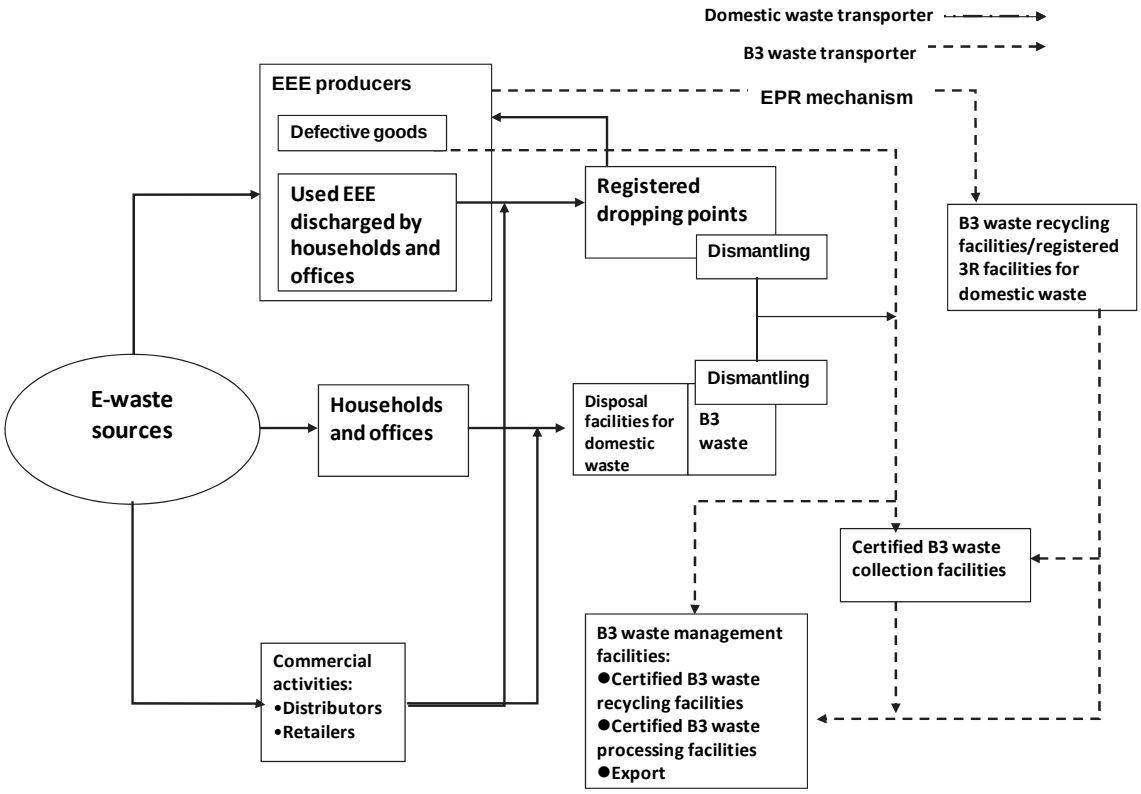
Minister of Environment Regulation for E-waste management

Under the current legal system in Indonesia, E-waste from industrial processes (e.g., defective products) is classified as B3 waste. As such, it is subject to the control regime under the Environmental Protection and Management Act. Producers (enterprises) of E-waste have an obligation to properly process it through a licensed recycling business operator. Meanwhile, the Waste Management Act of 2008 requires local governments to collect domestic waste, including E-waste. Under the currently existing mechanism, the domestic E-waste collected by local governments is not handed over to a licensed recycling business operator. In order to rectify this situation, work is currently in progress to introduce a new Minister of Environment regulation which will make it obligatory for local governments to set up household-derived E-waste collection points for the forwarding of this waste to licensed recycling business operators.



Source: Materials provided by the KLH

Figure 3-54 Legal Framework for E-waste Management in Indonesia



Source: Materials provided by the KLH

Figure 3-55 Overall Framework for E-waste Management Currently Examined by the KLH

As part of the drafting process of this regulation, the roles of various stakeholders in the collection and management processes of E-waste are being examined as described in the Table below.

Table 3-39 Roles and Responsibilities of Stakeholders in the New Ministerial Regulation for E-waste Management Currently Being Drafted by the KLH

Stakeholder	Main Roles and Obligations
Producers	• Monitoring of the state of product recovery and handling of waste • Management of E-waste * Although the materials provided by the KLH do not clarify the details of management, the draft regulation is examining the following obligations of stakeholders. ➢ Take back of E-waste delivered by users or retailers ➢ Appropriate storage of E-waste by type on acceptance ➢ Appropriate processing by itself or by licensed third parties • Design of environment-friendly products
Consumer and Distributors	• Handing over of E-waste to collection facilities
Collectors	• Cooperation with producers and local governments for the promotion of the development of collection facilities • Establishment of an incentive mechanism for take-back
Reconditioning Industry	• Reconditioning based on product specifications • Management of waste generated in the reconditioning process

Source: Prepared by the Study Team based on the presentation by Mr. Upik at the Workshop on E-waste Management Framework

The new regulation provided by the KLH during the visit in April, 2014 is outlined in the Table below.

Table 3-40 Structure and Descriptions of the Draft Regulation for E-waste Management

Article	Subject	Description in the Draft Version
1	Definitions	Sets forth the definitions for electronic products, E-waste and individual stakeholders
2	Sources of waste	Sets forth households, offices, industrial activities and commercial activities as sources of E-waste
3	Target waste	Targets such white goods as TVs and washing machines, PCs, copying machines, and such small household electrical/electronic appliances as mobile phones, notebook PCs, mice, projectors, fluorescent lamps and others
4	Import control	Prohibits the import of E-waste
5 & 6	Roles of each stakeholder and provision on EPR	Plans to describe the concept of EPR and the roles of local governments, producers, importers, users, distributors, collectors, transporters, recyclers (Article 5 is blank in the current draft)
7	Handing over	Sets forth that collected E-waste should be handed over to licensed recycling facilities
8 – 10	Management of B3 waste	Sets forth the compliance with various provisions concerning the management of B3 waste and the requirements to obtain a permit from the competent authority
11	Storage facilities	Sets forth the registration and establishment of impermeable protection facilities as the requirements of storage facilities
12	Compensation and incentives	• Sets forth the monetary compensation for bodies which have handed E-waste over to the recycling system • Sets forth the monetary compensation by local governments for bodies which store E-waste at registered storage facilities • Sets forth a. Tax exemption for the procurement or import of equipment related to the processing of E-waste

Article	Subject	Description in the Draft Version
		b. EPR program awarding system c. Better evaluation under the PROER • Sets forth the national government grant as an incentive for local governments and assessment by the ADIPULA
13	Administrative penalties	Sets forth stern cautions and administrative penalties for producers and local governments which do not comply with the law
14	Monitoring	Sets forth the monitoring operation for E-waste collection activities from sources by local governments
15	Effectuation	Plans to set forth the date of effectuation in the last article

Source: Prepared by the Study Team based on reference materials provided by the KLH.

On its completion, the first draft will be submitted to the legal unit of the KLH for its review. After this review, it will then be submitted to the Ministry of Home Affairs. The draft will then undergo a consultation process with the Ministry of Industry and other relevant ministries. The finalized text will be publicly announced as a Minister of Environment regulation. The draft regulation will not be discussed at the congress.

The submission of the first draft to the legal unit will be followed by a series of consultations with various stakeholders in 2015 and thereafter and the contents of the draft will be examined at a legal consultation meeting attended by the legal unit of the KLH with a view to making any necessary revisions and additions. This regulation intends the establishment of a general framework for E-waste management. The KLH assumes that more detailed provisions will be set forth by the Minister of Environment as enforcement regulations (having lower status than the regulation currently being drafted) or bylaws of local governments.

c. Responsible Organizations and Management System

Waste management administration of the national government

The Ministry of Environment and the Indonesian Environmental Impact Management Agency (BAPEDAL) used to be the two national government organizations in charge of environmental issues. However, Presidential Decree No. 2/2002 which revised the earlier Presidential Decree No. 101/2001 stipulating the jurisdiction of the said ministry and agency was promulgated on 7th January, 2002, amalgamating the BAPEDAL with the new Ministry of Environment (KLH) which has inherited the duties and functions of the old Ministry of Environment responsible for the planning of environmental policies and global environmental issues and of the BAPEDAL responsible for the implementation of environmental conservation measures, environmental monitoring and other activities.

According to Presidential Decree No. 2/2002, KLH has the obligation to formulate and coordinate policies relating to environmental management and the prevention of (adverse) environmental impacts (Article 16). The ministerial duties to fulfill this obligation are listed (Article 18) and B3 waste management is placed under the obligation of KLH as described in the box below.

[Main Duties of KLH]

- Formulation of government policies relating to environmental management and environmental pollution control measures
- Formulation of minimum service standards and guidelines for the environmental administration of local governments (regencies and cities)
- Guidance for and the supervision of local governments (regencies and cities) (formulation of environmental guidelines and implementation of environmental training and environmental monitoring)
- Ratification of environment-related international treaties and their enforcement
- Formulation of a national policy for an environmental information system
- Formulation of environmental standards and guidelines for the measurement of environmental pollution
- Formulation of guidelines required for the conservation and management of the natural environment
- Management of B3 waste (dangerous materials, hazardous materials and toxic materials)

Deputy IV (B3 waste and general waste management department) in KLH is responsible for establishing legal framework for management of B3 waste including E-waste.

At present, KLH is primarily facing the following problems.[75]

- While Indonesia has undergone a decentralization process in terms of the legal framework, the centralized government structure still remains in part of the administrative system. Provincial governors, municipal mayors and local governments simply act as local branches or local implementing bodies of the national government in some aspects of administration. Almost all policies are decided in Jakarta and implemented by various sections of local governments. Under these circumstances, some of the decisions made are not sustainable.
- The present KLH was established through the merger of the new defunct BAPEDAL and three Deputies of the former Ministry of Environment. However, as the law enforcement authority of the BAPEDAL was transferred to local governments, the new KLH now has seven deputies which do not have law enforcement authority.
- In the national referendum on environmental management in 2007, the popularity (recognition rate) of KLH was some 23%. 88% of the people did not know the ministerial regulations and 24% of these people replied that KLH did not have legal binding power. Indonesia has introduced an administration evaluation system and the evaluation result for KLH does not appear to be very positive.

Waste management administration by local governments

Against the background of discontent with the centralized government system among regions and the trend of regional separation and autonomy which strong manifested in 1998, the Law on Local Government (Law No. 22/1999) and the Law on Fiscal Balance Between the National Government and Locals (Law No. 25/1999) introduced significant decentralization. This sudden institutional reform and the under-development of the necessary administrative structure on the part of regencies and cities to which administrative authority was transferred created several problems, including ambiguity concerning the division of the roles to be played by the national government and local governments. The Law on Regional Governance (Law No. 32/2004) and the Fiscal Balance Law (Law No. 33/2004) rectified some of these problems and the drive for decentralization has continued up to the present. Following the decentralization of the authority and functions of the national government, the transfer of national government employees and financial sources to local governments has also been in progress. In the area of environmental administration, many administrative duties and authorities have been transferred to local governments (mostly regency and city governments). In line with this trend, KLH has disclosed various guidelines, etc. to local governments as part of its efforts to ensure the smooth implementation of environmental administration in the midst of decentralization.

In the area of environmental management, local governments have conventionally used their cleansing department to collect general waste. Because of the insufficient transfer of knowhow and experience for law enforcement in regard to environmental management, including waste management, from the BAPEDAL during the period running up to its merger with the old KLH, the environmental management bureaus of regencies and cities in particular face many problems today.

[75] Japan Environmental Technology Association, Report for the Study on Borderless Environment entrusted by the Ministry of the Environment in FY 2008, 2009 (in Japanese)

3.3.2 Material Flow

a. Flow from Generation Sources to Final Disposal/Export

Generated amount of E-waste

In Indonesia, the Bandung Institute of Technology (ITB: Institut Teknologi Bandung) has played a central role in developing the Preliminary Inventory for E-waste.[76] The following table shows the production capacity of electrical equipment in Indonesia listed in the 2005 Inventory.

Table 3-41 Production Capacity of Electrical Equipment in Indonesia Listed in the 2005 Preliminary Inventory

No.	Commodity	Production Capacity	Unit
1	Air-Conditioners	29,181,400	Unit
2	Televisions	63,882,025	Unit
3	Refrigerators and Components	8,585,400 1,300,000	Unit Piece
4	Electrical Components	191,330,425 4,128,117,920 10,514,709 2,561,420 29,200 4,000	Set Piece Unit M2 Mh Ton
5	Computer Components and Equipment	639,361,850 6,876,500 18,734,197	Piece Set Unit
6	Monitor Computer	1,252,000	Unit
7	Printer	309,038	Unit

Source: Presentation by KLH in the Workshop on E-waste Management Framework in Indonesia (29th April, 2014)

Since this inventory was preliminary and developed in 2005, the full scale nationwide inventory should be developed. There is other research on inventories featuring specific areas, such as Bandung.[77]

Characteristics of Flow from Sources to Export/Final Disposal

The characteristics of the flow of used electrical and electronic equipments (EEEs) and E-waste found through an interview survey with local stakeholders in Indonesia are described in the box below.

- Compared to other countries, there are more cases of people simply storing non-functional EEE at home. This trend is more prominent in rural areas.
- If not stored at home, used EEE is likely taken to a repair shop. Such shops accept equipment beyond repair. While repairable equipment is reused, unrepairable equipment is believed to be either discarded as it is or sold to the informal sector.
- Most repair shops are believed to operate informally unless they are directly run by one of the leading manufacturers.
- When non-functional equipment is not taken to a repair shop, it is often sold to an informal waste picker (or scavenger) who makes door-to-door calls. These waste pickers buy not only E-waste but also materials which are used as resources.
- Even though some local governments operate a collection scheme, such schemes do not offer much

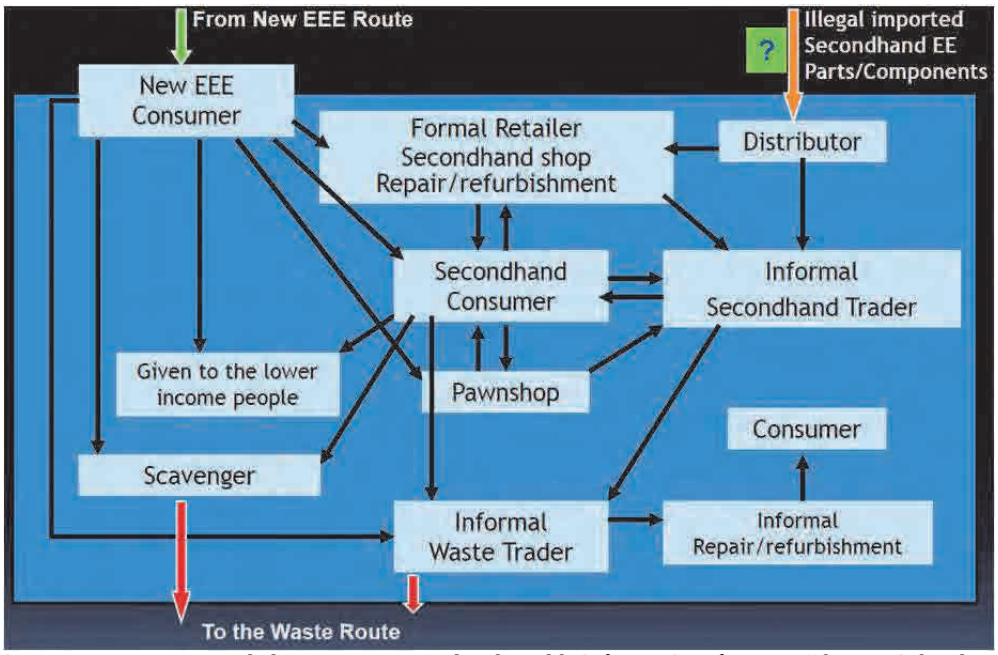
[76] The Preliminary Inventory can be found at the following URL address of the Basel Convention: (http://archive.basel.int/centers/proj_activ/stp_activities/ew-indonesia.pdf)

[77] One example is the "Study on Computer E-Product Ownership at the Household Level in the City of Bandung: (http://www.ftsl.itb.ac.id/wp-content/uploads/2009/12/study-of-computer-e-product-ownership.pdf).

economic incentive for people who can sell E-waste to the informal sector. As a result, the amount of E-waste collected by local governments is negligible.

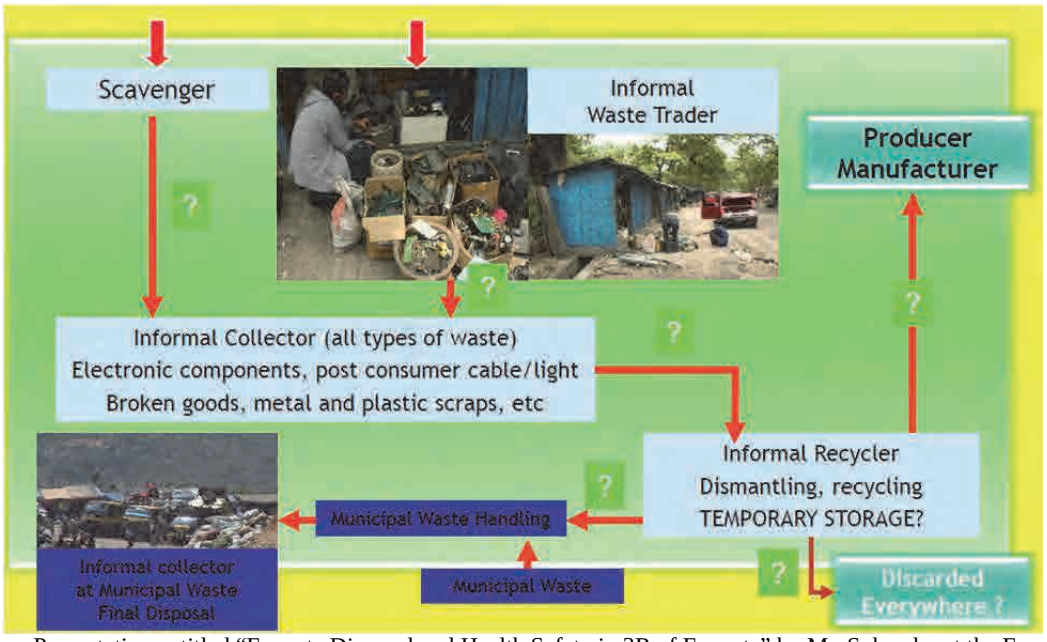
- In addition to domestically generated E-waste, a large volume of second-hand goods is imported from China, Taiwan, Singapore, Japan and other countries. Some imports of E-waste are illegal and the quality of some secondhand goods imported is so poor that it is almost equal to E-waste. While the demand for CRT (cathode ray tube) has declined, its proper processing is difficult, making illegal import one the major problems.
- · Many informal repair shops operate in Glodok, a district with the largest concentration of electrical and electronic stores in Jakarta. Imported goods are also sent to Glodok. Those which cannot be repaired are forwarded to Tangrang, Surabaya and other places for the informal recovery of iron, copper, gold and others.

Professor Enri Damahuri of the ITB and others have identified the flow of used EEE and E-waste in Indonesia as shown in Figure below. As mentioned earlier, illegal imports are abundant and there are many routes for the discard of E-waste, including via use as secondhand goods and discard from repair shops, in addition to direct discard by consumers to the informal sector. There is still much uncertainty regarding the fate of used equipment or E-waste after collection by informal waste traders and further study is necessary.



Source: Presentation entitled “E-waste Disposal and Health Safety in 3R of E-waste” by Mr. Sukandar at the E-waste Training Workshop for Asia and the Pacific held on 10 – 14 August, 2009

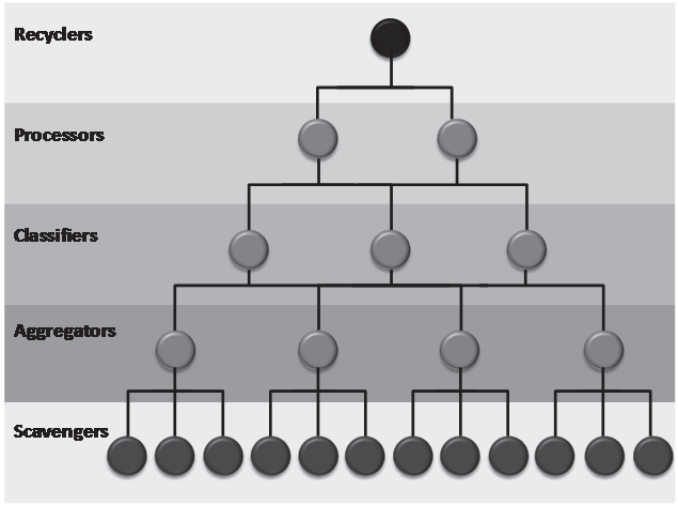
Figure 3-56 Flow of Spent Electrical and Electronic Equipment in Indonesia



Source: Presentation entitled "E-waste Disposal and Health Safety in 3R of E-waste" by Mr. Sukandar at the E-waste Training Workshop for Asia and the Pacific held on 10 – 14 August, 2009

Figure 3-57 Flow of E-waste in Indonesia

Besides, Rockman (2010) studied recycling stream of PCs in Yogyakarta and it categorized informal sector as seen in the following figure.[78]

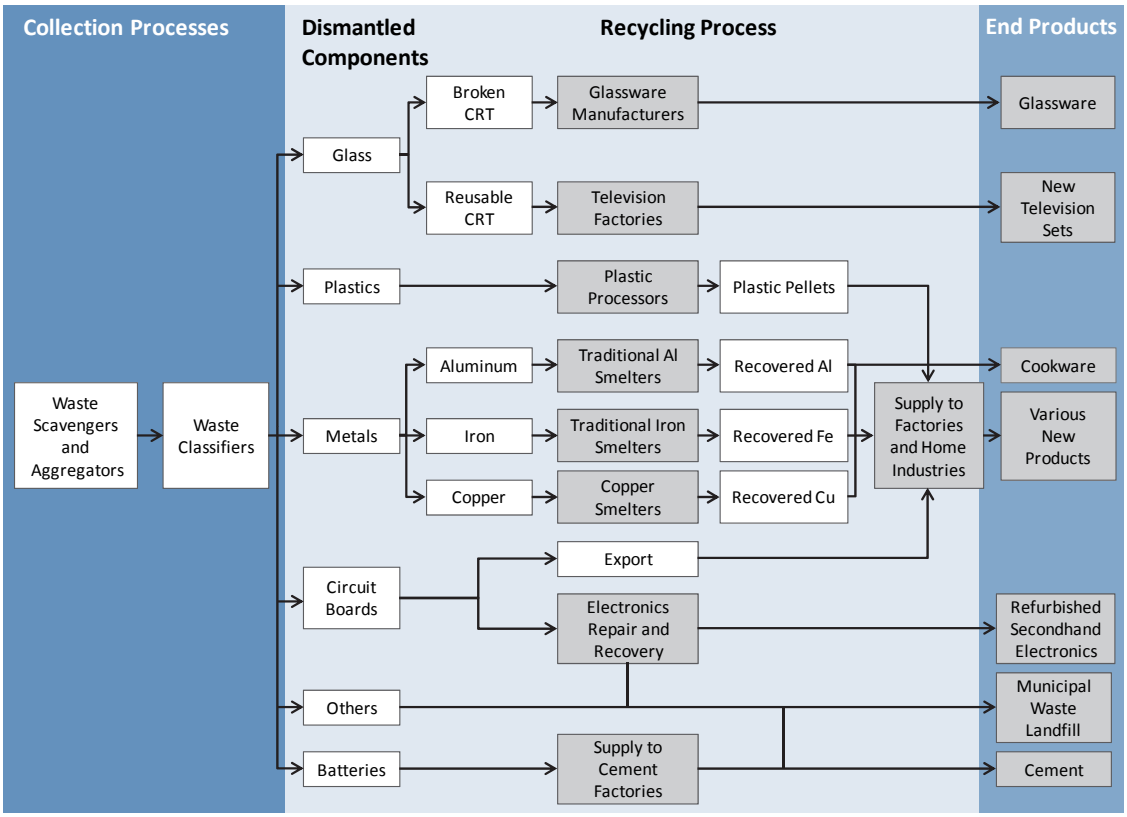


Source：" E-waste in Indonesia: The Case of Personal Computers" . Fauziah Rochman, MESc 2010

Figure 3-58 The Hierarchy of the E-waste Stream in Yogyakarta

According to the analysis of Rochman (2010), scavengers in Yogyakarta, who conduct door-to-door collection from households, belong to the largest group in the whole PC recycling stream. The most of scavengers operate business individually or family based. The PCs collected by scavengers are purchased by aggregators. Normally an aggregator collects wastes from 10-20 scavengers and purchases whatever materials considered valuable without specific preference. The E-wastes collected by aggregators are then moved to classifiers, processors and recyclers (as seen in the following figure).

[78] "E-waste in Indonesia: The Case of Personal Computers". Fauziah Rochman, MESc 2010 (https://environment.yale.edu/tri/uploads/Fauziah_Rochman.pdf)



Source: "E-waste in Indonesia: The Case of Personal Computers". Fauziah Rochman, MESc 2010

Figure 3-59 The Flow of PCs Wastes in Yogyakarta

Situation of final disposal

Several recycling facilities in Indonesia are licensed by KLH but are only engaged in such intermediate treatment activities as collection and dismantling. The recovery of metals from the electronic scrap from the intermediate treatment process is conducted by an improper smelting process in the informal sector as described in the following section or in a foreign country after export from Indonesia.

b. Size and Technical Level of Various Actors

Size and technical level of collectors

As mentioned earlier, household waste is collected by local governments in Indonesia. However, waste with a high resource value, including E-waste, is not collected by the formal route operated by local governments and is instead collected by informal waste traders.

According to the results of interviews with environmental NGOs, waste pickers operating in the informal sector in Indonesia are often Madurese from East Java Province. The characteristics of their operation are a lack of organized activities and small-scale operation unlike the cases in other countries.

Malang and some other cities have waste banks which purchase the resources recovered by waste pickers. The purchase of E-waste by a waste bank is confirmed in some areas. These waste banks are registered with the local government and KLH encourages local governments to facilitate the establishment of waste banks.

Size and technical level of recyclers

Indonesia has seven E-waste recycling facilities licensed by KLH which are simply involved in the treatment of industrial E-waste, such as defective goods from the production processes of manufacturers, and which do not handle E-waste from households (although some facilities recycle printed circuit boards (PCBs) collected by informal collectors).

Much of the E-waste collected in the informal sector undergoes improper dismantling and valuable extraction processes by informal recyclers operating in Tangerang and Surabaya. without the employment of adequate environmental control measures.

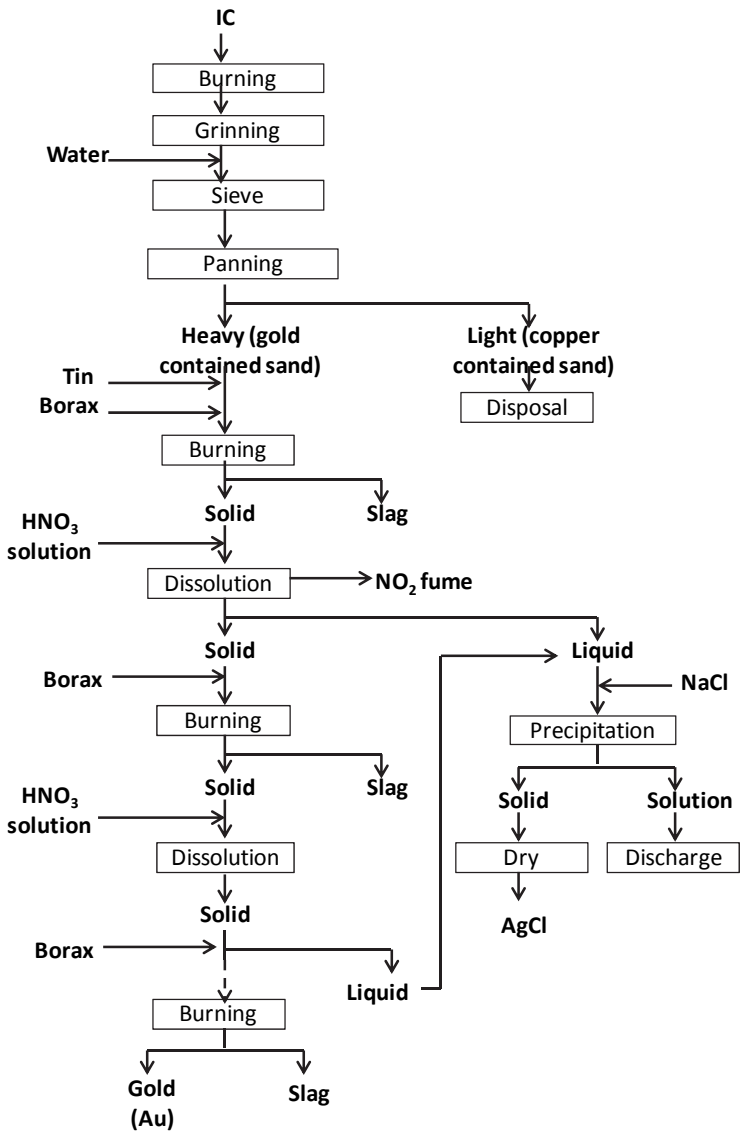
< Situation of Recycling by Informal Waste Traders in Tangerang >

Many traders erect a high fence around the site to block the view.

Piled-up disassembled CRTs (this trader is only involved in disassembly).

National Institute for Environmental Studies (NIES) studied process of gold and silver recovery from waste PCBs carried out by informal recyclers in suburb of Bandung city in 2011 and summarized the process as follows:[79]

[79] Aya Yoshida, et al. (2011) “Classification of E-waste recycling technology in Asian Developing countries” (Japanee only) (http://www.env.go.jp/policy/kenkyu/suishin/kadai/syuryo_report/pdf/K2347.pdf)



Source: Aya Yoshida, et al. (2011) "Classification of E-waste recycling technology in Asian Developing countries

Figure 3-60 Precious Metal Recovery Process from E-waste in Suburb of Bandung

In case of Bandung, after waste PCBs are shredded and separated, nitric acid (HNO3) solution is added to dissolve silver, and then gold is extracted from the remaining solids. This process generates 95% purity of gold. In some cases, hydrogen peroxide solution is also used to remove gold plating from the waste PCBs. Those chemical is easily available in local market with economically affordable prices for informal recyclers. In many cases, workers do not wear glove or protective mask and no emission control equipments are introduced at working places. Furthermore, liquid waste is discarded into river without treatment and it causes environmental pollution or health damage.

The NIES (2011) also studied gold recovery process in Bulacan, the Philippines and found that sodium cyanide solution, more toxic chemical, is used to dissolve gold. In China, aqua regia (mixing concentrated nitric acid and hydrochloric acid) is used in some cases. The process and chemical conventionally used vary from one country to another, but in general the process is associated with a risk of huge negative impact on human health and the environment.

Source: Presentation entitled “E-waste Disposal and Health Safety in 3R of E-waste” by Mr. Sukandar at the E-waste Training Workshop for Asia and the Pacific held on 10 – 14 August, 2009

Figure 3-61 Example of Precious Metal Recovery in Suburb of Bandung

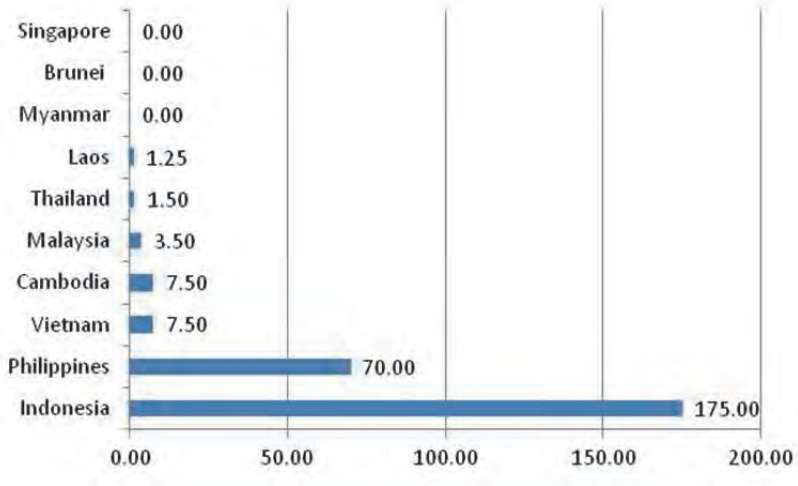
In the case of Bandung, slug generated from gold recovery process with NHO_3 solution (containing tin or borax) is purchased by other recyclers for further gold recovery process. According to the study of NIES (2011), mercury is used for extraction of gold from slug in some cases. In developing countries including Indonesia, mercury amalgamation is traditionally used by ASGM (artisanal small scale gold mining) sector to extract gold from ore since it is economically cheaper method. Amalgamation is a concentrating process in which metallic gold or silver, or an alloy of the two, is mixed with mercury, either in an amalgamation drum, or on an amalgamation table, where the precious metal bonds with the mercury to form the metal laden mercury amalgam.

According to the study of UNEP (2013), ASGM is the largest components of anthropogenic emissions.[80] To tackle mercury problems, “Minamata Convention on Mercury”, a global treaty to protect human health and the environment from the adverse effects of mercury, was adopted at the Diplomatic Conference held in Kumamoto, Japan on 7-8 October 2013.[81]

According to the database of Mercury Watch, global mercury use by ASGM in 2010 is estimated 1,620 ton and Indonesia is the third largest mercury users (175 tons) behind China (444.5 ton) and Columbia (180 ton). As seen in the figure below, amount of mercury used by ASGM sector in Indonesia and the Philippines are extremely higher than other ASEAN countries.

[80] UNEP Global Mercury Assessment 2013 (http://www.unep.org/PDF/PressReleases/GlobalMercuryAssessment2013.pdf)

[81] Press release of Ministry of the Environment Japan on October 25th, 2014 (Japanese only) (http://www.env.go.jp/press/press.php?serial=17255)



Unit: metric ton
Source: Mercury Watch Database

Figure 3-62 Mercury Use by ASGN Sector in ASEAN Countries in 2010

Government of Indonesia recognizes that mercury emission from ASGM sector is one of the significant sources of mercury contamination.[82] Mercury is usually used to extract gold from ore, however, it is likely that mercury is also used for gold recovery from E-waste, thus further investigation should be carried out to obtain clear picture of informal recycling.[83]

c. Monetary Flow

In the overall waste stream, E-wastes are traded in the market either as reusable secondhand electronics or recyclables. Especially PCs and mobile phones are traded with high price since they contain relatively more precious metals, such as gold. Only the case of industrial E-waste (e.g., off-speck products), industry pays the licensed facility recycling and treatment cost based on the Government Decree No. 18/1999.

Informal recycling activity extracts valuable resources and recover precious metals by improper smelting, however non-valuables are illegally dumped without proper treatment and cost for environmentally sound management is not integrated into market price. Furthermore, negative externality (social cost) of environmental pollution or health hazards caused by improper recycling is not internalized.

However, there is a huge number of informal actors and collection and recycling of E-waste are very important means of earning a living for them. Therefore, empowering informal sectors to formalize them or providing them with alternative livelihood is even more important rather than internalizing externality only by strictly regulating their business.

Money transaction between informal collectors

Professor Damahuri and others of the ITB conducted a study on 18 collectors operator in Bandung and their findings relating to the E-waste collection volume, purchase price from households and sales price to recyclers are shown in the following Tables.

[82] At the meeting of "the Inter-governmental Negotiation Committee to prepare a global legally binding instrument on mercury (INC)" which was held prior to the Diplomatic Conference in Kumamoto, Government of Indonesia made remarks which explained the status of mercury contamination caused by ASGM and call for international cooperation to ban use of mercury in ASGM sector.

[83] One of the E-waste dismantlers who the JICA study team visited in Tangerang showed signs of mercury poisoning, such as shaking in a limb, impaired walking and narrowed visual field.

Table 3-42 Quantity of Monthly Collection of E-waste by 19 Collectors in Bandung

	Quantity of Monthly Collection by Collectors			Total (18 Collectors)
	Small Collectors(4)	Medium-sized Collectors(13)	Large Collector(1)	
CRT	35	363	400	798
LC display unit	0	6	0	6
Motherboard	15	308	2,000	2,323
Processor	13	254	6,000	6,267
VGA (Video Graphics Array)	13	282	8,200	8,495
Sound card	13	308	12,500	12,821
LAN	21	163	14,500	14,684
Hard disc	16	320	1,000	1,336
CD/DVD	16	306	290	612
Floppy disc	1	123	500	624
Power supply unit	21	390	270	681
Other	0	65	0	65
Total	164	2,888	45,660	48,712

Source: Presentation entitled "E-waste Disposal and Health Safety in 3R of E-waste" by Mr. Sukandar at the E-waste Training Workshop for Asia and the Pacific held on 10 – 14 August, 2009

Table 3-43 Purchase Price and Sales Price of E-waste of 18 Collectors in Bandung

	Purchase Price (IDR/unit)		Sales Price (IDR/unit)	
	With some damage	Reusable	With some damage	Reusable
CRT	30,000-100,000	>100,000	60,000-150,000	100,000-275,000
LC display unit	50,000-100,000	>100,000	>70,000	>100,000
Motherboard	10,000-30,000	75,000-200,000	10,000-40,000	10,000-200,000
Processor	5,000-50,000	50,000-100,000	5,000-50,000	100,000-150,000
VGA	2,500-15,000	15,000-20,000	5,000-35,000	30,000-100,000
Sound card	2,500-15,000	15,000-20,000	5,000-35,000	25,000-150,000
LAN	2,500-15,000	15,000-20,000	5,000-20,000	10,000-20,000
Hard disc	4,000-20000	25,000-100,000	5,000-30,000	30,000-250,000
CD/DVD	1,000-7,000	25,000-30,000	2,000-25,000	30,000-150,000
Floppy disc	1,000-7,000	------	1,000-10,000	-----
Power supply unit	4,000-15,000	10,000-20,000	5,000-30,000	25,000-40,000

Source: Presentation entitled "E-waste Disposal and Health Safety in 3R of E-waste" by Mr. Sukandar at the E-waste Training Workshop for Asia and the Pacific held on 10 – 14 August, 2009

According to the study on PC recycling flow in Yogyakarta by Rochman (2010), total transaction value of E-waste is approximately 2,500 USD/day, however incomes are unequally distributed. The incomes per week for scavengers, aggregators and separators are 13.62 USD, 35.7 USD and 300 USD respectively.

Money transaction by informal recyclers

According to the interviews on informal recycler recovering precious metals from PCBs conducted by NIES (2011), 1g of gold, 4g of silver and 300g of copper can be recovered from 1kg of IC-chip, and cost for raw materials and process (e.g., purchasing cost of chemicals) is 160,000 IDR, revenue is 329,00 IDR and net profit is 169,000 IDR. Monthly income is 2.0 -2.5 million IDR and some large scale operators earn 4.0 -5.0 million IDR, which is even higher than average slurry of formal company.

3.3.3 Activities of the Stakeholders

a. Activities of Manufacturers

EEE manufacturers in Indonesia hand over defective products from their own production processes to recyclers licensed by KLH for treatment. However, producers have no legal obligation to collect E-waste produced by consumers.

Some EEE manufacturers have installed drop boxes as major EEE retailer stores for voluntary collection. There is a case of the manufacturer bearing the cost of trade-in as part of the sales promotion at retailers separately from the trade-in operation of major retailer companies, such as Electronic Solution, which receive a promotion fee from the manufacturer.[84]

b. Activities of Retailers

Electronic Solution, a leading mass market EEE retailer in Indonesia, provides a trade-in service whereby a voucher is issued in exchange for a used product when a new product is installed at the home of a customer so that the customer can receive a discount using this voucher on the price of a new product purchased by the customer next time. While this company conducts ad hoc campaigns to increase the amount of discount for this trade-in, it always provides a trade-in service on the request of a customer.

In the case of this company, the practice of trade-in is a sales promotion tactic and no profit from trade-in is expected. As used equipment collected through trade-in is sold in bulk to a subsidiary, the company has no accurate information on the subsequent flow, treatment and recycling of the sold items. There is a record of the collection of 100 to 200 used pieces of equipment a month by the entire chain in Indonesia and the company has good potential as an E-waste collection route. This example suggests the importance of providing an economic incentive for retailers who have experience of collecting E-waste with a view to facilitating the collection of E-waste, especially delivery to the normal route.

The purchase price of E-waste from customers, i.e. discount price offered to customers, is decided by a partner enterprise, taking the profitability of the collection business into consideration. The purchase price and sales price during a trade-in campaign is shown in the Table below.

Table 3-44 Trade-In Price of E-waste during Trade-in Campaign by Electronic Solution

Product	Trade-in Price (IDR/unit)
CRT TV (14-inch)	65,000
CRT TV (20～21-inch)	90,000
CRT TV (29～34-inch)	175,000
CRT TV (41-53-inch)	450,000
CRT TV (55-61inch)	700,000
LC TV (19-26-inch)	125,000
LC TV (27-32-inch)	200,000
LC TV (40-50-inch)	450,000
LC TV (55-inch or bigger)	550,000
Refrigerator (1 door/2 doors)	100,000
Refrigerator (side by side)	400,000
Air-conditioner	200,000
Washing machine	100,000

Source: Information supplied by Electronic Solution

[84] Based on results of interviews at PT. Eletronic Solution.

c. Activities of Citizens' Groups

The KPBB and other environmental NGOs in Indonesia are actively involved in the control of air pollution associated with leaded petrol and their influence on debates on the policies of KLH, including those relating to waste management, is increasing. It has been reported that residents' associations are actively promoting environmental education on the separate collection of waste at the level of Kampung[85] which is a key structural element of the local community. A local community in Indonesia has a women's group called a PKK which conducts a range of social activities. There are cases of PKKs establishing a working group to oversee such community activities as the separate collection of waste. As leading members of the PKK are often the wives of government officials, PKKs have strong influence in some communities.

An environmental NGO in Bandung is actively implementing an urban program to collect used electrical and electronic equipment under the concept of "Zero Waste" and has achieved some positive results. However, it is facing the problem of a difficulty of securing business operators which can guarantee the sound treatment of the collected E-waste.[86]

d. Waste Collection by Local Governments

The Waste Management Act of 2008 stipulates the collection of domestic waste by local governments. E-waste from households is also supposed to be collected by local governments.

Each local government stores the collected waste at the temporary storage sites (TPS) it manages. At the TPS in Jakarta, Surabaya and other areas, the waste is then separated into organic waste and inorganic waste. The former is used to produce compost while recyclable inorganic waste is sold to local recyclers. The current legal framework does not have any clear rules for the handling of special waste defined by the Waste Management Act and there is no compulsory requirement for E-waste to be delivered to a recycling facility licensed by KLH. Because of this, no provincial government has its own bylaw relating to the collection and treatment of E-waste and other types of hazardous waste collected from households.

BPLHD officer participating in the workshop held by KLH expressed the opinion that the current lack of information on recycling facilities capable of conducting environmentally sound recycling must be rectified so that such information can be shared by all stakeholders.

In short, the current situation appears to be that the quantity of E-waste collected by local governments is small and that the collected E-waste is either sold to local collectors/recyclers or disposed of at a landfill site.

3.3.4 Introduction of Technologies and Infrastructure Development

a. Infrastructures for Collection and Recycling of E-waste

In Indonesia, E-waste of industrial origin must be treated by a business operator licensed to handle B3 goods and B3 waste based on the Environmental Protection and Management Act. The licensing system relating to B3 separates transporters, incineration plants (those incinerating waste from other enterprises or their own E-waste), collectors, recyclers (either own waste or waste from other enterprises), stores (transfer and storage) and landfill operators.

The handling of electronic scrap and PCBs requires a license for a B3 recycler issued by KLH. The current license holders are shown in the Figure below.

[85] Kampung means a village or small community in Indonesian.

[86] Based on results of interviews with PT. Mukti Mandri.

Source: Waste Management Framework in Indonesia (29th April, 2014)

Figure 3-63 Location of E-waste Recycling Facilities Licensed by the KHL

The general situation of the development and operation of E-waste recycling facilities is outlined in the box below.

- All facilities mostly accept such E-waste as rejected parts from industrial processes and do not accept household E-waste (in the case of PT. Citra Asia Raya, it purchases waste PCBs from informal collectors but the origin of these PCBs is unknown[87]).
- While the overall scale and processing capacity vary from one facility to another, the type of operation generally involves collection and dismantling and none of these facilities have advanced to the stage of rare or precious metal recovery.
- The type of E-waste targeted is ICT-related items with a high resource value (PCs and mobile phones). None of the facilities listed here are involved in the collection and dismantling of white goods which require large investment to ensure environmentally sound recycling and of which the content of valuables is low.
- Many E-waste recyclers are currently located on Java Island. In view of the demographic distribution in Indonesia, it is judged to be more feasible to start proper operation in densely populated Jakarta and other large cities with existing recycling facilities with a view to gradual extension to other islands. To achieve this development process, it is firstly necessary to clarify and map the treatment capacity of each operator. This should be followed by the examination of a wide area recycling plan for E-waste generated in all parts of Indonesia.

The current development and operational status of each facility is described next.

PT. Mukti Mandri Lestari (MML)[88]

- E-waste Collection and Management Situation
  - The facility is located in Bekasi, West Java and obtains license for E-waste collection by KLH.
  - Main items for recycling include PCs, servers, air-conditioners, CRT TVs, printers, cables generated from EEE manufacturing process. Total amount of E-waste recycled is approximately 60 tons per year.

[87] Based on the results of interviews at PT. Citra Asia Praya
[88] Based on results of interviews at MML on 25th October, 2013

- MML does not currently collect domestic E-waste (discarded from household), partly because of competition with the informal sector.
- MML only collects and treats industrial E-waste. Its next step is the treatment of white goods and it hopes to expand the treatment line in the future.
- While the price of E-waste purchased by MML from the industrial sector varies from one product to another, MML's offer price is generally lower than that of the informal sector.
- There is only a recycling process at present and no repair or reconditioning work is undertaken.
- MML is cooperative with the drafting process of new E-waste regulation by KLH because of it recognizes importance of securing the stable E-waste supply to licensed facilities instead of the informal sector.

- E-waste Recycling Process
  - MML conducts the manual dismantling of industrial E-waste and the mechanical separation of copper and plastic waste but cannot recover precious metals at present.
  - As many Japanese subsidiaries use MML, MML's level of compliance with the environmental standards is high. MML is actively involved in environmental education in local communities.
  - MML is currently examining the feasibility of the new business of exporting scrapped PCBs to Japan. It is also considering the recycling of white goods in the future provided that a certain supply volume is secured.
  - The parts or components mounted to PCBs are removed using melting solder. Aluminum parts and parts containing precious metals are removed. Plastic resin is crushed by a machine and sole as glass powder.
  - Punched out waste and PCBs without any mounted parts are mechanically crushed. After crushed, they are sorted in accordance with specific gravity using a vibrating sieving machine. The outputs are powder containing copper and plastic powder (containing silica fibers). The former is processed into ingots while the latter is delivered to a cement plant by paying the plant a disposal fee.
  - CRTs are accepted at US$ 10 per unit to cover the cost of disposal (reverse onerous trade). Both funnels and panels are landfilled. Shadow masks, electron guns and others may be sold if there is a buyer. However, the higher disposal cost exceeds any profit from sale.

< Scenes of operation >

Storage (items are stored per manufacturers)

Copper wire stripper

Dismantling of cathode ray tube (CRT)

Dismantled CRT TVs (metals or plastics are recycled locally)

Manual dismantling of PCs and servers (PCBs are removed)

Melting solder to remove parts or components from PCBs

PCB shredder

Powder containing copper after gravity separation (sellout as final product)

PT. Citra Asia Raya[89]

- Outline of the Facility

- The facility in Bekasi, West Java is only involved in collection. The collected E-waste is transported to a recycling facility on Batam Island for dismantling and recycling.
- The company has obtained an E-waste collection and recovery license from KLH. It plans to construct an E-waste recycling facility near Jakarta in the future if it is commercially viable.

[89] Based on results of interviews at PT. Citra Asia Raya on April 30th 2014. Please note that the JICA study team only visited collection facility located in Bekasi, nearby Jakarta.

- The sources of E-waste are (i) manufacturers who pay a processing fee (mostly manufacturing scrap, etc.) and (ii) the informal sector.
- Used EEE is dismantled and sorted into metal (e.g., copper), plastic and other resource categories. PCBs are crushed by a hammer mill and then separated into different resources based on the specific gravity.
- The recovered metal is made into ingots for export to China. None are sold in Indonesia.

- Operation Status of the Collection Facility at Bekasi

- The collection facility located at Bekasi receives already dismantled PCBs instead of E-waste in its completed product. The items received are mainly PCBs for IT equipment and mobile phones.
- Although E-waste partly comes from manufacturers for paid processing, more E-waste is purchased from the informal sector. The purchase price varies depending on the type of product.
- There are cases of informal collectors without their own processing facility bringing in collected E-waste to the collection facility at Bekasi for dismantling. They sell PCBs to Citra and take back other parts.

< Scenes from the Collection Facility at Bekasi >

Inside of collection facility (1)

Inside of collection facility (2) (many PCBs (after dismantled) more than complete products)

Sorted server (dismantling and recycling operation will be carried out at the facility in Batam Island)

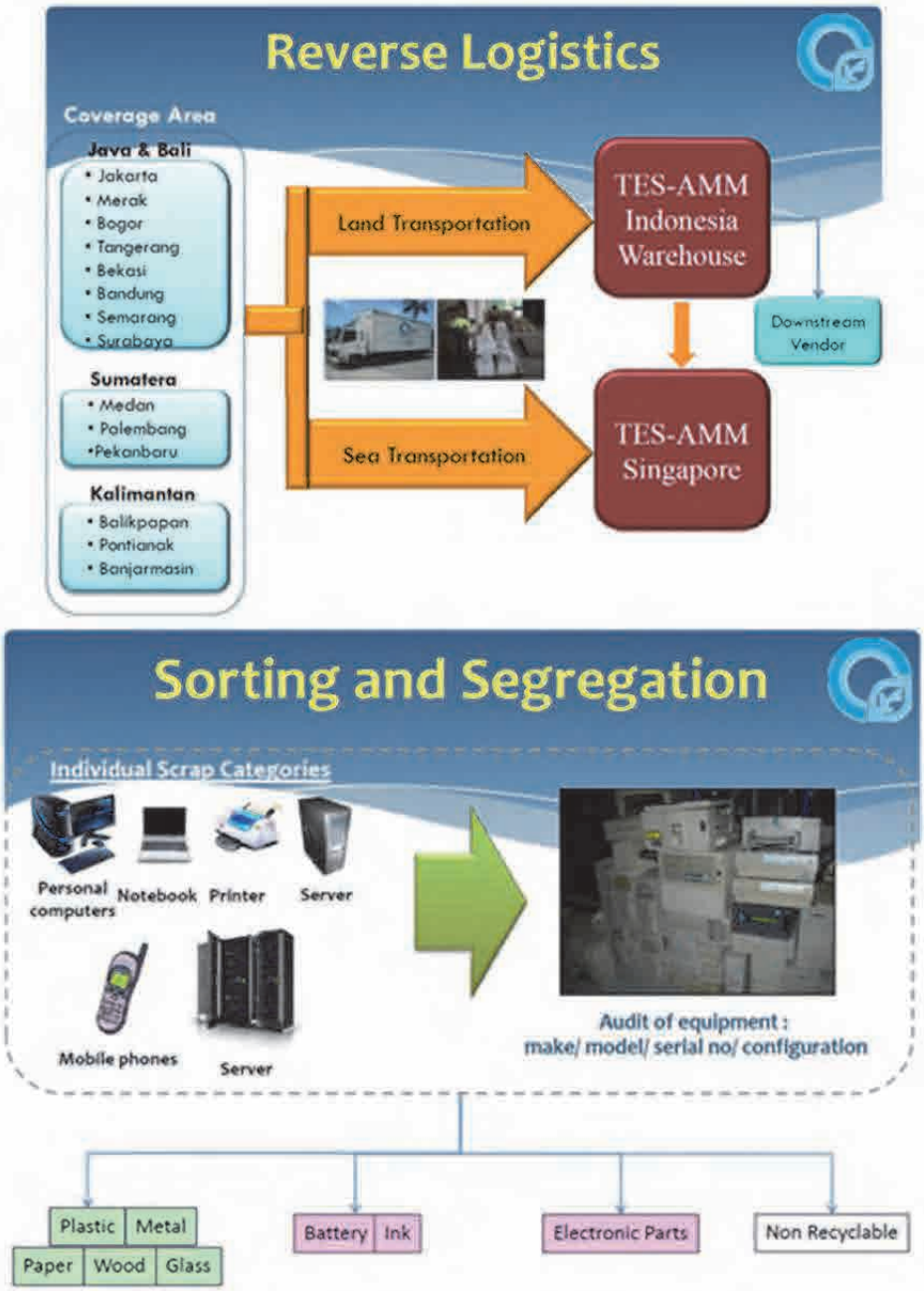
Stored PCBs

PT. TES-AMM Indonesia[90]

- Outline of the Facility

- The parent company is a global recycling company based in Singapore. PT. TES-AMM Indonesia has obtained an E-waste collection license from KLH.
- The Indonesian branch was established in 2010. The local operation consists of collection, storage, dismantling and separation. Recycling consists of the export of certain E-waste to a facility in Singapore in accordance with the procedure of the Basel Convention.
- The target items for collection in Indonesia are ICT equipment (mobile phones and networking equipment) and consumer electronics (PCs).
- The reverse logistics operation is centered on Java Island but also covers Sumatera and Kalimantan Islands. Collection is made by land and sea transportation. The locally collected E-waste is sent to a warehouse in Bekasi in a suburb of Jakarta for export to Singapore.
- At the Bekasi facility, the E-waste is sorted into resources (metal, plastic, paper, wood and glass), batteries/ink cartridges and electronic parts. Electronic parts are exported to Singapore. Other resources are sold to domestic recyclers. Non-recyclable items are disposed of at a controlled landfill site (PT. PPLi) in Indonesia.

[90] Based on a presentation by PT. TES-AMM Indonesia to the National E-waste Stakeholder Meeting organized by KLH on 26th May, 2014



Source: Presentation by PT. TES-AMM Indonesia at the National E-waste Stakeholder Meeting on 26th May, 2014.

Figure 3-64 Outline of the E-waste Collection System and Sorting Process of PT. TES-AMM Indonesia

PT. Teknonatama Lingkungan Internusa (TLI)[91]

- Outline of the Facility

- While the main pillar of operation is the treatment of general hazardous waste, the TLI is actively engaged in the recycling of B3 waste. Post-treatment residuals are forwarded to a cement plant located nearby TLI.

[91] Based on a presentation by TLI at the National E-waste Stakeholder Meeting organized by KLH on 26th May, 2014

- The facility accepts B3 waste from all corners of Indonesia which is entirely sent to a facility located in West Java Province. The construction of a new facility in East Java Province is planned.
- TLI has obtained an E-waste collection and treatment license from KLH and has introduced a system to crush PCBs and to sort different materials. The technology has been imported from Taiwan.
- However, the facility has not yet properly started operation because of the lack of a steady supply of E-waste.

PCB Crushing and Sorting System Imported by TLI

Situation of Recycling Involving Non-Licensed Facilities

In addition to the facilities described above, some cases of electronic scrap and PCBs being collected by non-licensed individual Madurese people are observed. In industrial areas in Jakarta, Surabaya and Batan, there are local enterprises which handle scrap from manufacturing factories. In one case, the E-waste collected by a local enterprise is sorted and crushed for export to Singapore.

b. Disposal Sites for Residuals

Some enterprises in Indonesia have their own treatment facility for B3 waste but PPLi is the only enterprise which has such a facility as a disposal contractor. PT. PPLi is a waste treatment enterprise which was established in 1994 with joint investment by the Government of Indonesia. It became a subsidiary of Dowa Eco-System Co., Ltd. of Japan in 2009 as a member of Modern Asia Environmental Holdings (MAEH).[92] As the sole general treatment facility for hazardous waste in Indonesia, PPLi provides the following services.

- Sampling, testing and analysis of waste
- Transportation of waste (liquid, solid and in drums)
- Waste treatment (solidification, stabilization and thermal destruction), physical-chemical treatment and bio-chemical treatment
- Waste landfill complying with international standards

[92] From the Home Page of Dowa Eco-System Co., Ltd. (http://www.dowa-eco.co.jp/business/global/indonesia/)

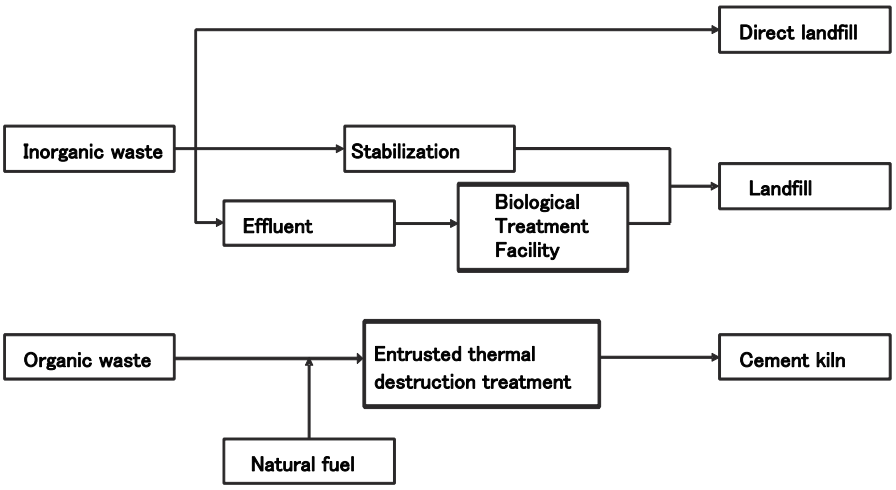


Figure 3-65 Flow of Treatment at PPLi

Many of PPLi's customers are Japanese subsidiaries and the treatment facility has been installed as a general facility complying with the standards of the World Bank, EU and US EPA standards. PPLi has established its own environmental management policies and operates its own environmental management system. In-house vehicles are used for the collection and transportation of waste. Each lot of accepted waste undergoes chemical analysis prior to treatment and disposal to avoid the improper treatment and disposal of waste brought to the facility.

PPLi is not involved in the treatment of E-waste and has not obtained a license from KLH. It is necessary to examine how to secure the flow for the proper disposal of the residuals generated by the existing recycling facility.

Utilization of dry smelter

As mentioned earlier, the licensed E-waste recycling facilities of KLH are intermediate treatment facilities which are primarily engaged in collection and dismantling. There is no facility which is capable of recovering precious metals from waste PCBs and other items. The only available options to recover useful resources from the E-waste collected by the informal sector are (i) metal recovery using an improper smelting process and (ii) export to ensure environmentally sound recovery.

In Japan, E-waste is firstly dismantled and pre-treated at a household electrical and electronic equipment recycling plant. Metal scrap from PCBs undergoes an efficient metal recovery process and sound treatment at a wet or dry smelter The guidance documents on environmentally sound management prepared for the Mobile Phone Partnership Initiative (MMPI) [93]or the Partnership for Action on Computer Equipment (PACE)[94] developed under the Basel Convention recommend treatment at a smelter. In Indonesia, PT. Smelting has the Gresik Copper Smelter which is the largest copper smelter in Southeast Asia with a copper smelting process of a similar size to that of a dry smelter in Japan.

The profile of PT. Smelting is given below. [95]

[93] Guidance document on the environmentally sound management of used and end-of-life mobile phones (http://www.basel.int/Implementation/PartnershipProgramme/MPPI/MPPIGuidanceDocument/tabid/3250/Default.aspx)

[94] Guidance document on the environmentally sound management of used and end-of-life computing equipment (http://www.basel.int/Implementation/PartnershipProgramme/PACE/PACEGuidanceDocument/tabid/3246/Default.aspx)

[95] Ministry of Economy, Trade and Industry (METI), Japan, FY 2011 Report for the Study for the Promotion of Export of Infrastructure Systems: Feasibility Study on Non-Ferrous Metal Recycling Project Using a Copper Refinery in Indonesia (http://www.meti.go.jp/meti_lib/report/2012FY/E002217.pdf)

- PT. Smelting was established in 1996 with joint investment by Mitsubishi Materials Corporation (capital investment ratio: 60.5%), PT. Freeport Indonesia (25%), Mitsubishi Corporation (9.5%) and JX Nippon Mining & Metals (5%).
- This copper smelter was constructed as the first full-scale copper smelter in Indonesia for the purpose of processing copper ore from the Grasberg Mine. It commenced operation in December, 1998.
- Using refined copper ore as the main raw material, the smelter produces electrolytic copper, gold and silver slime, strong sulfuric acid, copper slag and gypsum.

Table 3-45 Main Products, Their Use and Production Capacity of PT. Smelting

Product	Use	Production Capacity (tons/year)
Electrolytic copper	Electric cables; copper pipes	300,000
Copper anode	For electrolysis	350,000
Gold and silver slime	Gold bullion; jewelry; industrial products	1,800
Strong sulfuric acid	Fertilizer	920,000
Copper slag	Raw material for cement; concrete	655,000
Gypsum	Raw material for cement	35,000

Source: Ministry of Economy, Trade and Industry (METI) Japan, FY 2011 Report for the Study for the Promotion of Export of Infrastructure Systems; Feasibility Study on Non-Ferrous Metal Recycling Project Using a Copper Smelter in Indonesia

Source: Ministry of Economy, Trade and Industry (METI) Japan, FY 2011 Report for the Study for the Promotion of Export of Infrastructure Systems: Feasibility Study on Non-Ferrous Metal Recycling Project Using a Copper Smelter in Indonesia

Figure 3-66 Flow of Smelter Operation at PT. Smelting

Although PT. Smelting does not accept scrap, including E-waste scrap, it has the potential to become a key base for the recovery of metals from E-waste generated in Indonesia.

As the utilization of the Gresik Copper Smelter to treat electronic scrap will require fresh investment in the pre-treatment process, PT. Smelting is reluctant to proceed with such investment unless a level of supply to sustain operation can be secured. As Indonesia prohibits the import of

E-waste and other hazardous waste by law, a stable supply of PCBs from abroad cannot be anticipated. It is, therefore, necessary for Indonesia to produce a sustainable and stable supply of E-waste of Indonesian origin. In turn, this will require an increased domestic E-waste collection rate. The examination of viable measures to create a flow of post-treatment metal scrap from KLH-licensed recycling facilities to the Gresik Smelter is also necessary.

The use of the Gresik Smelter located in Indonesia for the final recovery of metals has a transportation cost reduction advantage for those enterprises which currently recover metals through export. At the same time, the introduction of acceptance criteria at a smelter will provide an incentive for existing intermediate treatment facilities for E-waste to conduct the pre-treatment of E-waste prior to the dry smelting process in an environmentally sound manner.

In the coming years, identification of the problems hindering the promotion of E-waste recycling at a copper smelter as the final treatment and the development of measures to overcome the problems along with the need to increase the E-waste collection rate through the introduction of the principle of EPR will become important.

3.3.5 Economic Measures

a. Capacity to Bear the E-waste Treatment Cost

At present, the E-waste recycling facilities licensed by KLH mainly handle ICT-related items with a high resource value which are produced in the production processes of manufacturers. Meanwhile, the sustainable operation of these facilities to treat and recycle white goods in the near future is judged not to be feasible without a subsidy and a stable supply of raw materials because of the need for large-scale initial investment and the low content of valuable precious metals in such items. The actual treatment cost of white goods is also relevant to the requirements of KLH for recycling facilities and further detailed cost analysis is required.

A discussion on desirable E-waste management based on EPR has just begun in Indonesia. It is important for consumers, producers and recyclers to understand each other’s opinion and to discuss how various stakeholders can achieve a fair and transparent sharing of their social responsibilities among themselves.

b. System by Which Investment Can be Recovered

As mentioned above, Indonesia currently has no facility which is capable of the dismantling, treatment and/or recycling of used white goods. In reality, many such items are taken back by an informal repairer or collector. While reusable goods are repaired, unrepairable goods are illegally dumped after the removal of usable parts and useful metals. It is, therefore, essential to examine a mechanism which is suitable for Indonesia to manage E-waste based on the forecasted potential volume of E-waste of household origin while referring to the experience of Malaysia and other neighboring countries. This examination process should involve existing recycling facility operators and should determine how much investment is required, who should contribute and how much and how to manage the recovered investment.

A stable and predictable supply of raw materials is required to sustain the operation of recycling facilities. Without the assurance of such supply, no investment in white good recycling facilities is feasible given the large scale of the required investment. As a first step, KLH should identify the flow of used EEE and E-waste in Indonesia and map those actors involved in the collection and recycling of these items while taking the treatment and recycling capacity and plans for the future expansion of existing recycling facilities into consideration. Based on this knowledge, KLH should determine how to secure a stable supply of these items which is essential for a viable white good recycling business at existing recycling facilities. Even if the supply of the necessary volume of white goods for treatment and/or recycling is assured, it is still necessary to analyze the required amount of investment for the introduction of new recycling systems and the likely operation cost of these systems in view of the detailed design of a highly realizable system.

3.3.6 Social Responses

a. Consumer Awareness of the Discard and Treatment of E-waste

As described in the previous section, there are cases in Indonesia of the separate collection of waste and environmental education being practiced at the Kampung and other community levels, indicating the existence of possible bases for promotion of the proper discard of E-waste in the future. However, the level of knowledge and understanding on the part of the public in regard to the potential hazard of E-waste and environmental problems as well as health damage originating from inadequate treatment is low. Because of the conventional practice of selling used goods to the informal sector, the concept of paying for the cost of recycling has not yet spread among the Indonesian people.

At the workshop organized by KLH in April, 2014, a consumers' group (YLKI) expressed its view that Indonesian consumers (households) have not yet reached the stage of being able to afford the cost of the treatment or recycling of the E-waste they have produced themselves and that a system to charge a fee at the point of the generation (households) of E-waste cannot properly function at the present time. The InSWA also stated that the statutory obligation of consumers to discard E-waste to formal E-waste collection channels run by the local government will not be able to stop the flow of E-waste to the informal sector because of the recycling fee charged to consumers, suggesting a need to provide consumers with some type of incentive.

In view of the present situation in Indonesia, it is unrealistic to punish those households which fail to discard their E-waste to a formal collection route. It is, therefore, important to gradually raise their awareness and understanding of the importance of sharing the cost of environmentally sound treatment and recycling among all members of society in a fair manner.

b. Purchasing Behavior of Consumers

As in the case of other Southeast Asian countries, consumers in Indonesia are strongly inclined to buy new models of electrical and electronic equipment, especially mobile phones, and tend to replace fairly new phones with the latest models. The criteria for product purchase are price, brand and functions and the environmental aspect is currently ranked low.

KLH is currently prioritizing the implementation of a program called PROPER which is designed to facilitate voluntary environmental measures by large enterprises, to evaluate the performance of individual environmental measures and to publicly disclose the evaluation results. The PROPER evaluates the environmental measures adopted by enterprises operating in areas relating to water, air and B3 waste management and the disclosure of its evaluation results is helping the public to improve its level of understanding of environment-conscious enterprises and products. The positive achievements of the PROPER suggest the importance of evaluating and publicizing the voluntary E-waste collection efforts of enterprises.

c. Incentives for E-waste Collection

A Minister of Environment regulation on E-waste management which is currently being drafted by KLH contemplates the introduction of such preferential measures as evaluation based on the PROPER and generous terms for bank loans for manufacturers and generous grants by the national government and generous treatment under the ADIPULA (green city evaluation system) for local governments as incentives for E-waste collection. However, further discussion among stakeholders is required to make such incentives function as planned with manufacturers and local governments. As this draft relies on the efforts of manufacturers and local governments without any provision of incentives for households to discard their E-waste to formal collection routes, further careful examination of such aspects is necessary.

As mentioned earlier, Electronic Solution and some other retailers currently provide a trade-in service as part of their sales promotion strategy. As the collected used items are sold all at once to a partner enterprise, they have no control of the flow of E-waste after sale. If trade-in by retailers is to be emphasized as an E-waste collection route in the coming years, the provision of incentives (e.g.,

financial assistance) for retailers should be considered along with the obligation for retailers to pass the traded-in E-waste to a formal collection route.

d. Academic and Knowledge Resources

Professor Damahuri of the ITB and others have built a pool of very important and useful information for inventory studies on as well as the cost analysis of appropriate recycling activities necessary for the design of a viable E-waste management system in the future through their work to identify the flow of used EEE and E-waste and to clarify the present reality of repair and reconditioning in the city of Bandung.

In Indonesia, the Basel Convention Regional Centre for Southeast Asia (BCRC-SEA) is located at the building of the KLH and has been active in the promotion of various Basel Convention-related projects in Southeast Asia. BCRC-SEA has organized a series of workshops or seminars for capacity building to improve E-waste management in the region. The existing and future knowledge resources of the BCRC-SEA should prove to be very effective for the spread of Malaysia's experience and know-how concerning the enactment of an E-waste collection and recycling law to Indonesia and other neighboring countries.

3.3.7 E-waste Management Framework in Indonesia

The Workshop on the E-waste Management Framework in Indonesia was held in April, 2014 as outlined below for the purpose of (i) exchanging opinions with various stakeholders on the specific waste management by the KLH and the underlying concept for the planned ministerial regulation for E-waste management and (ii) making recommendations by the JICA Study Team on information obtained by the present study and future E-waste management in Indonesia.

- Date: 29th April, 2014 09:00 – 15:00
- Venue: Park Lane Hotel (Jakarta)
- Program

Time	Agenda	Presenter
09:00 – 09:45	Registration	
09:45 – 10:00	Briefing on the purposes and assumed outcomes of the workshop	KLH
10:00 – 10:30	Reporting on the E-waste study by JICA	JICA Study Team
10:30 – 11:00	Reporting on the progress of the work to draft the E-waste management regulation in Indonesia	JICA Study Team
11:00 – 11:30	Control of specific waste from households in Indonesia	KLH
11:30 – 12:00	Experience of and lessons learned by other countries concerning E-waste management based on EPR and recommendations for future approaches	KLH
12:00 – 13:00	Lunch break	
13:30 – 14:45	Discussion: On a sustainable E-waste management mechanism which is applicable to the present situation in Indonesia - Identification of existing good practice and their integration to a new mechanism - Roles and responsibilities of each stakeholder in the new mechanism - Required elements for EPR-based sustainable E-waste management which is applicable to Indonesia - Problems for the introduction of EPR to Indonesia and countermeasures	

- Participating Organizations

Organization	Description	No. of Participants
KLH	Ministry of Environment	10
Departemen Perindustrian	Ministry of Industry	1
BPLHD Provinsi DKI Jakarta	Jakarta Environmental Management Bureau	2
GABEL	Indonesian Electronic Producers' Association	2
PT. Sharp Electronics Indonesia	(Branch of Sharp Electronics in Indonesia)	1
InSWA	Indonesia Solid Waste Association (citizens' group)	2
YLKI	Yayasan Lembaga Konsumen Indonesia: Indonesian Consumers Association (citizens' group)	1
PT. Mukti Mandiri Lestari	(E-waste recycling facility)	1
PT. TES-AMM Indonesia	(E-waste recycling facility)	2
BCRC-SEA	Basel Convention Regional Centre for Southeast Asia	3
UNIDO	United Nations Industrial Development Organization	1
JICA Study Team	-	2
Total		28

- Main Issues Discussed and Outcomes

This workshop produced some positive outcomes as described below.

- As the participants shared the findings of the JICA's study on the collection, recycling and processing of E-waste in Indonesia, their understanding of the current problems, etc. was deepened.

  * There are two legal frameworks in Indonesia: one for hazardous waste management and another for domestic waste management. Even though there are facilities which are licensed by KLH to conduct environmentally sound recycling, their existence is not widely known.

  *Even though there are operators (including those in the informal sector) engaged in primary collection throughout Indonesia, their activities and what happens to E-waste after primary collection are not fully understood.

  *EPR does not mean that producers are responsible for everything. All stakeholders must perform their roles respectively to achieve clearly established common goals.

  *In order to develop collection mechanism and to promote the environmentally sound recycling of E-waste, particularly white goods, cost is necessary, therefore it is necessary to examine the scale of the cost, who bears it and how to manage it.

- The participants enhanced the level of their understanding of the experience and pending issues of the household E-waste recycling system in Japan and other countries as well as the differences between national systems.

- Domestic stakeholders in Indonesia shared the underlying concept for the planned ministerial regulation on E-waste management which is currently being drafted by KLH and expressed their opinions regarding its eventual legislation.

The main opinions expressed by the workshop participants regarding the E-waste management mechanism based on EPR are summarized below.

Table 3-46 Main Opinions of Workshop Participants on the E-waste Management Framework

Organization	Main Opinions
KLH	➢ One of the characteristics of Indonesia is many business operators offering repair and reconditioning services. As the operation of waste banks has been successful for the recovery of useful resources in Surabaya and some other cities, it is an idea to incorporate such a function in the E-waste collection process. ➢ As the existing recycling facilities for E-waste are mostly engaged in intermediate treatment, a further study is hoped for to examine a viable recovery method for precious metals.
Jakarta Provincial Government	➢ There is no information for local government relating to the scale, items handled, and capacity of the recycling facilities licensed by KLH. ➢ A bylaw in Jakarta has provisions concerning the E-waste management of from the manufacturing process but there are no provisions for the management of E-waste from households and offices. The municipal government is awaiting the guidance of the national government regarding the latter.
InSWA	➢ Many informal recyclers are in operation. The entire picture of the flow of E-waste is difficult to see. More detailed analysis is probably required to clarify who is actually involved and what proportion of E-waste is handled by the informal sector which ends up with illegal disposal. ➢ The provision of incentives is essential to make consumers voluntarily discard their E-waste to a proper (formal) collection route. Manufacturers should be responsible for recycling and their obligation should be clearly stated in the regulations even though some considerations for existing business operators may be necessary. If manufacturers claim that such recycling constitutes a heavy burden, the nature of this burden should be clarified. ➢ The waste bank system is, in fact, only properly functioning in the city of Malang. The nationwide mapping of good practices of recovery/collection should be conducted. ➢ A study is probably required to investigate the types and sources of waste transported to PPLi sites (controlled hazardous waste disposal sites). ➢ There is a problem of legally or illegally imported E-waste. Some E-wastes are declared as secondhand items for direct reuse purpose, but not functional).
YLKI	➢ E-waste is conventionally sold to the informal sector. Consumers in Indonesia have not yet reached the stage of practicing appropriate waste discard by paying a treatment/recycling cost at the time of discard.
GABEL	➢ Local EEE manufacturers in Indonesia have been losing their competitiveness even in the domestic market because of the massive import of cheaper products from China. The introduction of EPR may damage the profitability of local manufacturers. It is hoped that EPR will not be a compulsory provision. ➢ Enterprises are appealing to unlicensed recyclers and storage site operators to obtain a license but these efforts alone are insufficient. It is essential for general consumers, business users and those operating in the informal sector to understand the necessity for the proper handling of E-waste. ➢ In reality, foreign subsidiaries are abiding by the law but problems are caused by numerous domestic micro-enterprises. There are many enterprises which are still causing environmental pollution even though they have obtained ISO certification.
Licensed E-waste recyclers	➢ In the case of Indonesia, a long time is required for the development of a nationwide recycling system because of its vast land and lack of domestic processing capacity. The national government should launch a nationwide education campaign to encourage the public to discard its E-waste by a formal collection route.

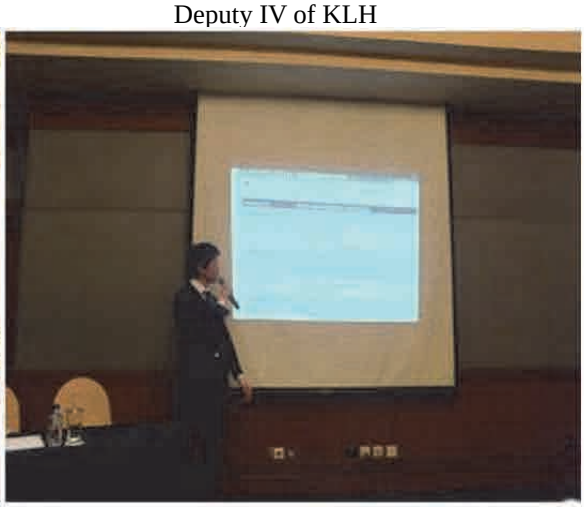
	➢ If KLH is entrusted to prepare ministerial regulations, recyclers are ready to provide the necessary support. It is believed that ministerial regulations will not impose an additional burden on recycling business operators. It is hoped that regulations to assist the development of a better society will be prepared. ➢ Regulations should not be prepared by KLH alone but through a process of consultations with other ministries. At present, many regulations are enforced without inter-ministerial coordination. There is no rational relationship between the regulations. Some of them have contradictory provisions. The integration and streamlining of these regulations will create a better business environment for various stakeholders.

<Photo of workshop>

Workshop Venue

Opening remarks by Mr. Said Muhadha, Deputy IV of KLH

Presentation made by KLH
(about draft of new E-waste regulation)



Presentation made by JICA Study Team
(about the finding from survey)

3.4 Other (Singapore)

Electrical and electronic appliances manufacturers are important stakeholders in the formulation of a E-waste management system. In Malaysia, Thailand and Indonesia, person-in-charge to oversee the discussion on regulations relating to collection of E-waste, environmental measures and recycling are present, but in most companies, the Asia-Pacific region is managed as a single entity with the relevant person being based in Singapore. It is normal for personnel to provide instructions and guidance to the country representatives and to present a common voice for the electrical and electronic appliance industry.

Hence a survey was carried out in Singapore to understand the present state in Malaysia after the completion of the Penang pilot project and recent trend of the proposed legislation and the activities being carried out by the companies relating to E-waste. Further, as most of the recycled or segregated parts from various countries are being exported to Singapore for the recovery of precious metal, a survey of the treatment facilities in Singapore was also carried out.

3.4.1 Assessment of the Pilot Project by the Manufacturers

a. Company P

Assessment of the Penang pilot project and the post completion phase

- A major challenge is the fact that there is no direct merit of the vendors being involved. At present the vendor stores are charging to collect from the consumers and having the recyclers come and collect the goods. They are making a good profit just by this act. If this system is changed to a voucher managed system, the workload on the vendors will increase but there will be no merit.
- It should be possible to establish a fund and allocate a portion of the fund as a fee of cooperation to the vendors.
- In regards to expansion to the other 5 states, no involvement of the manufacturers is seen. It is unclear what is being sought from the manufacturers. It would be better if it is clear what the DOE is asking for and its definition. Without a proper definition, asking the manufacturers to get involved in EPR is troubling.
- If only the vouchers are to be presented to promote the collection of E-waste there is no involvement of the manufacturers.

Roles that the manufacturers can play

- The thing that is being sought after is shared responsibility. If the vendors, logistics companies and the local governments carry out the primary collection and the manufacturers are responsible for the transportation of the collected E-waste to the recycling facilities (secondary collection), then it is a role that can be played. Primary collection by manufacturers is difficult.
- Whether the method of the recyclers purchasing E-waste is sustainable or not depends on what extent of treatment is being demanded. If removal of the motherboard and separation of the usable items is all that is required, then it can be done without additional cost. Hence, all will depend on what level of treatment and environmental measures is demanded by DOE.
- The portion where the manufacturers can cooperate is the “recycling technology”. However, if how much effort is to be put on recycling and what is being demanded by the government is not clear, then the required cost will also not be clear. If the removal of the motherboard is all that is required, then additional cost is not required.

Further activities required

- Cost analysis is required to determine recycle cost.
- It is necessary ensure that there is no loophole in the loop involving the vendors, the manufacturers and the recycling companies.
- Our request to JICA is to secure a budget and ensure involvement in this project. Further we also would like to request information dissemination to the Malaysian government and presentation of opinion by JICA. The manufacturers are prepared to provide the required data. Manufacturers can get involved in the formation of the base for involvement in the recycling business, subsequently contributing to Japan`s interest.

b. Company T

Assessment of the Penang pilot project and the post completion phase

- A joint implementation of collection activities was proposed to Senheng, the vendor. Their response was that the proposal is timely and good as it will have a connection to a monetary tool.
- It is planned to collaborate with this company and implement a revised-Penang model for white household goods. It is planned to use our own vouchers.
- In the 5 states, the recycling company (SP) is cooperating with DOE. They are trying to win an exclusive contract so that they can get enough materials. They are of the opinion that they need additional support from the government.
- The problem with this model is that there is no incentive for the logistics company.
- It is also necessary for the recycling company to get some sort of subsidy. A very important factor is what type of treatment is being demanded from the recycler.

The company’s own initiatives

- The collection of E-waste being carried out by the company is done by using the company’s distributor network (the company is bearing the transportation cost to transport the items from the consumers to the warehouses).The model involves the recyclers purchasing the collected E-waste from us.
- The sales channels are fully being utilized but the response to the activities in Penang is lukewarm.
- SP have carried out an analysis of the sustainability of the model where the recyclers purchase the goods and have concluded that there are no issues. However no detailed confirmation or discussions have been done. It is a hopeful observation that the model is OK but needs to be confirmed.

Further activities required

- DOE is probably of the opinion that manufacturers need to be further involved.
- DOE is probably of the opinion that the government needs to step-in in some way. One of the executives of DOE is probably thinking that although the approach will be voluntary at first and progress step-wise.
- The fact that not all the manufacturers are involved (especially Koreans) is not a good thing. It is the role of DOE to get everyone involved.
- As can be seen above, vendor stores that are nearest to consumers and hence can carry out a very convenient system of collection are suitable to be the primary collectors. At the same time, some sort of incentive is also being recommended. It is necessary for the government

to stipulate the requirements for an environmentally sound recycling in order to estimate the cost required for proper recycling.

3.4.2 Proposal of the Manufacturers regarding the Proposed Legislation

The comment input of Inforcomm and Technology Industry Group (ICT Group) which is a representative group representing Japanese and American and European manufacturers of cell phones, white goods and OA equipments etc, on the legislation proposed by DOE is summarized below. This has been compiled in early March of 2014.

a. Flow of E-waste

- It is desirable for the manufacturers to voluntarily carry out collection for free in collaboration with stakeholders of other industrial bodies
- It is desirable for the manufacturers to have the flexibility of getting involved in the formation of a collection system that will make a free collection of E-waste from consumers possible.
- It is not realistic for the government to regulate collection centers.
- Obligating the collectors to register the collection centers will act as a barrier to the formation of a collection system.

b. Recycling Fee

- In principle, recycling tax and payment of fee is not supported. The reason is that it will either lead to increase in the cost for the consumers or increase the recycling burden on the manufacturers leading to disincentive of environmentally friendly design.
- As it is difficult to estimate the cost because the goods are of various types, it will add more work to managing the cost as payment will have to be done item wise.
- Having only a single fund will act as a hindrance to competition. Hence it is better if it can be carried out by an individual entity or a group.

c. E-waste Recycling fee and Reporting

- Formulating a reporting system is important. The criteria for collecting data type should be identified.
- If only a single recycling fund is established, it is against the principle of competition.
- In order to establish a functioning scheme, it is important to regulate the improper activities of the informal sector. In order to secure a sufficient flow of E-waste by the manufacturer, it is important for the recycling scheme to be established.

d. Recommendations on EPR of the Manufacturers

- The role of the manufacturers include the formation of a system of collection, segregation and recycling in collaboration with the related stakeholders, formation of a financial mechanism relating to collection and recycling, cooperation on awareness raising, cooperation on reporting of the necessary data and continued improvements and cooperation.
- Along with the role of the manufacturer, the role of the government should be to manage the regulations in totality, identify and form a network of collection of E-waste from the consumers, awareness raising, and support in the formation of top level recycling facility and providing incentives.

- It is desirable for the local government to carry out the role of cooperating with the federal government to form a collection network and collecting E-waste and passing on the E-waste to authorized recyclers, manufacturers and recyclers.
- The recycling companies should take the responsibility of cooperating with the government to establish recycling infrastructure, collaborate with the manufacturers in a sustainable collection of E-waste and collect E-waste by coordinating with the informal sector.
- The consumers should bear the responsibility of taking their E-waste to the specified E-waste collection centers.

As shown above, a lot of comments have been made regarding the collection of E-waste and cost. Regarding recycle cost especially, the manufacturers intend to follow the regulation and not support the payment of additional cost for recycling, but are recognizing that the formation of a financial mechanism for collection and recycling is their responsibility and are not against the idea of making a payment.

Further, the manufacturers recognize that formation of a mechanism is essential to secure sufficient amount of E-waste but are against a tight stipulation by the government and are looking for a measure with flexibility.

There was no mention of the use of vouchers used in the Penang pilot project and it seems that they are not considering it as a tool that is essential for the promotion of collection.

3.4.3 State of Establishment of Recycling Infrastructure

Company T has segregation facilities in Penang and other countries and is carrying out recycling of parts from Malaysia, Indonesia and Thailand. The facility at Penang cooperated in the pilot project.

a. Outline

- The company has collection points and recycling facilities in various other countries in addition to Singapore. It has phase 4 facilities that are equipped with mechanical segregation and precious metal collection devices at Singapore, Malaysia, China and India.
- The company accepts manufacturing residue from manufacturers and waste products but does not accept products collected from the city.
- The treatment capacity of the facility in Singapore is 1000 – 1200 t/month and at present is treating about 600-700 t/month (product base). Out of this, 500t is imported. It has 180 staffs out of which 80-90 work inside the facility and the rest involved in management.
- About 60% of the initial investment cost of the facility is for pollution prevention devices.

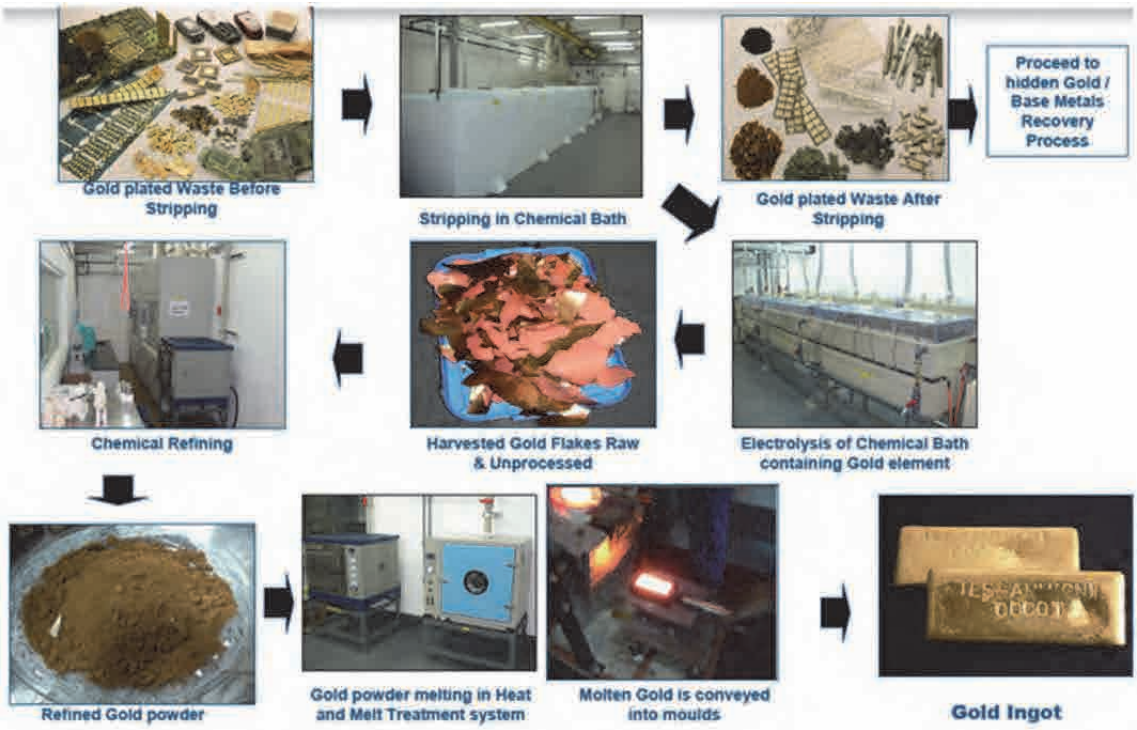
b. Management of Accepted Products

- The facility at Singapore only accepts waste products from businesses and does not accept ad hoc drop-ins. The main items accepted are cell phones, PCs, circuit boards. They do not accept white goods and CRT monitors.
- The products are purchased from the generator. The price is set by conducting a Lap Analysis, based on the amount of gold present. The price is determined by how much gold can be recovered from the smelter.
- The NEA of Singapore has designated printed boards as B1110 and has determined that Basel procedure is not necessary but if the exporting country has stipulated it as toxic waste then NEA carries out the prior notification and permitting responsibility.

- The materials that are accepted follow the “Material Acceptance Plan” and are managed such that unintended items do not mix.

c. Treatment Flow

- The collected waste product is separated into repairable (later sold) and recyclable items. The recyclable material is manually dismantled and segregated and separated into “Apparent Precious Metal” and “Hidden Precious Metal”.
  - Parts formed from non-ferrous metals : Treatment at chemical bath-Electrolysis-Melting (high temp treatment at electric furnace) of powdered product obtained through chemical smelting, formation of ingots →sale (refer to the diagram below)
  - Parts made from non ferrous metals and other materials (semiconductor parts and printed boards): Shredding to powders using a hammer mill shredder → Separation into metal and non metal powders using Electrostatic Separator → Metal portion melted and formed into ingots, non metal portion formed into pallets
  - The metal portion that has been changed into ingots contains copper nickel, zinc and other rare metals and cannot be processed by this facility. Hence it is exported to other countries including Japan where platinum and palladium are recovered.



Source: Document provided by company T

Figure 3-67 Treatment Flow

Shredder with Hammer mill

Electrostatic Separator

- The product obtained from the treatment process is gold obtained from electrolytic process. Metal ingots containing gold, silver, platinum, and palladium are also formed.
- In the manual dismantling and segregation process, wherever possible, the products are not broken down into material or parts and segregated wholly or by types.

Worker carrying out dismantling and segregation

Parts and materials separated after dismantling

- Cell phones are separated into plastics, boards, Li-ion batteries, metals. After separation the plastics, boards and batteries are shredded to reduce volume whereas metals are compacted.
- After that, the plastics are formed into pellets by pelletizers. The mother boards pass through the electrolytic process etc and are changed into ingots. The batteries are separated into metals and not ferrous metals by shredders and separators.

d. Pollution Prevention Equipments

- Pollution prevention equipments include dust collectors, effluent treatment, cyan leak alarm system etc. Dust collectors also have wet scrubbers. The cyan leak alarm operates continuously for 24 hours. The cyan used for metal recovery is stored in a closed locked space.
- Effluent that is generated during the wet metal recovery phase undergoes treatment. Sludge from the effluent treatment system is taken to a landfill. Sludge generation from the effluent treatment facility is about 1t per month.

- Effluent treatment is carried out as a batch process and includes coagulation-sedimentation → chemical oxidation → drying by filter press → disposal.

Effluent treatment equipment

Scrubber

e. Safety Measures

- The workers are given work instructions on paper with information on handling and proper method of treatment.
- Based on a periodic maintenance program, the state of operation of the equipments and pollution prevention devices is confirmed. An assessment of the downstream treatment/disposal companies is also carried out periodically.
- Personnel are allocated for safety management. Adequate implementation of recording of accepted items is done in a thorough manner. In addition, periodic reporting of treatment, disposal, amount of sale of treated product, amount of import etc is done to Singapore NEA.

4 Summary of the Study Results

4.1 Malaysia

4.1.1 Present Condition

a. Institutional and Social Recognition of the E-waste Issue

- In Penang, JICA pilot project showed that primary collection of E-waste through retailers was effective. Moreover, effective awareness raising activities has enhanced consumer's understanding of E-waste issues and facilitated household E-waste collection through retailers.
- DOE recognizes that development of legal framework for E-waste management system in cooperation with stakeholders from various strata of society is necessary. The purpose of legal system development is to prevent negative impacts on human health and the environment as well as promotion of recycling and recovery of the rare metal contained in E-waste.

b. E-waste Generation, Collection and Recycling

- In Penang, where the pilot project had been implemented, and other 5 states, primary collection is being conducted by the retailer who has its own branch network nationwide, and this shows some progress. Besides, multi channel primary collection of E-waste has been carried out by local governments, subcontractors commissioned by local governments and religious groups.
- Although there are recycling facilities licensed by DOE, adequate amount of E-waste including from household is not collected in some cases. One of the reasons is that E-waste collected by retailers are not handed over to the licensed recycling facilities and flowed into informal sector.
- Most of the recycling facilities licensed by DOE do not have treatment infrastructure for white goods from households. In general, white good contain relatively lower resource value. Hence sales profit of recycled material contained in white goods cannot cover cost for capital investment and operation of the facility. Those costs are not recovered sustainably under the current system.
- There are some activities that need to be carried out including calculation of environmental cost, examination of cost to be shared among society, development of mechanism for ensuring environmentally sound recycling.

c. Legal Framework on E-waste Management

- DOE is now drafting new legal framework for E-waste management, but here are some pending issues to be addressed, including clarification of roles and responsibilities of stakeholders, examination of promoting mechanism for household E-waste collection, recycling fee collection system required for environmentally sound recycling.
- The stakeholders including DOE recognizes that new regulation needs to specify compulsory handing over of collected E-waste by retailers to recycling facilities licensed by DOE as well as recycling fee charging system.

4.1.2 Challenges

The main challenges in Malaysia are summarized as seen in the table below.

Table 4-1 Summary of Challenges of E-waste Management in Malaysia

Viewpoints		Specific challenges to be addressed
Flow from generation to treatment	Discard	● There are data discrepancies in the estimation of household E-waste generation. According to data publicized by DOE, estimate of household E-waste generated is about 700,000 tons/year, but other studies shows different estimate. ● In some cases, E-wastes are not discarded but stored in house even they are not functional and unwanted. ● E-waste is flowed into informal sector that dismantle or recycle E-waste in environmentally unsound manner without acquiring appropriate license by the government.
	Primary collection	● Municipalities and retailers carry out individual collection (door-to-door collection) or drop-off (setting up collection boxes at stores). However those activities are only limited to collection by a few major retailers or voluntary collection by manufacturers on an ad-hoc basis. ● Large items (e.g., refrigerator and washing machines) are difficult to transport, but effective transportation mechanism and appropriate incentive for collectors have not been examined yet. ● The practice of informal collection has not been studied in detail, thus reality or collected amount is still unclear. ● E-wastes collected by retailers or municipalities are in some cases flowed into informal sector because they are not legally obligated to hand over the collected E-waste to the licensed facility.
	Secondary distribution	● Collection centers have not been developed for the purpose of effective transportation between primarily collection and the licensed facilities (e.g., specified stockyard designated by the Japanese Home Appliances Recycling Law). ● Necessity, operation mechanism and financing method of the said collection center have not been examined yet.
	Treatment and recycling	● Technologies for recycling and treatment and necessary environmental protection measures are different by product. Although some studies are conducted, capability of the existing facilities if they can ensure ESM for the various types of products is not fully understood. ● While individual facility makes efforts voluntarily for environmental protection, no common operational requirements have been established for promoting environmentally sound recycling.
others	Cost burden	● In order to realize sustainable E-waste collection and promote environmentally sound recycling, cost for promoting environmentally sound recycling is necessary particularly for white goods. However cost actually required for collection and recycling has not been analyzed and mechanism for bearing and sharing cost has not been fully examined.
	Data management	● While there is a system in place for E-waste from industrial sources classified as hazardous waste (scheduled waste) to be confirmed through consignment note, but no reporting system have been utilized for E-waste from households. ● It is required to sbumit data on E-waste production and trade to DOE, but it is not clear how DOE utilize reported data. Addtionally, standard or format for

Viewpoints		Specific challenges to be addressed
		reporting has not been developed. ● E-waste trade data can be obtained through consignment note, but no system in place for monitoring and visualization of E-waste flow by utilizing consignment note.
	Legal framework	● There is no legal obligation to take back E-waste from consumer and hand over the collected to the licensed facility. ● Rules and responsibilities of stakeholders are not legally defined. ● E-waste is traded based on market principle without government intervention and cost necessary for promoting environmentally sound recycling is not internalized. ● While rules and responsibilities of stakeholders or economic measures for promoting E-waste collection has been studied by DOE, there are some pending issues including examination of establishment of cost bearing mechanism or the entity who manage overall E-waste management system.

4.2 Thailand

4.2.1 Present Condition

a. Recognition of the E-waste Issues by the Authority and the Society

In Thailand, as E-waste management law (EPR law) has been already introduced, and an E-waste collection campaign has been tried with the government's leadership, Thailand has been recognized as a forerunner among the Asian counties in regard to formulating an E-waste management system. Since Thai's population is considerable big, twice as large as Malaysia's, many EEE producers, recyclers, smelters, trading companies, etc. are interested in entering into recycling industry in Thailand.

Despite efforts have been tried in many years as a basis for formulating a management system, there remains some issues, such as lack of measures' objectiveness, insufficient consensus building, and no specific clear goal. The current draft law includes many creative ideas, such as local government's supervision of take back centers, commission to private companies and NGOs, etc.; however, it still lacks necessary measures to realize the system, such as the procedure to set product fees, technological requirements for recycling facilities, establishment of necessary hard infrastructures, and so on. For these reasons, the realization of the E-waste management system has been long delayed.

b. State of E-wastes' Discard, Collection, and Recycling

Informal sector

Informal sector has been very active, and as they dismantle E-wastes, they are causing serious environmental problems. Small buyers purchase E-wastes by going door to door by small cars or by motorcycles with carriers. They sell these E-wastes to another informal traders who dismantle E-waste by themselves.

Typical E-wastes, such as TVs, washing machines, refrigerators, air conditioners, etc., are collected regularly, and they are manually separated into copper, iron, aluminum, printed circuit boards, plastics (ABS resin), etc. They conduct improper dismantling, such as coolant and insulation CFCs are released into the atmosphere, waste oil from compressors are not collected, and so on.

Activities conducted by informal sectors are not totally regulated. Formal collectors and collection route has not been established. There is no good practice, such as activities done by retailers or local governments. Now, it is a very difficult situation to make informal sector to fade out.

Retailers

The take-back activity by retailers is not common. PCD stated there are some trials by retailers in some part of Thailand. However, it is not quite lawful to collect E-waste from households even though it is not prohibited.

Recycling facilities

There are approximately 40 formal facilities registered; however, most of them are not actively collecting E-wastes from households. Only few companies, such as Wongpanit, Umicore, TES-AMM, and WMS (Waste Management Siam) collect E-wastes for manual dismantling. There is no facility where large-scale equipments are installed with high level of treatment to process CFC gases and led-containing glass.

DIW's licensing system, which issues permits to factories including E-waste recycling facilities, does not have a perspective whether to conduct environmentally sound treatment. Under the currently discussed draft decree, the licensing system has been introduced, in which environmentally sound treatment are required for PCD to issue licenses.

c. Current Status of the Legal System regarding E-waste Management in Thailand

As stated above, even in year 2014, the draft upper law, "Draft Act on Fiscal Measures for Environment" submitted by the Ministry of Finance has no clear date to be enacted. Although a financial regulating mechanism has been presented in the draft upper law, the fund scheme using product fees added to new products to cover buy-back fees is not likely to be implemented by to date.

The tentative E-waste collection scheme presented in the draft upper law is as follows:

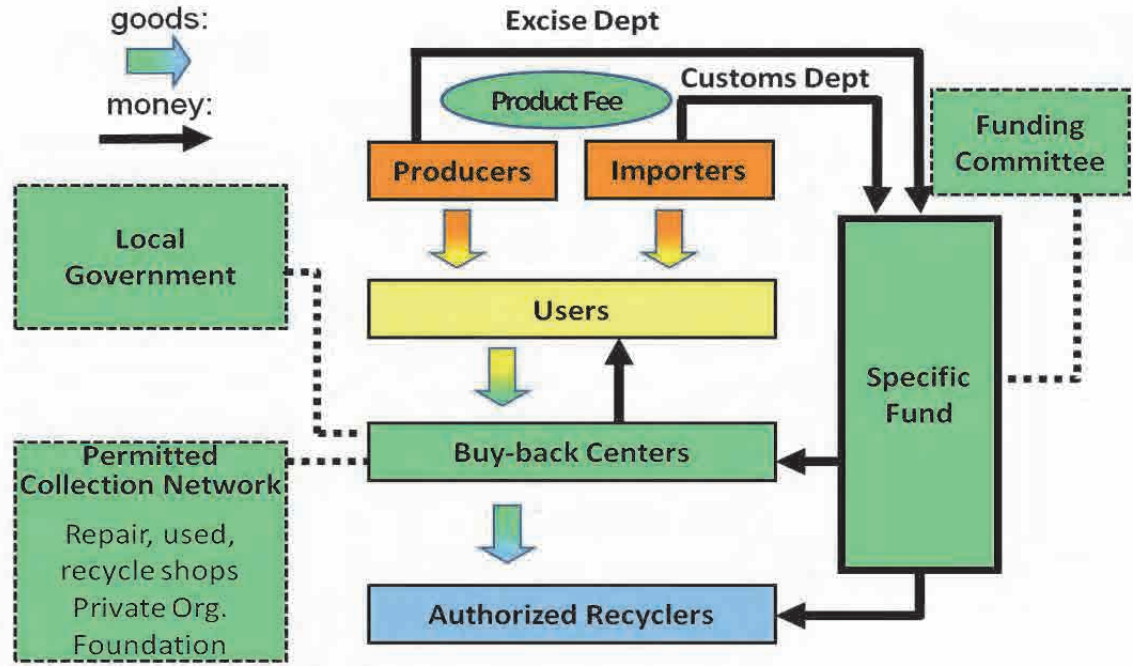


Figure 4-1 Tentative E-waste Collection Scheme Presented in the Thai's Draft Royal Decree

The main flow of the E-waste collection scheme, which is proposed in this draft Royal Decree is as follows:

Once this collection scheme has been implemented, the producer or importer, who sells new electric and electronic products has to pay additional product fee set by each product type through the Excise Department or the Customs Department to the fund established specifically for E-waste management.

For primary collection, repair, used, recycle shops, private collectors, charity organizations, etc., who properly obtained a license, purchase from households at a fixed price. These collectors only engage in collection, and they are not allowed to dismantle received E-wastes.

Received E-wastes are transferred to Buy-back Centers, which is supervised by local governments, and these collectors receive fixed fees set by product types. Buy-back Centers will be subsidized by the fund depending on E-waste collection volume.

For secondary distribution, received E-wastes are sent to recycling facilities approved by PCD to be treated in an environmentally sound manner.

Even though this draft decree is not totally abandoned, it needs further attention since the study to determine product fee and management costs has to be carefully analyzed. If not, the entire management system will go bankrupted. Especially, determining engineering and operational costs of the recycling facilities needs cooperation from producers and recyclers is necessary.

There is no regulation regarding licensing of E-waste collection from households. If any private company wants to collect E-wastes, there is no formally acknowledged method. There are approximately 40 formal recyclers, but many of them only focus on industrial E-wastes, and they manually dismantle E-wastes. Recycling facility which can process large amount mechanically does

not exist to date. It is impossible to implement the scheme presented by the draft decree since there is no licensing system for private companies to collect, and there is no recycling facilities specifically treating E-wastes from households. If this draft decree is not likely to be approved, PCD is considering an alternative, in which an E-waste recycling management scheme is established by another new law other than a Royal Decree or a ministerial notification.

4.2.2 Challenges

The current situation of the E-waste management was examined from legal, financial, and social perspectives in the section above. The challenges that become clear through the analysis of the current situation are shown below, challenges, such as designing of a sustainable E-waste collection scheme and establishing of an environmentally sound recycling system, are discussed.

Table 4-2 Challenges regarding E-waste Management in Thailand

Point of view of challenges		Challenges
Flow from generation to treatment	Generation	<u>Proper discard to formal route</u> Regarding the generation of E-wastes in Thailand, 3,470,000 items are supposed to be generated in year 2010 according to the study, which PCD commissioned to the National Center for Environmental and Hazardous Waste Management (EHWM) at Chulalongkorn University. However, about half (52%) are stored at home, and only few goes to formal recycling facilities. Most of the E-wastes are dismantled by informal sectors, and serious environmental pollution and health problems are created in the process.
	Primary collection	<u>Establishment of effective collection system</u> The challenge with primary collection is that there is no law specific to E-waste management, and private companies cannot lawfully collect E-wastes that are considered a hazardous waste. For the reason above, the take-back activity, which is active in Malaysia and India, is not practiced commonly in Thailand. The challenge is that the retailer's network, which has contact points with consumers, is not fully utilized. Also, local governments, which are responsible for treatment of hazardous wastes from households, some local governments try to collect fluorescent lamps, aerosol cans, dry cell batteries, and other small E-wastes; large-sized white goods are not collected at all. On the other hand, E-wastes from households are collected by the three-wheel motorcycles and pick-up trucks; they are dismantled without environmental and safety measures, extracted useful resources, then the worthless parts are thrown away.
	Secondary distribution	<u>Compulsory Transfer and effective location of collection points</u> Regarding the secondary distribution, the challenge is to prevent collectors from selling E-wastes to informal sectors; therefore, collectors have to be required to transfer all E-wastes to take-back centers. Another challenge regarding the secondary distribution is how to locate these take-back centers nation-wide. It is important to design the locations according to efficient transportation from households and offices to take-back centers and from take-back centers to licensed recycling facilities. It is necessary to consider a wide regional collection system with transportation cost.

Point of view of challenges		Challenges
	Treatment and recycle	<u>Establishment of recycling facilities that process waste products</u> Those recycling facilities with factory code 106 treat E-wastes, but most of them only treat wastes from factories or their own waste products. There is no facility, in which large-scale equipments are installed and operate regularly. It is also necessary to conduct a study to determine the size of these recycling facilities and their locations by estimating E-wastes' supply based on the amount of generation.
Others	Cost burden (recycle cost)	<u>Detailed cost analysis</u> In Thailand, the draft decree proposed collecting Product Fee from producers and importers and establishing a Fund in order to financially support E-wastes' purchases by the Take-back Centers. However, currently an alternative is considered that producers set their own recycling objective, and establish collection and recycling scheme based on EPR management system. In either case, cost estimate of different E-waste's proper treatment has to be conducted. The challenge is to accurately compile detailed data since the study conducted in the past was rather rough.
	Policy Implementation	<u>Formulation of a specialized law on E-waste</u> In Thailand, there is no law that is specialized on E-waste, and that is the reason why the location of recycling and treatment's responsibilities is unclear. It has been number of years since the specialized law on E-waste has been discussed, and its early enactment is keenly desired. Even after its enactment, it is necessary to formulate implementing bylaws and standards to specify more detailed regulations and to ensure environmentally safe and sustainable recycling.

4.3 Indonesia

4.3.1 Present Condition

a. Awareness of the Government and Public Citizens about E-waste Issues

- In Indonesia, there are several good practices of voluntary solid waste collection and environmental education actively carried out on a community level (e.g., Kampung). However, E-waste is emerging issues and ordinarily citizens are not fully aware of the potential risk of E-waste on human health and the environment.
- Under the framework of the Basel Convention, the E-waste is one of the key waste streams to be addressed and parties now have intensive discussion on the possible measures to prevent environmental pollution caused by environmentally unsound treatment/recycling of E-waste and to promote efficient recycling. Because of this situation, the Deputy IV of KLH is now drafting new Ministerial Decree on E-waste management based on EPR.

b. The Status of Generation, Collection and Recycling of Household E-waste

- In Indonesia, it is common that E-waste generated by consumers (household and office) is to be dealt with in any of the following ways.
  I. Keeping E-waste in the households/offices without handing over to collectors/recyclers
  II. Bringing in repair shop (it is common in Indonesia that used electronic and electric equipment (EEE) is to be repaired (or re-conditioned) and be resold at the secondhand market. It is likely that most of those un-repairable EEE generated at the repair shop is collected by informal sectors)
  III. Selling out E-waste directly to door-to-door informal collectors
- In Indonesia, other than E-wastes disposed by consumer, non-functional secondhand EEEs are imported (or even smuggled) into the country for the purpose of direct reuse in some cases.
- In some municipality, there are “Waste Banks” functioning as collection centers of recyclable materials. Those Waste Banks registered with local governments and KLH encourages local governments to set up new Waste Banks or utilize the existing ones to promote collection of recyclables.
- Most of E-wastes flowed into informal sector first goes through manual dismantling process and then smelted in environmentally unsound way to extract precious metals such as gold Residues generated from E-waste recycling process containing hazardous substances are illegally dumped without proper treatment. Further study and analysis is needed to better understand real situations of the business of those informal sectors (e.g.., location, operation scale, and practices of dismantling, recycling and treatment).
- Some retailers offers “trade-in” program which provide customers with discount for the new items. This program is carried out on ad-hoc basis for the purpose of sales promotion.
- There are in total 7 E-waste recycling facilities (6 companies) are licensed by KLH. Infrastructures for E-waste recycling is now being developed, therefore those facilities so far only accept industrial E-wastes which are generated from production process (mainly ICT goods). The facilities mainly focus on collection and dismantling of E-waste and no technology for precious metal recycling is in place. Therefore, metal extraction is usually carried out through inappropriate smelting process domestically or exported to other countries.

c. Legal Framework of E-waste Management

- Pursuant to the Environmental Protection and Management Law (Law No. 32/2009) and its relevant government regulation, the industry should appropriately recycle/treat E-waste generated by its production process at the recycling facility licensed by KLH. On the other hand,

all the household wastes including E-wastes are collected by municipality pursuant to Waste Management Law (Law No. 18/2008).

- However, under the current legal framework, municipality is not obligated to hand over those collected household E-waste to the recycling facility licensed by KLH. Therefore, KLH is now drafting new Ministerial Decrees which clarifies definition and management framework of "Special Waste" stipulated in Waste Management Law and requires municipality to hand over household E-waste to licensed facilities.
- KLH has a political will to establish a viable E-waste management system which is applicable to the current situation of Indonesia, based on lessons learned in other countries which have already introduced EPR system. Furthermore, KLH is asking for public comment widely on new decree and is flexible to reflect the opinions of stakeholders.

4.3.2 Challenges

a. Challenges of E-waste Management in Indonesia

Major challenges of E-waste management in Indonesia are summarized as follows;

Table 4-3 Summary of Challenges of E-waste Management in Indonesia

Stage	Challenges
Discard	● Indonesian household traditionally (or conventionally) keep their used EEE even if it is not functioning. So the large amount of E-waste has been kept at individual homes without discard to collectors/recyclers. ● Households can receive money upon discard of E-waste since collectors from informal sectors often visit households and purchase it. Hence economic disincentive is provided to households not to hand over E-waste to municipality collection system stipulated in the law.
Primary collection	● It would appear that a large amount of E-waste is flowed into informal collectors (waste pickers) and small-size repair shops. ● The entire picture of stakeholders involved in E-waste collection (e.g., number, location and scale of business) is still not clearly understood. Hence more detail survey and mapping of the relevant actors are necessary. ● In some areas such as East Java, informal recyclable collection business has been conventionally active. However, Indonesia is a vast archipelago country and social and technical infrastructure for E-waste collection might have not been established yet in some areas, especially in remote islands. Therefore collection activities in remote areas need to be studied.
Secondary collection	● KLH is now drafting new regulation which obligated municipalities and retailers to hand over collected E-waste to the licensed facilities. However, even if it is legally obligated, based upon market economic principle, there will be price competition between the licensed facilities and informal sectors for valuable resources. If the price offered by informal sectors is more attractive, E-waste might not be handed over to the facilities. ● The temporary storage sites (TPS), which is managed by the local governments, has been established across the country and this can be utilized as collection center. However, in reality a large amount of E-waste is now flowed into informal sectors and only a little is collected by municipalities. ● There are some good practices where "waste banks" successfully function as collection center for recyclables (e.g., plastics or papers) in Indonesia. In order to utilize waste banks as collection center of E-waste from informal sectors, further studies are necessary to see if it could serve as collection center for

Stage	Challenges
	bulky wastes. Moreover, the material flow after waste banks also needs to be surveyed. ● Most of E-waste recycling facilities licensed by KLH are located in Jawa islands. To achieve nationwide E-waste collection/recycling system, economic and technical feasibility of wider-area collection system also needs to be examined.
Dismantling, recycling, treatment	● Currently no infrastructure for dismantling, recycling and treatment of bulky white goods (e.g., TVs, refrigerator, washing machines or air conditioners) is in place. The problems are not only that technology has yet been established, but also the facilities cannot bear the recycling cost since recycling of white goods creates negative economic values contrary to ICT equipments (PCs or mobile phones). Moreover, unlike ICT equipments, most of white goods are discarded from households, hence facilities cannot make investment decision unless collection system from household is developed and stable and predictable material supplies to the facilities are ensured. ● The recycling facilities licensed by KLH mainly focus on collection, dismantling and separation of E-waste therefore metals contained in E-waste is not being recovered currently. ● In some areas such as Tangerang, E-wastes are manually dismantled and metals are extracted in environmentally unsound manner. The further study is needed to figure out real situation of these informal business activities and its impact on human health and the environment. ● Currently metal recovery process is carried out by informal sectors through environmentally unsound smelting process, or exported to other countries. The Gresik, which is one of the biggest copper smelter in South East Asia, is available in Indonesia, but so far does not accept E-waste. ● Some of the licensed E-waste recycling facilities commissioned to PT. PPLi for treatment and disposal of the residues from their recycling process. PT. PPLi has controlled landfill, however, most of non-valuable residues containing hazardous substances generated from informal E-waste recycling are illegally dumped

b. Challenges of E-waste Management Regulation Being Drafted by KLH

The draft E-waste management regulation currently being drafted by KLH will be examined internally and be revised through dialogue with stakeholders. For the current draft version, the followings need to be considered for improvement.

- In Indonesia, the legal framework for domestic waste management is separate from the legal framework for industrial hazardous waste management. Therefore, the new regulation focuses on the assured flow of domestic E-waste collected by local governments to E-waste recycling facilities licensed by KLH. However, the details have not yet been finalized.
- EPR mechanism cannot properly function unless (i) stakeholders have a common goal, (ii) the roles of individual stakeholders are clearly specified by law and (iii) the body responsible for the functioning of the said mechanism has the capacity to deal with any issues which arise, as seen in the experience of other countries. For this reason, careful drafting is required to come up with truly effective legal provisions, particularly for Chapter 5, based on the detailed fact-finding results of the current and expected activities of each stakeholder.
- The current draft considers retailers and reconditioning industries to be responsible for primary collection in addition to the conventional collection by local governments. However, there are no detailed plans on how to coordinate with these bodies and what incentives should be introduced to ensure successful collection.

- At present, the collection of E-waste in Indonesia is mainly carried out informally. The draft does not specify the status of as well as how to utilize and monitor such informal collection and how to integrate it to the formal collection mechanism (KLH is currently interested in the collector registration system in Malaysia).
- The responsibilities of manufacturers currently being considered include the establishment of a collection system and promoting environmentally sound recycling at licensed facilities voluntarily or in collaboration with local governments. Whether or not the PROPER[96] currently considered as incentives for the commitment of manufacturers can really function as the intended incentives should also be examined.
- There is no concept of who is going to bear the cost and management of the system indicated in the current draft. Partly because of opposition by electrical and electronic equipment manufacturers, KLH appears to prefer the option of establishing a management system without a funding mechanism. However, if the regulation is to cover the collection and recycling of white goods, it is essential to examine how the collection and recycling costs can be shared by stakeholders.
- No clear concepts have so far been developed regarding how to manage and operate the mechanism, how to periodically improve the mechanism through a clear understanding of the outcomes and verification of the problems encountered and who will be responsible for such work.

4.4 Summary and Comparison

Situation in three countries can be summarized in the table below for the comparison.

[96] The PROPER is a performance rating system based on individual factories not individual enterprises. The PROPER offers no benefits for importers who do not have a manufacturing base. Moreover, the PROPER is a general assessment system covering water and air pollution in addition to hazardous waste and it does not specialize in the assessment of E-waste collection and management activities.

Table 4-4　Comparison of the Current State and Challenges of E-waste Management in the Respective Countries

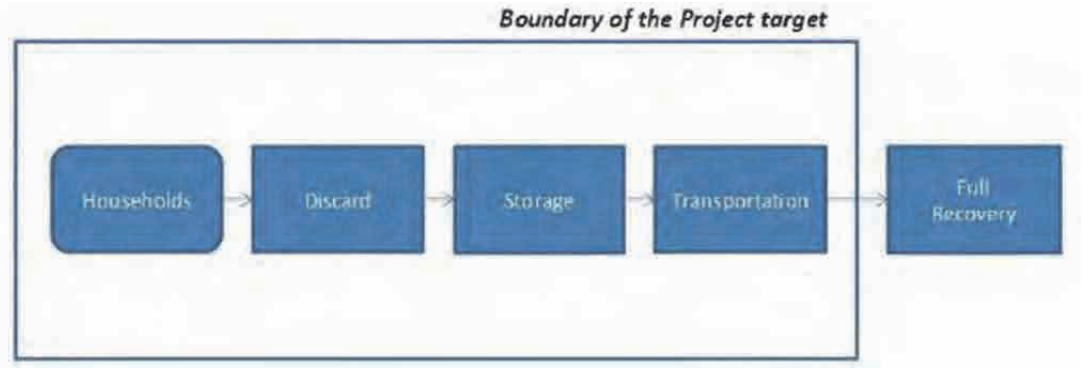
Legend：○：Base for a sustainable E-waste collection and environmentally sound recycling is already in place　△: Technological and social base or governmental activities are present but improvement is necessary
●：Lots of challenges remain and hence action from the government is desired　？：Not clear from the previous studies and further information collection is necessary

	Malaysia	Thailand	Indonesia
Public awareness	△A general awareness of E-waste exists but awareness level of handing over E-waste to the formal route is not high.	●Awareness of E-waste issues is still low. Awareness level of handing over E-waste to the formal route is also not high.	●Awareness of E-waste issues is still low.
Discard	△Awareness raising activities and collection programs are being carried out by charity groups, NGO and local governments.	△Collection program of small household electronics and awareness raising activities is carried out by educational bodies (universities) and local governments. Rate of keeping E-waste at homes is high.	●Consumers (households) traditionally sell E-waste to informal collectors or repair second hand shops. It is common that household stores E-waste rather than discard even if it is not functional.
Primary collection	△Mainly collected by informal sector but the government is considering monitoring and visualization of activities through registration system. ○There are examples of E-waste collection by local governments or companies commissioned by the national governments. △As seen in the Penang pilot project, collection by retailers is effective and Senheng is carrying out a nationwide collection. However, since the collection is voluntary and there is no obligation to hand over the collected E-waste to the licensed facility, it is flowed into informal sector in some cases. ●E-waste is traded based on market principle but this model is unsustainable, especially for white goods.	△Almost all E-waste is collected by informal sector but the draft regulation proposes to manage this by registration system △In the proposed regulation, local governmental bodies will supervise and manage buy-back centers which will be responsible for primary collection. △Collection of used goods by religious facilities like temples is socially accepted. Some consumers sell or donate goods. ●Retailers do not take back E-waste because collection of E-waste from households by private companies is not permitted by the law.	●Almost all E-waste is collected by informal sector and the government cannot monitor or control those activities. E-wastes are sold at a price depending on the content of valuables but cost of environmentally sound recycling and treatment, particularly for white goods are not internalized. ●The local governments collects household waste but E-waste is not well collected. △A few major retailers voluntarily collect used items when customers purchase new products (trade-in). However, the flow after taken back by retailers is not clear. ？ As Indonesia is a vast country, it is unclear how E-wastes are collected in isolated islands and remote areas.
Secondary collection	△There are no secondary collection centers established for the purpose of an effective E-waste transportation system. No discussion on setting up, operation, management and assignment of roles for such a center has been carried out.	●There are no facilities for temporarily storing the collected E-waste. ●No consideration has been done in the proposed regulation for secondary logistics from the buy-back centers to the recycling facility.	△Temporary storage sites managed by local government might be able to be utilized as secondary collection (As the area is large, effective use of the existing facilities is desirable) △There are examples where the “waste banks” registered by the local government have acted as collection points (However, it is unclear whether they also act as collection points for large size E-wastes)
Intermediate treatment (dismantling, recycling)	○There are 35 licensed facilities that can dismantle E-waste and recover precious metals. △The scale and the capacity of the 35 facilities differ. There is a condition for obtaining the license but there is no stipulation set by the government for environmentally sound recycling.	△According to DIW, about 40 facilities have received licenses to treat residues from EEE manufacturing plants, but these facilities mainly carry out manual dismantling and only a few facilities have capacity to recycle E-waste. ●The majority of the 40 facilities are situated in Bangkok and it is expensive to transport goods from the rural areas.	△Although not sufficient compared to the total E-waste generation amount, there are 7 facilities (6 companies) that have acquired the license from the government to conduct environmentally sound recycling. ●However, these facilities mainly carry out intermediate treatment like dismantling of high value ICT products and there are no facilities to treat white goods. The location of the facilities is centered in Java island.
Precious metal recovery	△Some recycling facilities recovers precious metal but the metal that can be recovered is limited and the purity also does not satisfy international requirements. Some parts are exported and residues are disposed of.	●At present, there are no facilities that recover precious metals from household E-wastes. Recovery process is either carried out in environmentally unsound manner domestically or is exported to other countries including Japan.	●There are no formal facilities that can recover precious metals and hence they are subject to either improper smelting process or export (*Gresik copper smelter is a potential final disposal facility but it does not accept electronic scrap at present).
Final disposal of hazardous residue	△There are some facilities with engineered landfill and incinerators which the level of technology is comparable to developed countries but the disposal of E-waste residue is not being carried out.	？3 landfills with leachate management systems exist for hazardous waste but it is not clear if E-waste residues are disposed of in those landfills.	△There is one facility with engineered landfill for hazardous waste which also accepts treatment residues from the licensed E-waste recycling facilities but the majority flows to the informal sector and illegally dumped.
Legal framework for E-waste management	○New regulation on E-waste with involvement of manufacturers, collectors, recycling facilities and consumers is now being drafted. △While rules and responsibilities of stakeholders or economic measures for promoting E-waste collection has been studied by DOE, there are some pending issues including examination of establishment of cost bearing mechanism or the entity who manage overall E-waste management system.	△Draft regulation on E-waste management is being considered but has not yet been finalized.	○The authority responsible for household hazardous waste collected by the local governments had been legally not clear, but it was clarified. △E-waste management regulation which introduces EPR is being drafted but further discussion is required on issues like responsibility of the stakeholders, incentives, cost burden and the entity responsible for managing the overall system.
Cost sharing	△Discussion of cost bearing mechanism for the promotion of environmentally sound recycling and sustainable collection is necessary and the analysis is necessary for the development of an effective system.	△There is a plan to set up a fund mechanism from the recycling fee collected from manufacturers which is to be used for subsidizing collection by retailers and environmental measures by recycling facilities. However recycling fee and the method of its collection has been not analyzed yet.	●The new regulation being drafted by KLH proposes to obligate manufactures to collect E-waste and to provide incentives to them, but financing method (cost bearing mechanism) is not fully considered
Other matters	△It is required for stakeholders like manufacturers and recycling facilities to submit data on E-waste production and trade to DOE, but it is not clear how DOE utilize reported data. Standard or format for reporting has not been developed yet. △The effectiveness of the system can be improved by monitoring and visualizing E-waste flow by utilizing the E-waste trade data (managed by manifests).	△Through E-waste collection campaign, a level of public awareness has been raised, but the result of the collection campaign is yet to be analyzed and hence not utilized for drafting new regulation.	●Besides the domestically generated E-waste, a huge amount of E-wastes are imported into Indonesia illegally.

5 Identifying the present condition after the completion of Pilot project in Penang and challenges found in promoting similar experience in other areas

5.1 Present Condition after the Completion of the Pilot Project

This section summarizes the present condition and challenges of the "The Project for Model Development for E-waste Collection, Segregation and Transportation from Households for Recycling" conducted in Penang from September 2011 to March 2013. As shown below, the target scope of the pilot project was generation, collection, storage and transportation to recycling facilities of household E-waste.



Source: JICA, The Project for Model Development for E-waste Collection, Segregation and Transportation from Households for Recycling Final Report

Figure 5-1 Scope of the Pilot Project

In addition, the chapter also focuses on measures to promote collection of E-waste from households, involvement of the stakeholders, state of improper activities, sustainability of the collection mechanism and activities from the viewpoint of environmentally sound activities.

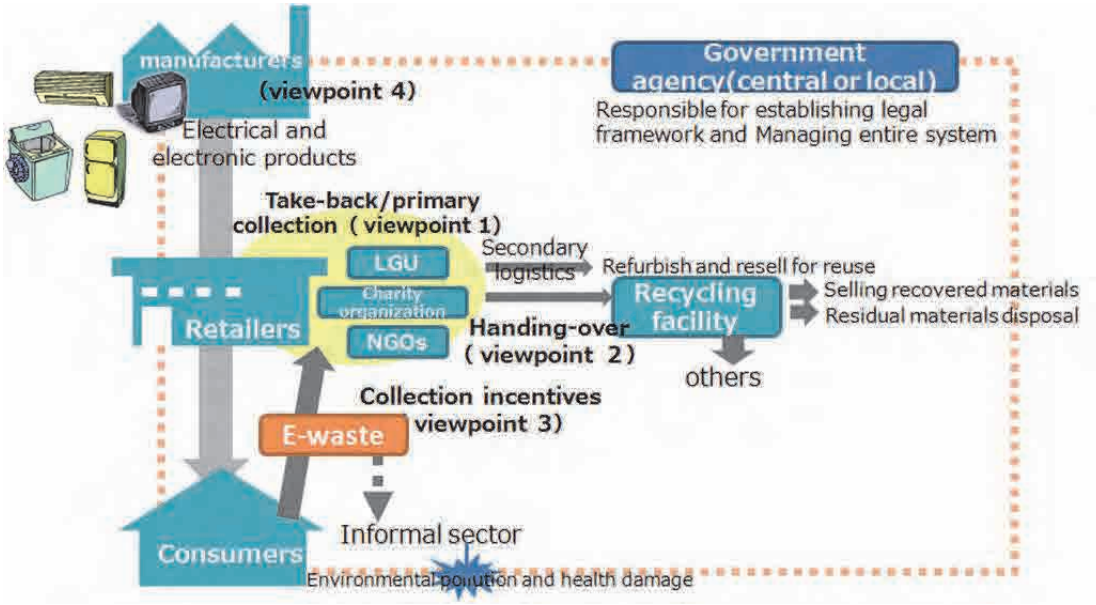


Figure 5-2 Viewpoints to Understand the Present Condition

The present condition has been reviewed through the following viewpoints.

5.1.1 Viewpoint 1: Current State of Take-back of E-waste (Primary Collection)

The result as of December 31st of the E-waste collection project that was conducted from the first half of August 2012 with the participation of 25 shops is shown below. In the half year period, the largest number of items collected was mobile phones with about 250 units. This is thought to be because of the ease of carrying as opposed to other products. The number of collected white goods like TVs, refrigerators, and washing machines was about 200 units. The effectiveness of taking back of E-waste during the purchase of new products is demonstrated.

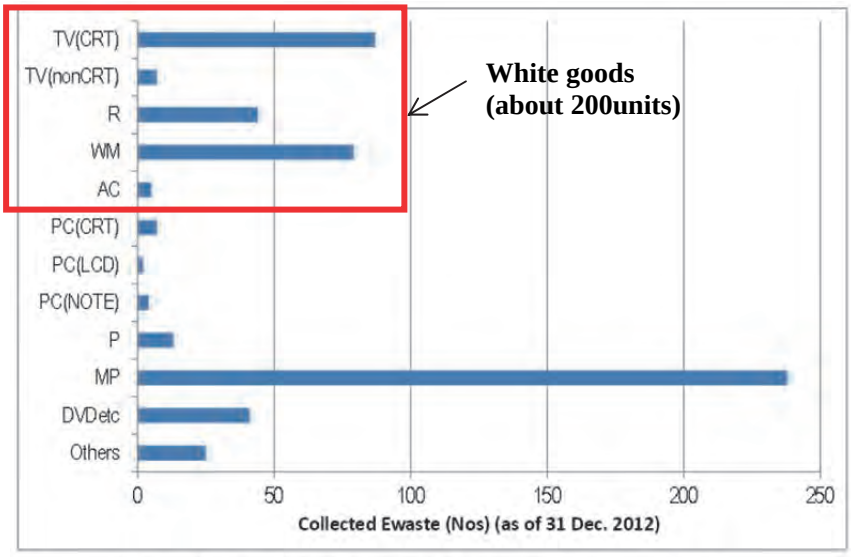


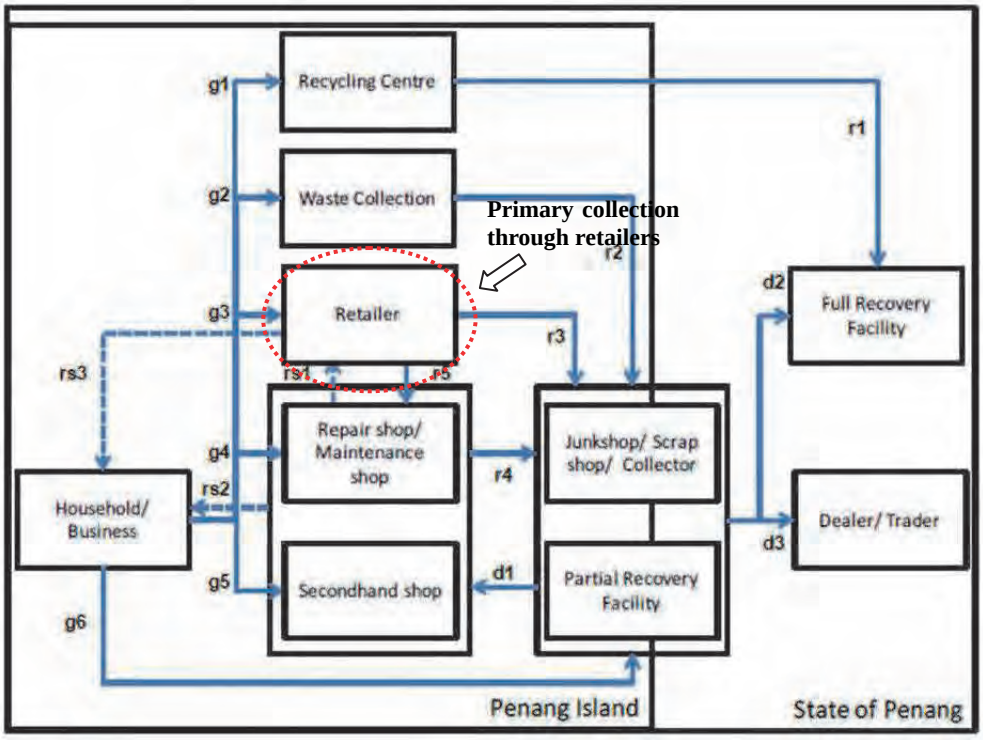
Figure 3-2. Number of collected e-waste (as of 31 Dec. 2012)

Source: JICA, The Project for Model Development for E-waste Collection, Segregation and Transportation from Households for Recycling

Figure 5-3 Number of Collected E-wastes

However, after the completion of the pilot project, collection by the retailers has not been very active. Further, data obtained through the pilot project and its feedback to DOE and other stakeholders were also not properly carried out.

Having reviewed the effectiveness of the E-waste collection channels, collecting through retailers was one of the most efficient and convenient ways especially for such large and bulky items as refrigerator, washing machine and other similarly large items. This was proven by the Pilot project as one third of collected E-waste from household was through retailers. It can be fair to say this was one of the most important outcomes of the Pilot project to identify the effective and convenient collection channels for E-waste from household.



Source: JICA The Project for Model Development for E-waste Collection, Segregation and Transportation from Households for Recycling Final Report

Figure 5-4 E-waste Collection Rate by Different Collection Channel

Signs	Television set (CRT and non-CRT)	Refrigerator	Washing Machine	Air-conditioner	Personal Computer (Desktop)	Personal Computer (Laptop)	Mobile Phone
g1	0.0	0.0	0.0	0.0	4.5	0.0	0.0
g2	12.5	8.5	13.7	0.0	31.8	0.0	5.6
g3	15.0	29.8	33.3	37.5	4.5	10.0	36.1
g4	23.8	21.3	9.8	25.0	4.5	40.0	11.1
g5	8.8	12.8	11.8	0.0	13.6	30.0	36.1
g6	40.0	27.7	31.4	37.5	40.9	20.0	11.1
r1=g1	0.0	0.0	0.0	0.0	4.5	0.0	0.0
r2=g2	12.5	8.5	13.7	0.0	31.8	0.0	5.6
r3=g3*k	0.2	0.0	0.0	0.0	0.4	0.7	0.4
r4=(g4+g6)+l	2.9	3.8	3.5	0.0	3.9	2.8	0.8
r5=g3-r3	14.9	29.8	33.3	37.5	4.2	9.3	35.8
rs1=r5	41.3	29.8	33.3	37.5	4.2	9.3	35.8
rs2=g4+g5+d1-r4	14.9	35.0.	25.3	25.0	15.0	67.4	46.4
rs3=r5	41.3	29.9	33.3	37.5	4.2	9.3	35.8
d1=(g6+r2+r3+r4)*m	11.7	4.8	7.3	0.0	0.8	0.2	0.0
d2=(g6+r2+r3+r4)*n	3.9	1.2	1.0	0.0	11.6	3.3	0.0
d3=(g6+r2+r3+r4)*o	40.0	34.0	40.4	37.5	64.7	20.0	17.9

Primary collection through retailers

Source: JICA, The Project for Model Development for E-waste Collection, Segregation and Transportation from Households for Recycling Final Report

Figure 5-5 E-waste Collection Rate by Different Collection Channel

The Study Team conducted interviews on the retailers regarding the present status of E-waste collection and difficulties they faced. The survey results are summarized as follows.

Table 5-1 Summary of the Interviews on the Retailers

Survey items	Summary of the interview result
Present status of buy back after the completion of Pilot project (PP) (including difficulties identified during PP period)	• Even after the completion of Pilot project in March 2013, retailers collected E-wastes from customers and provided them with vouchers, which are differently redesigned by retailers. • Shan Poornam sometimes did not come and pick up collected E-waste even the retailers requested to do so over the phone. Since the space of storage is limited, collected E-wastes were eventually sold to informal sector. • The problem of the PP mechanism is that only recycling facility can make profit because all burden of managing voucher are borne by retailers and E-wastes were collected with almost no positive value.
Difficulties for E-waste collection	• It is burdensome to transport bulky white goods, particularly in Penang where there are many high-rise housing. Hence, incentives also should be provided to retailers. • For successful E-waste collection, regulation is necessary. At the same time, strict regulation on informal sector and formalization of informal activities are quite important. • Unless informal sector is regulated by government with strong commitment, E-wastes are not channelized to the formal recycling facilities.
Problems of voucher	• Paper work for managing voucher was burdensome. • Voucher could partially serve as an incentive to consumers not to keep E-waste at home but to discard it to recycling flow.

In the interview survey, it was commonly pointed out that voucher was too complex to become an easy measure for incentivizing consumers and the collected E-waste were sold to informal sector due to the lack of compulsory handing over duty to the licensed recycling facility by the regulation.

5.1.2 Viewpoint 2: State of Handing over of the Collected E-waste

The state of the E-waste collected from the consumers is as follows.

Most of the E-waste collected is not taken to recycling facilities, recycling facilities are not conducting a periodic collection, and requests to take the collected items are often ignored. Even if voucher is offered to collect goods from households and a lot of effort is done to manage E-waste, recycling facilities are not taking the collected products and as a result the products end up flowing to the informal sector which offer more money, hence indicating that environmentally sound recycling practices are not being followed. Further, the collected cell phones and household goods are left in the stores making storage space a big problem. The recycling facilities were not collecting these used goods from stores resulting in the stores themselves not collecting from consumers.

Collected cell phones being left uncollected at stores

Collected household E-waste being stored at retailers storage

There are several reasons why this type of scenario has unfolded. One of the reasons is that the recycling facilities that are supposed to collect the E-waste are mainly treating off spec components or post use computers and do not have the required treatment line for white goods. Receiving goods that cannot be treated from technological point of view cannot be a welcome factor for these facilities.

As the transportation of the collected goods from the vendors to the recyclers was being born by the recycling companies, an effective collection based on requests was not being carried out.

Further, one more factor is the fact that profit from the sale of raw materials obtained from recycling is almost zero. For example, voucher offered for washing machine was 10RM (about 310 yen). This implies that the recycling facilities are offering this amount to purchase the goods, but the cost required for transportation and dismantling cannot be covered by the sale of materials like Iron, Aluminum etc obtained from recycling. Hence, larger the collection, more the loss.

A part of E-waste is being collected by the recycling facilities and recycled. However it is not clear what type of recycling is being carried out. In the pilot project, 80 CRT TV sets and 40 refrigerators were collected and were supposed to be recycled at recycling facilities, but there is no record of how lead glass, CFC used for coolant as well as insulation were ultimately treated and landfilled.

The scope of the pilot project was focused on the collection of E-waste from consumers but it also shows that the collected E-waste is not being recycled properly.

JICA Study Team conducted interviews on recycling facilities regarding the present status of transfer of E-waste from retailer to recycling facility.

Table 5-2 Summary of Interviews on the Recycling Facility

Survey items	Summary of the interview result
Evaluation of the Pilot project(PP)	• During the PP, E-waste was purchased through voucher and voucher was paid solely by the recycling facility. • The PP model which E-wastes are purchased by recycling facilities is not sustainable. Particularly, white goods have almost no value, thus recycling facilities have no incentive to actively purchase E-wastes. This will be more so in future when used white goods are in the market. • After completion of the PP, the recycling facilities do not go to retailers to pick up E-wastes. • Since white goods have almost no value, the model which collects only white goods is not sustainable. Sales value of parts or components cannot cover cost for environmentally sound treatment

Survey items	Summary of the interview result
	of white goods as they require some additional cost for proper pollution controlling measure. • During the PP, management of voucher was burdensome. • Only some amount of mobile phones, TVs and washing machines were dismantled among all E-wastes collected at the PP. In total only 3-4 tons were dismantled. This was very small fraction among the total collected E-waste due to the lack of proper technical capability at the recycling facility.
E-waste management regulation	• Unless involvement and cooperation of manufacturers and retailers are available, it is difficult to promote sustainable and profitable collection and environmentally sound recycling only by recycling facility. • Collection and recycling of white goods are not promoted if government intervention is not available. • Cost analysis on E-waste recycling under a certain condition or methodology is critically necessary. • Promotion of environmentally sound recycling of E-waste needs some additional cost and it should be collected upon purchase of new product.
Informal sector	• Informal sector collects and treats E-waste without license. It is illegal activity and government's enforcement is not adequate. • Regulation by the government is essential to control the informal sector.
Infrastructure of E-waste recycling.	• It is necessary to develop recycling facility for environmentally sound recycling of white goods which is different from the existing facility and to ensure space for storage. New investment is necessary to install the equipment at the recycling facility. In order for this happen, ample volume of E-waste should be collected and recycled for returning the investment. • In Malaysia, infrastructures for recycling white goods are not in place. Hence all facilities cannot actively accept them.

5.1.3 Viewpoint 3: Measures to Promote Collection

In the Pilot project conducted in Penang, vouchers were used as a measure to promote collection. However, as explained before, vouchers are complicated, there is too much administrative burden on the vendors and as there is problem of shortage of space for the collected items, many stores were reluctant to hand out vouchers.

However, even in Penang a few initiatives can be seen where vouchers are used as incentives to collect E-waste from consumers. For example, LSS which also participated in the pilot project, has a 50 RM voucher, DELL and IRM have cooperated in a voucher program at ICT mall etc. Many of the vouchers are similar and use a simple mechanism.

Voucher used by LSS

Voucher used by ICT mall

PC collected at collection box

Transaction record (copies only of the receipt)

Regarding the effectiveness of vouchers, although they are acting as incentives for consumers, they are not functioning as a mechanism to accomplish a large scale collection of E-waste. Further, according to company S that also givers out vouchers, although goods are being collected from consumers, sale to the informal sector is still continuing. When white goods are collected directly from households, they are done for free without vouchers and some degree of collection has been accomplished.

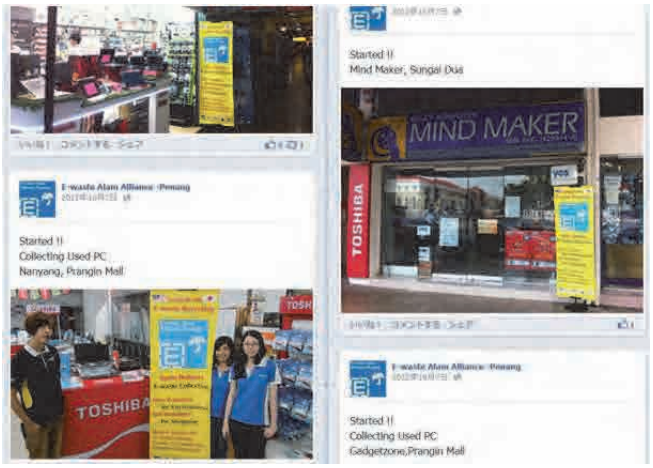
It is possible to try to increase the collection amount by increasing the value of the vouchers, but this may act as a disincentive in carrying out environmentally sound recycling due to cost issues.

The method of obliging the vendors to buy back old products during the sale of new ones is probably a more effective method. In Malaysia, like in Japan the style of purchasing electrical and electronic goods at large stores is becoming main stream. Collection of old products during delivery of new ones is very convenient for the customers. In the consumer awareness survey conducted at Selangor, 76% of the respondents showed willingness towards a free transaction and some were even willing to pay a small fee for taking back their old items.

From this, it can be adjudged that if a convenient service that can satisfy some conditions can be offered, E-waste collection is possible even without vouchers.

In addition to presenting vouchers to promote collection, awareness raising initiatives involving SNS (Social Networking Service) also contributed. However, after the pilot project, due to the absence of an active proponent, the content/s have only been renewed once on April 7, 2014.

SNS site



Details of the participating store

The Pilot project has contributed to raise the awareness about the E-waste related issue among ordinary consumers by proving voucher and through various media including SNS and other information and communication tools. It can be fair to say that this was one of the most important outcomes.

5.1.4 Viewpoint 4: Involvement of the Stakeholders (Manufacturers)

In order to achieve a sustainable promotion of E-waste management, it is necessary for the stakeholders like manufacturers of electrical and electronic products, vendors, consumers, collectors and recyclers to get involved and fulfill their role. Japanese electrical and electronic manufacturers comply with E-waste recycling laws internationally and have the know-how on effective collection and recycling practices.

In the pilot project the involvement of the manufacturers was limited, although there was a level of agreement and understanding about the result of the pilot project. Several concerns from the sustainability perspective were pointed out. For example, questions were raised about the resources for vouchers to promote the collection of E-waste only coming from recycling facilities. Some manufacturers has been promoting E-waste collection through the dealers and repair network for own brand and the result has not been as encouraging as expected. Having experienced this activity, manufacturers pointed out the necessity for elaborating how the necessary cost can be shared among the stakeholders and emphasized the importance of regulatory measures to channelize the E-waste to the formal recycling channel not only with the such economic incentives as voucher without leaking to the informal sector.

JICA Study Team conducted interviews on manufacturers regarding the PP and draft E-waste management regulation. The summary of interviews is summarized as follows.

Table 5-3 Summary of Interviews on Manufacturers

Survey items	Summary of the interview result
Evaluation of the PP	• E-waste was purchased by recycling facility with vouchers. However, E-waste, especially white goods would not be able to be purchased any time. • In the PP, voucher prices were set higher than the prices offered by informal sector to attract more E-waste into the formal channel. But in the reality, not many E-wastes were actually attracted only by this measure. • JICA should be involved in drafting process of new regulation which promotes sustainable E-waste management even after the PP.

Survey items	Summary of the interview result
E-waste management regulation	• Rules should be shared among stakeholders. The legal framework should be established taking functional capability of each stakeholder into account. For instance, manufacturers have limited opportunities to contact with consumers, so it is difficult to collected E-waste directly from them. • Manufacturers are somehow in the position to support and cooperate for promoting environmentally sound recycling. But it is difficult to promote the sustainable activities only for CSR purpose. Regulation based on fair shared responsibilities among relevant stakeholder is necessary and should be developed. This enables the manufacturers to conduct necessary activities. • It is unrealistic to place all responsibilities only on manufacturers. • To utilize voucher as an incentive is not sustainable. • Selling E-waste to informal sector should be strictly controlled with the regulation. • The necessary cost for environmentally sound recycling should be fairly analyzed with clear condition including how this cost is charged and collected and when. Also the discussion is necessary on how the collected cost (fee) is utilized for accomplishing originally intended purposes. • Government should understand there are differences among the different type of E-waste such as size, weight, and components of valuable fraction and the fraction requiring the proper pollution controlling measure during its recycling process.

5.1.5 Viewpoint 5: Management of the system by the government (after the completion of the PP)

According to a self assessment by the Malaysian government, there are challenges in the sustainability of the E-waste collection model of the pilot project and there is a limit on the authority of the government (DOE Penang has no authority). Hence, it is assessed that there are challenges in continuing the collection of E-waste on the model used in the pilot project.

In the interview conducted with DOE Penang, it was recognized that the pilot project focused on the promotion of collection of E-waste from households and transportation to formally licensed recycling facilities, but it is also necessary to establish the E-waste management mechanism after the waste is brought in to the recycling and treatment phases.

Malaysian government is supposed to self-evaluate the PP after completion of the PP in July 2013. However, there is not any documented evaluation report, so interviews on the government were conducted many times. JICA Study Team conducted interviews on the government authority, as the administrating body for overall system for E-waste collection and recycling, regarding evaluation of the PP and appropriate mechanism for sustainable E-waste management. The results of survey are summarized as follows.

Table 5-4 Summary of Interviews on Government Authority

Survey items	Summary of the interview result
The present status after completion of the PP	• E-wastes collected by retailers are not transferred to recycling facilities as originally planned. • There are some retailers who continues to collect E-waste even after completion of the PP, however, those collected E-waste are sold to informal sector. • Even if purchase price of recyclers is higher than that of informal

Survey items	Summary of the interview result
	sector, it does not adequately convert E-waste flow to be channelized to formal. • It is necessary to regulate the retailer to prohibit the collected E-waste to be sold to the informal sector and to promote handing over to the DOE licensed recycling facility. • It should be recognized there is not sufficient E-waste recycling capability especially white goods when expanding the PP type of activity to other states. Transporting all E-waste to the facility in Penang is not realistic.
E-waste collection and recycling	• Shan Poornam stores collected white goods, while no infrastructure for environmentally sound treatment (e.g., destruction of CFC) is in place currently. The items treated by Shan Poornam are only PC and hard disk. • Recycling facility should have capability to recycling white goods if E-waste management law is established. • Any recycling facility in Malaysia does not have infrastructure for treatment of household E-waste, especially white goods. • The scope of the PP was only collection, but the future activity should cover broader scope including environmentally sound recycling. Not only recyclables but also hazardous components should be targeted. Additional cost would be needed for environmentally sound treatment and appropriate data collection and cost analysis should be conducted. • Awareness raising for ordinary consumers is quite important to promote the E-waste to be channelized to the formal recycling facility. For this government sector could and should play active role.

It was pointed out that model employed in the PP had a limitation in terms of sustainability to promote E-waste channelized to the formal recycling facility in an evaluation of the PP. The PP introduced the voucher as an economic instrument to promote the E-waste collected from household and channelized to the formal route. Although this has contributed for raising awareness about the E-waste issue and has actually collected some amount of E-waste, the activity of the informal sector is active enough to prevent with this instrument. After the retailers collected E-waste with voucher, some E-waste were still sold to the informal sector due to the lack of compulsory handing over regulation to the licensed recycling facility. It was also observed that some religious group accepted E-waste as donation for charity from citizen and sold to the informal sector offering the highest price without knowing they may be treated with no proper pollution controlling measures. Some government authorities and private entities were in the position to support developing regulation to give them necessary legal mandates in order to fairly promote environmentally sound activities.

In this regard, proposing the major component necessary for the legal system of E-waste management is one of the objectives in the Pilot project[97]was quite appropriate and necessary.

The objective of the recycling system to be established in Malaysia should be, as indicated below, “to transform the flow of E-waste from existing scrap business including the informal sector to licensed recycling facilities (FRF)”.

[97] One of the objectives of the pilot project is to “5-5 Based on Japanese experience, propose the major component (especially EPR) of the legal system for E-waste management in Malaysia” and has been summarized in “Factor Analysis for an EPR Regulatory System Based on the EPR Systems in Asian Countries”

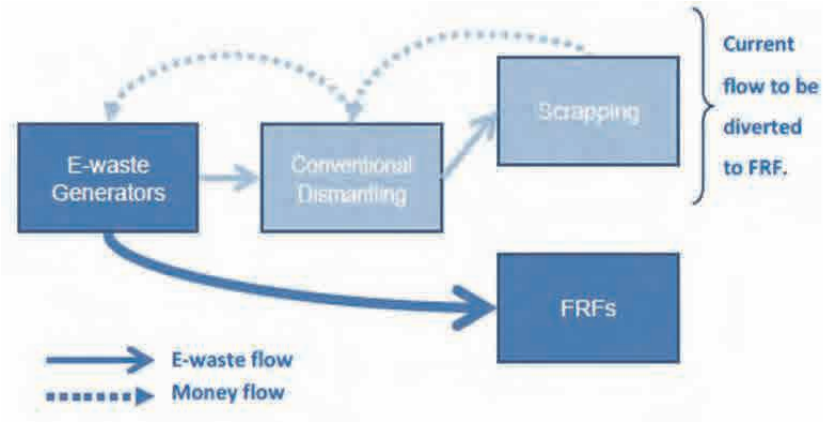


Figure 5-6 Flow of the Existing E-waste and How It Should Be

The points that should be considered for implementing the originally intended objective are summarized below.

- Firstly, in the proposal, regarding the "responsibility of the household (consumer)", it is mentioned that the consumers, as the generators of E-waste, have the primary responsibility. This is because it is expected that without a change in the behavior pattern of the consumers, problems relating to E-waste cannot be solved. Governmental activities to raise awareness are also recommended.
- Next, it is proposed that the government provide support by setting up a inter-sectoral stakeholder meeting to implement a smooth collection of E-waste by the manufacturers. The meeting will function as a place for discussion and with cooperation, effective collection will become possible. Collection efforts by individual companies are very ineffective. The Alam Alliance does not have the involvement of manufacturers but it can act as a platform where they can participate.
- Setting the target collection rate is recommended for evolving the flow of E-waste from existing scrap recyclers including the informal sector to licensed recycling companies.
- It is recommended that it is advisable to target manufacturers across the board, but if targeting all results in increase in transaction cost, then voluntary involvement is advised with the manufacturers having the option of whether to get involved in collection of E-waste or not.
- It is also proposed that manufacturers can either participate in the common collection system set up by Alam Alliance or conduct it on their own as long as they meet the collection target.

Trial version of the regulatory framework is proposed as follows:

Table 5-5 Regulatory Framework for E-waste Management proposed by the Pilot Project

Parameter		Content
Target E-waste		All E-waste[98]
Responsibility	Generator	• Generator will be responsible for proper handling of E-waste • The generator will be responsible for handing over to formally licensed recycling facilities (FRF).
	Manufacturer	• Express commitment to the state and local government regarding recycling of E-waste • To accomplish the collection target of E-waste, decide whether to join the Alam Alliance for collection and recycling (including contracting to FRFs) of E-waste or to carry out under own framework. • Monitor the collection of E-waste and report to DOE
	Vendor	• Hand over the E-waste collected from the generators to the formal recycling facilities
	DOE	• Set the collection target • Summarize the date on collection rate Conduct awareness raising programs • Disclose data and information Introduce a mitigative strategy and management • Coordinate with authorities that have jurisdictions over customs and manufacturing
	Local government bodies	• Support and arrange the regulatory framework for E-waste collection system • Establish the Alam Alliance
Alam Alliance	Member	• State and local government, manufacturer, vendor
	role	• Invite the vendors that will participate , manage • Generate the vouchers and manage • Design the pricing system and manage • Formulate a E-waste collection plan • Design the recycling system and manage
	Vendors	• Cooperate in the collection of E-waste • Disclose the necessary information including prices of the E-wastes to the consumers • Alam Alliance to hand over the collected E-waste to the recognized recycling facilities
	Manufacturer	• The manufacturers can hold the ownership of the collected E-waste • The E-waste collected by Alam Alliance can be distributed after consideration of the production scale.

As described above, recommendations like generators to bear the main responsibility and requiring vendors to hand over the collected E-waste to the recognized recycling facilities are valid points. This can be an important contribution the Pilot project has made. However, the trial version has to consider the following points as well.

- All the E-waste has been uniformly targeted. However treatment technology, environmental measures and effective collection methods differ for items and hence it is necessary to have measures after due consideration of the product characteristics.
- Option for the government, manufacturer or the recycling companies taking the lead in

[98] In the pilot project, the items targetted are TV (CRT and others), refrigerators, washing machines, A/Cs, PCs (desktop, notebook), printer, cell phones, DVD and VCD players, others (cell phone batteries, re-chargeable batteries, mouse, keyboard etc)

E-waste collection is presented, but the best role for each entity is different.

- It is proposed for the price of E-waste to be made clear and that it will be a positive number. However, cases where price will be negative are also possible.
- It is not clear who will bear the cost for vouchers.
- It is not clear who will bear the cost for the environmentally sound recycling of E-waste or environmental measures for treatment of its residues.
- One of the main objectives of the system is to ensure that E-waste that flows to the scrap dealers including the informal sector is rerouted to licensed recycling facilities. However there is no viewpoint of environmentally sound treatment like proper treatment of toxic substances.

5.2 Assessment of the Continued Project in Penang

This section summarizes the project continued in Penang.

5.2.1 Present condition

DOE Penang, MPPP, recycling facilities, retailers who have participated in the Pilot project established the Steering Committee to take over the responsibilities for continuing the project. However E-waste collection by providing voucher became not so active after the completion of the Pilot project by JICA.

5.2.2 Analysis on issues found in the result of Pilot project

The lessons and issues found from the pilot project are summarized below.

a. Complexity of the incentive for promoting collection

As has been pointed out by many stakeholders, the framework has been recognized to be too complicated. It is known from interviews that especially the vouchers which were used for promoting collection put a lot of burden on the vendors and the recycling facilities.

The vendor stores had to record, manage and report data like part numbers, manufacturers etc when receiving E-waste from consumers and had to assign staff just for this purpose. Recycling facilities had to cater to recording and referencing vouchers and E-waste from multiple vendors which made the managing process complicated.

In the pilot project, a lot of data was recorded to understand the effectiveness of the project, but when implementing as a tool for promoting collection in the real world, a simple form is desirable. It can be said that recycling facilities where the goods ultimately end up can carry out record keeping of the E-waste hence reducing the burden on the retailers (the primary collectors) so that they can focus on collection and handing over of the collected E-waste to the recycling facilities.

b. Merits of the Incentives for retailers

As an incentive to promote collection of E-waste vouchers have been used, but the burden to manage them outweighed their merits. By providing vouchers to people who brought in E-waste, it was possible for stores to distinguish themselves from others by providing them a sense of having profited and it was also possible for them to appeal their stance of consideration to the environment. However, it did not directly lead to increase in sales for the stores.

In the existing initiatives, there is no obligation of accepting E-waste or handing them over to recycling facilities. Until now, the staffs of the stores used to charge a fee to collect E-waste from the customers and sell it to the informal. In order to change this custom and ensure the flow of E-waste to licensed facilities, it is necessary to have legal obligations in place.

There were some initiatives where the vendor stores involved were introduced as good partners by parties such as SNS, but there were no other merits.

Hence, this did not lead to a continued collection of E-waste by the retailers.

c. Sustainability of E-waste Purchasing model

Purchase of E-waste from households by the recycling facilities was the normal and commonly accepted practice. The resource for the vouchers was being provided only by the recycling facilities. Although the price differs according to the item, one item was being purchased at a price of a few hundred yens. PCs have usable precious metals and hence can be sold at a profit but it is not the case for white goods. Hence, by purchasing them together, a cumulative profit was being secured.

In reality (outside the pilot project), this scenario has its limits. Environmentally sound recycling of white goods needs appropriate environmental measures to be in place leading to a scenario where non profitable materials need to be treated properly adding to the cost. This acts as a hindrance to the promotion of adequate recycling.

d. Limitation of Technological Capability of the E-waste recycling Facilities

The 2 companies that were responsible for accepting E-waste and carrying out recycling in the pilot project are the ones accepting electrical and electronic appliances, manufacturing residues of devices, off-spec products, and only PCs as post-use products and recycling them. They do not have a treatment line for white goods. The purchased E-waste was probably treated in a separate treatment line from the existing one by manual dismantling and segregating metals parts and mother boards. It is assumed that it was an irregular activity different from the facility`s regular work. It can be assumed that bringing in waste that cannot be completely treated by the facility would not have been welcome. Further, no assessment of how the E-waste that was brought in was treated and recycled and questions remain about environmentally sound recycling and proper treatment of toxic materials.

As the pilot project focused primarily on collection and transportation to the recycling facilities, the content of the recycling being done at the facilities and presence/absence of proper treatment of toxic material was not studied in detail.

e. Limitation of Pricing Method

One of the primary objectives is the promotion of transformation of movement of E-waste to the authorized route and hence purchase through vouchers was used as a controlling method to control the amount collected.

To promote collection by the authorized route, it was necessary to set the price higher than the informal sector, but in reality the E-waste was still flowing to the informal sector. Hence only price of the goods is not sufficient to divert E-waste to the authorized route. Systematic measures like prosecution of the informal sector and banning of hand-over to the informal sectors from stores is necessary to promote movement to the authorized route.

5.3 Promoting Penang Experience to Other States

Survey is done to understand the state and challenges of expansion to other states from Penang.

5.3.1 Present condition of promoting Penang Experience

a. Background

At the time of planning of the pilot project, DOE was planning similar activities in Perak, Selangor, Federal territory (Kuala Lumpur and Putrajaya), Melaka and Johor. However, instead of

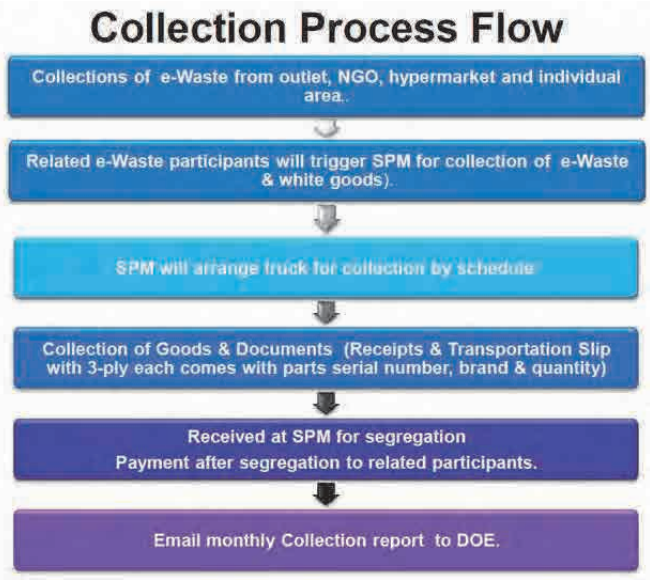
carrying out a similar activity like DOE Penang with the other states taking the lead, it was decided to implement in the form of a tie-up with a leading vendor (Senheng).

The DOE website lists the involved stakeholders as the state government, Local authorities in each state, manufacturers / Dealers (Retailers) / distributor / importer of electrical and electronic goods, National Solid Waste Management Department (JPSPN) / Solid Waste Management and Public Cleansing (PPSPPA), charitable non-governmental organizations, NGO etc. The platform established was the E-waste Alma alliance, the same once established during the Penang pilot project.

The target materials are TV (CRT, LCD), washing machines, refrigerators, cell phone, A/Cs, PC (desktop, laptop).

The objectives of establishment are as follow:

- Implementation of collection, segregation and transportation of the waste of E-waste generated from households effectively
- Develop a system of collection, segregation and transportation of E-waste from households across Malaysia centralized
- Increase public awareness will be the responsibility of the waste of E-waste from households owned
- Increasing awareness of the producer / seller / distributor of electrical and electronic goods on the importance of being responsible for the management of E-waste from households
- Encourage manufacturers / vendors / distributors of electrical and electronic waste collection to implement E-waste from households voluntarily and without additional charge
- Creating a network of cooperation with stakeholders in the management of E-waste from households



Source: DOE website

Figure 5-7 Process flow[99]

The activity has been carried out at 136 stores of Senheng.

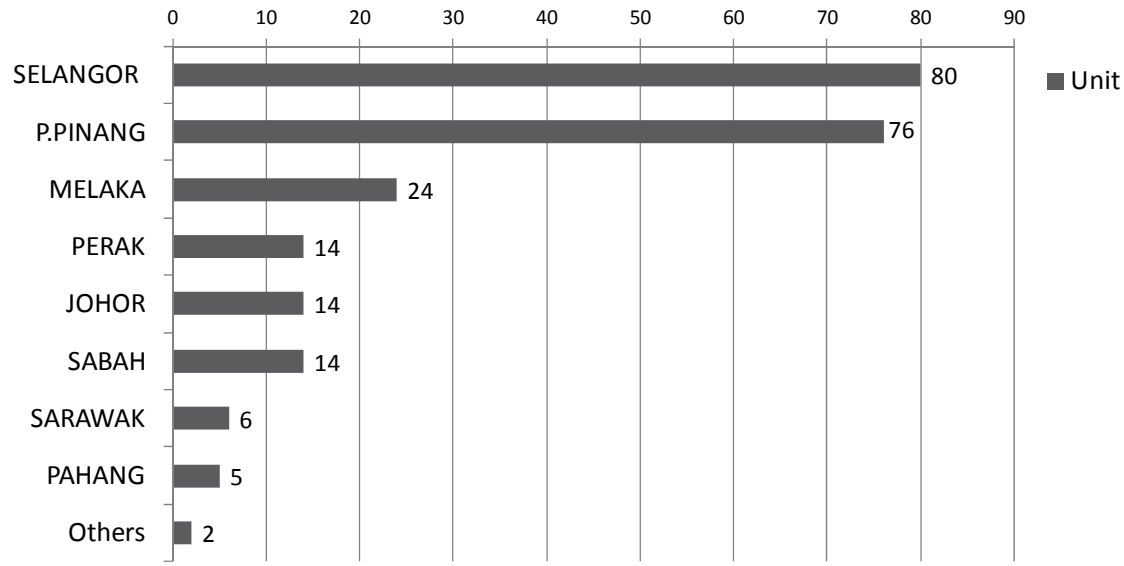
[99] http://www.doe.gov.my/webportal/wp-content/uploads/2014/02/Information-for-inclusion-in-the-DOE-Portal.pdf

Source: Documents provided by Senheng

Figure 5-8 Stores of Senheng

b. Current Condition of the project conducted by Senheng

The project that was started on December 12, 2013 has collected about 235 units till now (as of beginning of May). Kuala Lumpur and Penang cover more than 70 % of the total.



Source: Based on document provided by Senheng

Figure 5-9 Figure State Wise Number of Collected Units

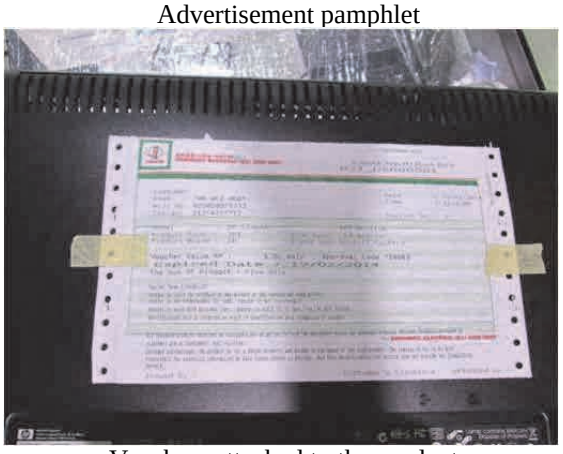
Following points were found by interviewing with logistic center in Penang and Senheng headquarters in KL.

- Shan Poornam is supposed to collect the goods but at times they do not respond to requests for pick up. There was a restriction on the storage space available. This was a problem for retailers.
- The number of collection made was not as encouraging as expected.
- The workers that are responsible for the collection seem to be collecting about 10-20RM from the customers and selling them to the informal route (responsibility of handing over does not seem to be obligatory). Thus, regulatory approach for handing over the collected E-waste to the licensed recycling facility is necessary.

Ad banner


Advertisement pamphlet


E-waste collected at stores


Vouchers attached to the products


Logistical center temporally storing e-waste


Storing place for e-waste collected through stores

6 Actions towards the Improvement of E-waste Management in Malaysia

6.1 Proposed Action for Improvement of E-waste Management in Malaysia

The followings are the legislative direction, desirable E-waste management flow, specific policy actions that Malaysian government should take for the future E-waste management.

6.1.1 Proposal for promoting sustainable E-waste collection and environmentally sound recycling

a. General Matters

- E-waste collection cannot be progressed if it was left only to market mechanisms based on the voluntary E-waste sales to collection center
- For the formalization of the informal sector, it is important to not only promote registry system but also the establishment of registry criteria, permission system to business operator with E-waste management capacity, and monitoring system for informal sector activities on E-waste handling. Also, more detailed survey is necessary to understand whether the formalization of the current informal sector is really possible through the proposed measures.
- Fee collection standard, fund management body, and the fund use should be clarified for the recycling cost, EPR fee, and registry fee.
- With regard to the report provided by manufactures on the volume of sales, the purpose, reporting standards, and reported data utilization methods should be clarified.
- In the establishment of recycling scheme, it is important not to eliminate an option where competition mechanism between different schemes based on the consideration of the recyclable E-waste generation scale.
- For the establishment of specific measures such as fee setting and collection, subsidization, and formulation of management mechanisms, thorough consideration should be taken together with developing legislative framework.

b. Desirable E-waste Management Flow

- Stakeholders for the sustainable collection and environmentally sound recycling of E-waste include manufacturers, retailers, recycling facilities, government (national government).
- The desirable E-waste management flow is shown in the figure below. According to it, consumers are to hand over E-waste to recycling facility stipulated in the law and to pay recycling fee. In this procedure manifest should be filled out to obtain necessary information.
- Although the taking-over of E-waste from consumers (primal collection) desirably should be conducted by retailers, other channels such as through municipal governments or other organizations can be considered. It is desirable to make taking-over of E-waste obligatory by law. It is also required to stipulate the agent who will conduct taking-over by law.
- E-waste first collected by agents such as retailers will be handed over to recycling facility. It is important to make this delivery obligatory by law too. This prevents the E-waste flowing to the informal sector where environmentally sound management of E-waste is not carried out.
- It is also advisable to set up E-waste collection centers which all the E-waste aggregate between primal collection and recycling facilities considering the convenience as well as efficiency of collection and transport.
- E-waste carried to the recycling facilities is required to be recycled in an environmentally sound manner according to the requisites stipulated by law. The recycling facility also should meet the

standards imposed by law. In order for some parts such as lead glass and CFCs to be recycled in an environmentally sound manner, additional cost is necessary. Recycling fee collected from consumers and others will be used for this purpose.

- In the case where treated parts in the recycling facilities are taken out to be used as recycled material for other manufacturing process or to be treated again or disposed to the landfill site, downstream facilities should also obtain proper permit from the government.
- Manufacturers have information on their products as well as expertise and know-how for the product recycling. It is reasonable that they should cooperate to the recycling implementation and bear the necessary recycling cost.
- Recycling fee and transaction data paid and submitted both by consumers and manufacturers to 'managing entity' in charge of administration and management of entire system. The main part of this entity is played mainly by manufacturers and they establish and operate the body as well as cooperate with government. This also manage fund.
- While managing body plays more implementing role, federal government conducts whole system design and various requisite establishments. After the law enforcement, federal government conducts the whole management, monitoring and regular reviews as necessary, and is responsible for requesting stakeholders' cooperation, information disclosure, and public promotion.

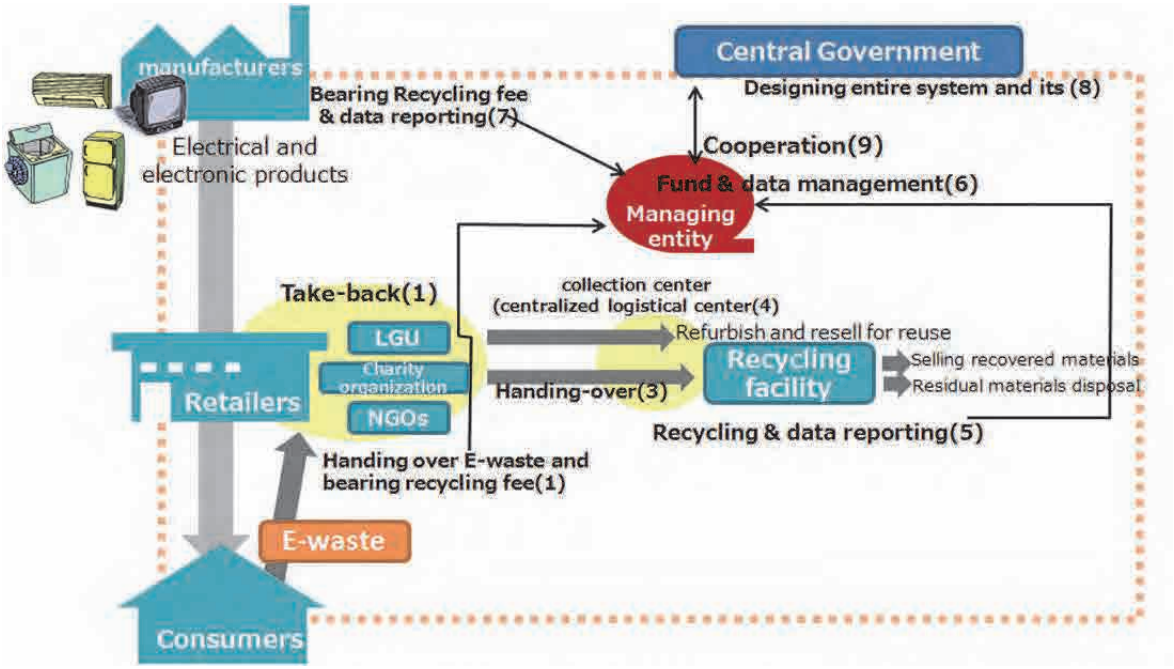


Figure 6-1 Overview of Entire E-waste Management Flow

c. Establishing Managing Entity

E-waste managing entity should be established with the aim for ensuring steady implementation of activities for sustainable E-waste management promotion. This type of managing entity is found in other developed countries such as Japan and EU in general. Although organizational form, roles, and responsibilities of the managing entity need further elaboration and definition, the following roles can be expected.

- Management of fund from recycling fee collected from consumers and manufacturers (assuming fund will be established based on the revenue from collected recycling fee)
- Management of E-waste transaction data between stakeholders
- Match making between transaction data and recycling fee

- Subsidization from fund to recycling facilities
- Compilation of recycling data and disclosure of the record
- Promotion of environmentally sound recycling
- Cooperation with governmental agencies

Managing entity is an implementation body for the system enforcement according to the regulation and legislative framework the national government developed. This body is established with the aim of preventing nation-wide E-waste recycling system and legislative framework from becoming a dead letter as well as ensuring robust operation of the designed measures within the system.

d. Identifying target items

- 4 bulky items "white goods" (TVs, washing machines, fridges and ACs) have different characteristics than 2 smaller ICT items.
- 4 items require larger investments, larger collection fees, and longer time to build processing facilities than 2 small items (PCs and mobile phones).
- Regarding rechargeable batteries, it is better to place them in the second phase since identification of proper recycling technologies and effective collection methods needs more time.
- Regarding florescent lamps, it is better to place them in the second phase since identification of proper recycling technologies and effective collection methods needs more time.
- Items should be prioritized rather than implementing all same time as the necessary systems are totally different.
- 4 large items and 2 small ICT items should be considered separately both in physical collection scheme and in financial scheme.

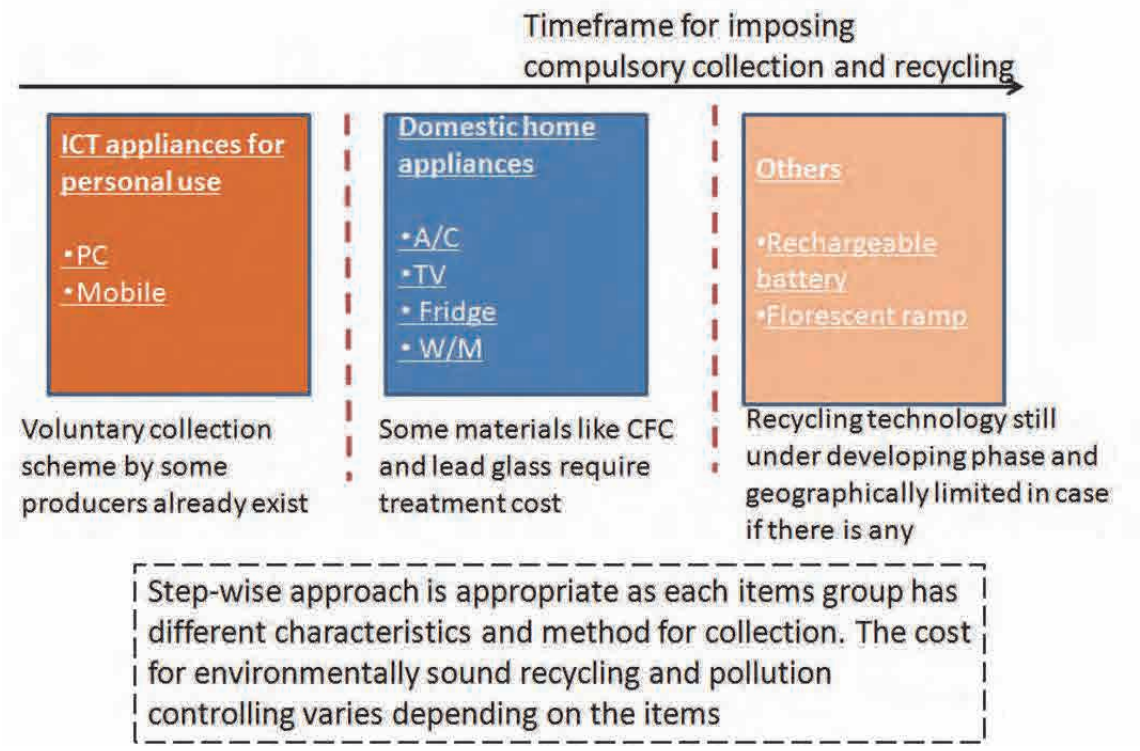


Figure 6-2 Timeframe for Imposing Compulsory Collection and Recycling for Each Item Group and the Characteristics

- Even an item has various kinds of recycling method. Level of requiring recycling can be varied and necessary technology and cost for the installation can be very different depending on the required recycling level. Therefore, step wise approach described below might be necessary and even more practical for the timeframe of imposing compulsory collection and recycling, considering the amount of E-waste that can be collected.

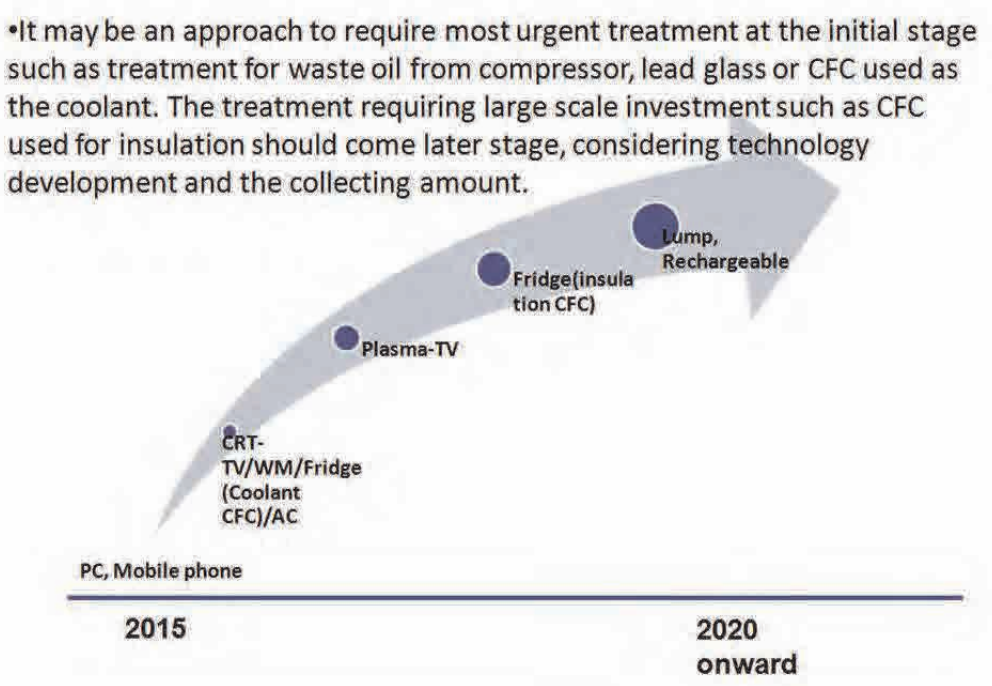
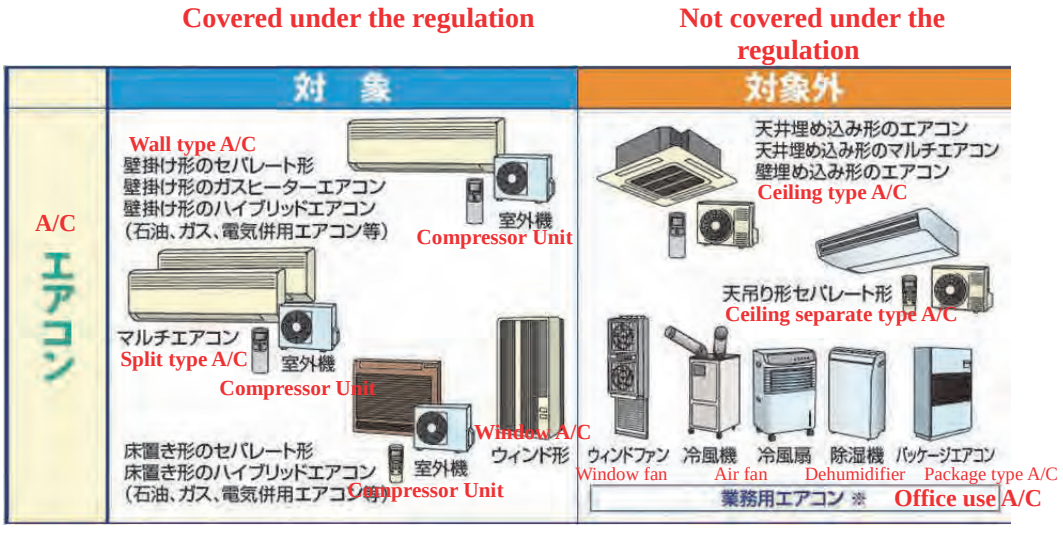


Figure 6-3 Step-wise Approach for the Implementation of the Target Item to Be Collected and Recycled

It is also useful to create information material to explain the type of E-waste that is subject to the regulation.



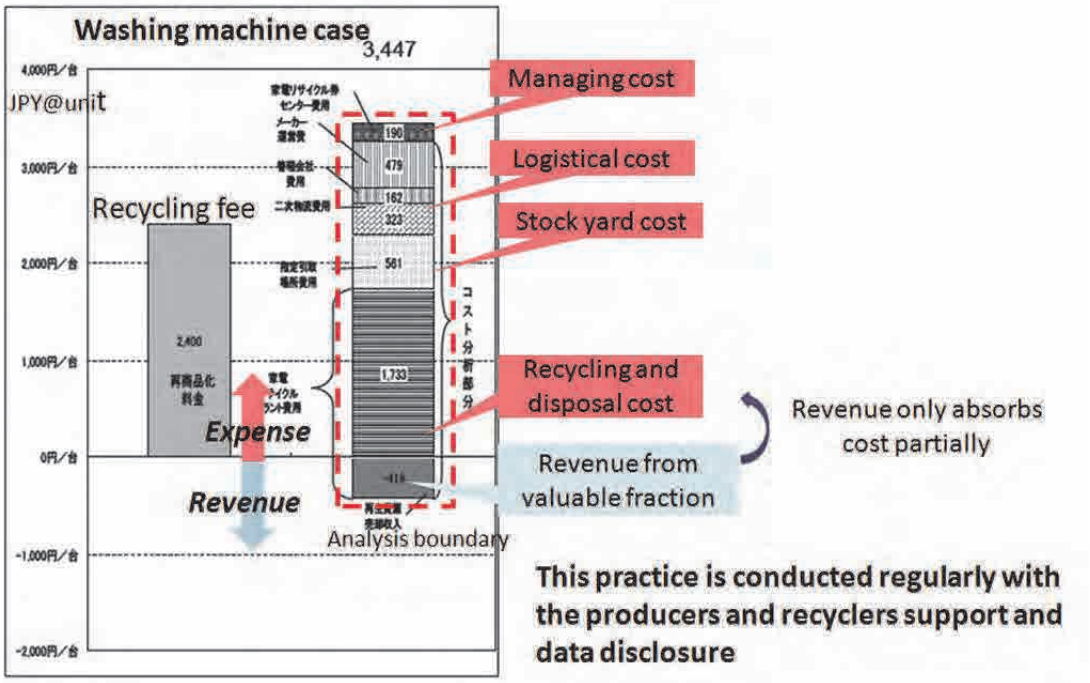
Source: Document prepared by Association for Electric Home Appliances[100]

Figure 6-4 Visual Explanation about the E-waste Item Subject to the Regulation

[100] http://www.rkc.aeha.or.jp/img/4list/p-1.pdf

e. Recycling Fee Analysis

- Among the targeted, white goods E-waste such as washing machine and refrigerator contain less base metals like steel and aluminum and precious metal. Revenue to be generated by selling the recovered material such as steel, aluminum and copper and reusable items solely cannot absorb the additional cost to be required for the environmentally sound recycling for lead glass, CFC or refrigerant oil without any pollution caused. Such additional cost varies depending on the recycling requirement set by the regulation, workers cost, disposal cost of the residual material which cannot be sold in the market. In Malaysia such cost analysis is necessary to identify the appropriate recycling fee to promote environmentally sound recycling.



Source: Document used in the technical consultation meeting on E-waste regulation organized by the Ministry of the Environment of Japan.[101]

Figure 6-5 Image of Cost Analysis Work

- Logistical cost should also be identified through the various stakeholder cooperation.

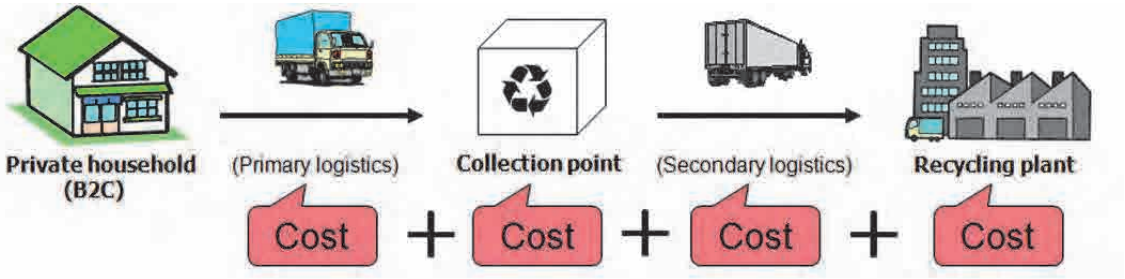


Figure 6-6 Necessary Total Cost for E-waste Collection and Recycling

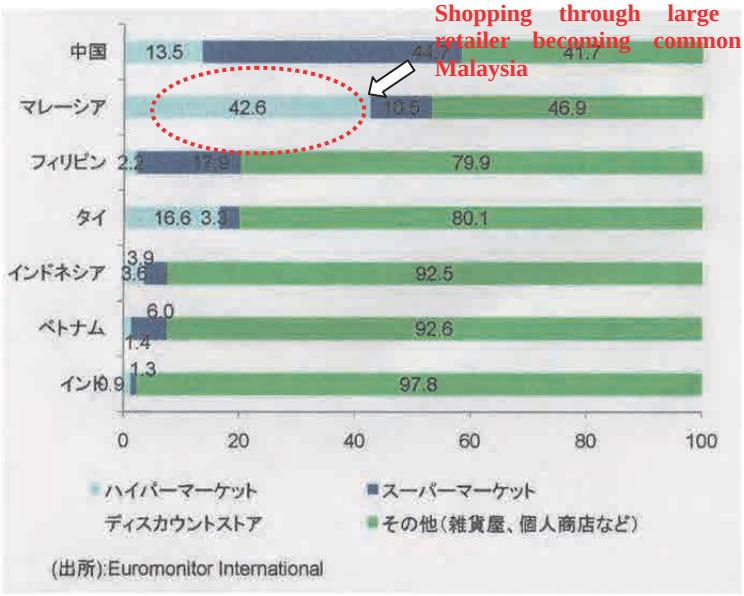
[101] http://www.meti.go.jp/committee/materials/g70308bj.html

f. Establishing Primary Collection

- Primary collection is one of the most important, crucial and key parts of the whole E-waste management mechanism.
- Comprehensive measures including strict rules are necessary to convert existing flow to be channelized to formal recycling chain and foster new channel for accomplishing sufficient E-waste collection in the loop.
- Without the enough feeding of E-waste into the loop at the beginning, nothing will start.
- While collection from households is conducted by multi channels, it is very important to impose all collectors transferring of collected E-wastes to licensed recyclers compulsory.
- Unless it is compulsory, proper collection is never completed.
- Strict rule is the must to prevent collected E-waste taken by informal sectors. Without it, it is difficult for the existing flow to be channelized to the formal chain.
- In Penang, even after the collection made by retailer successfully, some E-waste ended up at informal sectors.
- This happened because compulsory transferring is not imposed.

Figure 6-7 Roles and Responsibilities

- In the pilot project conducted in Penang, one third out of the total bulky item like refrigerator and washing machine collected from consumer was through retailer channel. The collection through retailer was proven to be an effective primary collection channel.
- The data below shows hyper market and large size retailer are becoming common retailing place than small scale papa and mama type of store among many Malaysian consumers nowadays.



Source: JETRO

Table 6-1 Shopping Pattern among Consumers

- As one of the most effective and main primary collection channel, retailer channel should be utilized especially upon the purchase of new product delivery and the return shipping for old product take back.
- Along with identifying the effective primary collection channel, stipulating compulsory handing over the collected E-waste to DOE licensed recycling facility. Without this, collection through retailer never complete and not be effective. Effective channel and method should also be considered in these three different cases, which are;
  - A:To discard E-waste when purchasing new one(old for new)
  - B:To discard E-waste without purchasing new one
  - C:Retailer discarding item is purchased from is out of business[102]

Source: City of Kawasaki[103]

Table 6-2 Different Pattern of E-waste Discarding Flow

[102] In Japan, there are three patters of E-waste collectoin by retailers. Case one is disregarding E-waste when purchasing new one (old for new). Case two is disregarding E-waste without purchasing new one. Case three is E-waste is brought retailers who cooperate for collecting used items or to designated collection points when the retailer product purchased from is out of business

[103] http://www.city.kawasaki.jp/kurashi/category/24-1-11-4-2-0-0-0-0-0.html

- In Japan, A and B case in which the retailer the E-waste originally purchased from is identified, the retailer is responsible for the primary collection and this includes mail order retailer, shop selling reuse item, pawn shop etc. On the other hand, if the generator does not know the shop from which the discharging item purchased from as described case C, generator bring E-waste to the retailers who cooperate for collecting used items or to designate collection points.
- Subsidy should be provided for the primary collection of E-waste to ensure the collection rather than market driven approach. It is even difficult to formalize the existing collection practice without the economic incentive and committed enforcement activity.
- Pros and cons analysis should be conducted for several pattern of collection and incentive based or market drive collection to select the effective collection method suitable to Malaysia context.

g. Establishing Secondary Logistical centers

- Analysis on whether the secondary collection for effective logistics and transportation for E-waste is necessary.
- Secondary collection for effective logistics and transportation also need to be defined and role should be ellaborated.
- Who pays logistical cost for transporting E-waste from collection center to recycling facility and how much must be analyzed.
- Location of the collection centers depend on numbers and location of recycling facilities. A question whether a collection center is needed relies on how many recycling facilities will be set up. It is necessary to conduct quantitative analysis of logistic costs by considering E-waste disposal amounts and recycling facility's capacity in an area in order to decide locations of collection centers.

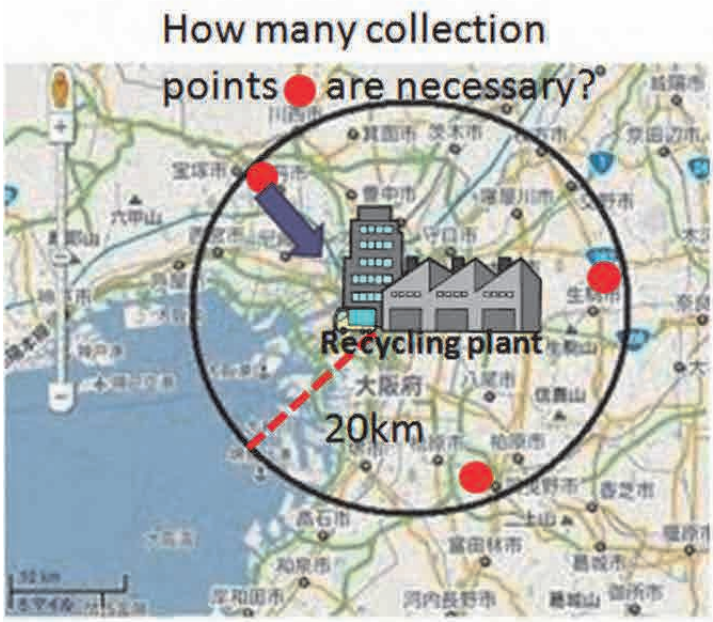


Figure 6-8 Analysis to Identify the Proper Location of Collection Points Considering the Recycling Facility Location that Accept E-waste

h. Establishing E-waste Recycling Facility

- E-waste recycling facilities that receiving E-waste from the primary collection channels such as retailers must be environmentally sound manage (ESM) facilities.
- It is advisable to formulate guidelines or ruling criteria for ESM E-waste recycling facilities by DOE.

- It is necessary to conduct quantitative analysis of logistic costs by considering E-waste disposal amounts and recycling facility's capacity in an area in order to decide locations of collection centers.
- Expected E-waste generation in Malaysia as of 2008 is 688,000 ton. This figure includes all type of E-waste including white goods and others. Provided the 80% of them is white goods item and collection rate is 50%, 35 FRF which currently licensed by DOE as a total are supposed to receive about 267,000 ton of white goods. This means about 7,600 ton of E-waste is treated by one FRF. If the weight per item is 15 kg, 500 peices of E-waste is treated theoretically by one FRF. This is quite low volume to sustain the one FRF to be financially viable.
- The analysis is also important to identify the best location and appropriate scale of recycling facilities considering the generated amount of E-waste.

i. Data Management by Managing Entity

- One of the substantial works conducted by the managing entity is the transaction data management. Collected "recycling fee" is to be spent with the aim for promoting environmentally sound recycling and is to be subsidized for the recycling facilities. Managing entity will collect the fee from consumers and other as well as data that obtained through the E-waste manifest and confirm the received E-waste by the recycling facility completed the environmentally sound recycling. They also expected to ensure the subsidy to be paid with the transparency transaction data.
- E-waste manifest used under Japan Home appliances recycling law can be a good role model to identify the E-waste flow and monetary transaction as well as to ensure the effective data management by utilizing the E-waste manifest. E-waste manifest has carbon copies to be used as transaction record of E-waste. One of the copies directly labeled on the E-waste and consumer, primary collector, recycling facility respectively receives the receipt upon discharging or handing over to the receivers. The final last copy goes to the managing entity for the transaction data management.

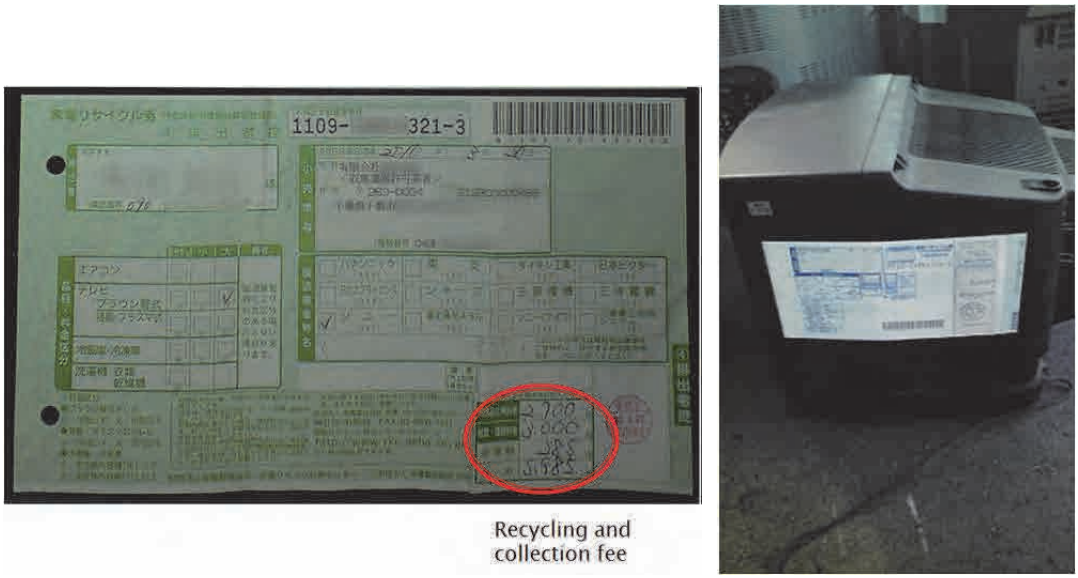
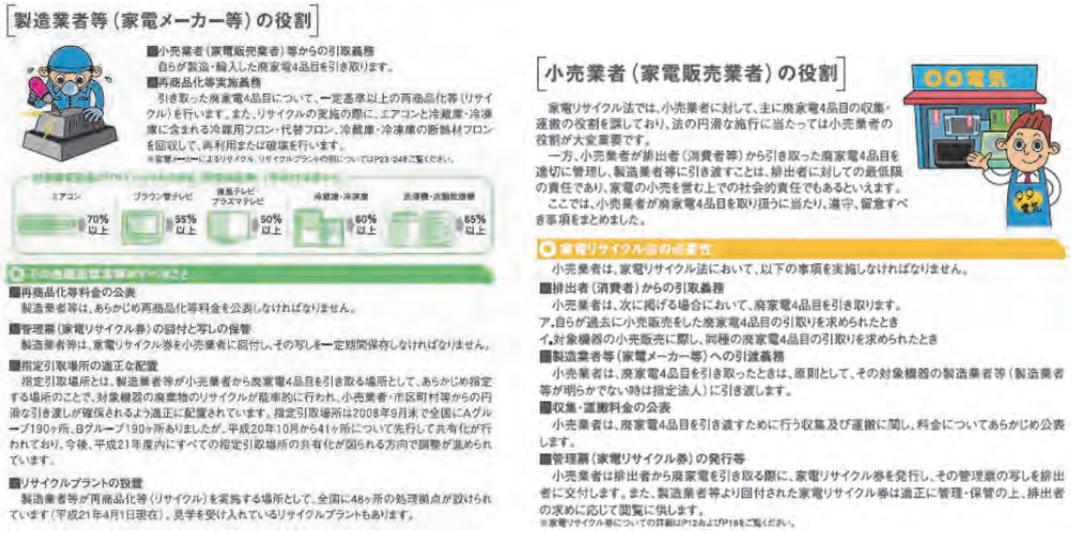


Figure 6-9 One Copy of E-waste Manifests Labeled Directly on E-waste

j. Identifying Roles of Stakeholders

- Visual information tool like leaflet for explaining roles of stakeholders is also effective and its awareness raising is important.



Source: Home appliance recycling law manual for workers engaging collection and recycling

Figure 6-10　Manual for Workers Engaging Collection and Recycling

- Raising awareness among consumers as E-waste generators is quite important. This directly influence where they are discarding to and prevent channeling them to informal sectors. Awareness raising tool like poster, banner and leaflet are also effective as described below.

Source: Annual report prepared by Association for Electric Home Appliances published in 2012

Figure 6-11　Example of Awareness Raising Tool for General Consumers

In addition to it, detailed manual to raise awareness among those who practices collection, recycling explaining more detail about the regulation including the role to be played and relating rules can also be effective.

Source:Manual for workers engaging collection and recycling

Figure 6-12 Practical Guiding Manual for Staff Engaging Daily Collection and Recycling Work

k. Identifying Role Played by Government Sector

- Among the stakeholders, role played by both central and local government sector is also important. There are many roles and activities that can only played effective by government sector.
- Among such roles and responsibilities that are to be played by government sector, registering informal sector and formalizing it can be played no one but government sector effectively.
- Such activities monitoring whether the designed measures within the E-waste management framework is properly operated and enforcing activity are also important. For example, to see whether the retailer collecting E-waste from consumers is handing over it to the licensed recycling without selling it to the informal sector even if they are offering higher buying prices. This type of monitoring work can also be enhanced by the entity like Producer Responsibility Organization (PRO).
- It might to be beneficial to include the monitoring mechanism and regular revising function in the E-waste management framework and regulation after the implementation of the law.

l. Utilizing the Outcome from the Pilot Project

In the pilot project in Penang, such communication tool as Penang E-waste Project, E-waste Alam Alliance-Asia, and E-waste Alam Alliance-Penang have been developed. This type of tool is quite effective for promoting the active participation and awareness raising among consumers.

m. Developing Guiding Documents for the E-waste Management Scheme

DOE plans develop guiding documents to describe detail rules for E-waste management after the main legal framework is established.

Regarding the E-waste collection, stakeholders understand it cannot be properly conducted without leakage to the informal sector unless the regulatory measures are in place. Therefore, both guiding documents describing recommending activities and regulatory documents imposing compulsory activities should be distinctly developed.

n. Promoting Collaboration among Different Government Departments

Present condition

For promoting similar practice to other states after the pilot project is completed, collaboration among the government sectors is important. Following is current status.

- In Malaysia Municipal Solid Waste (MSW) from household is either collected through the federalized system or collected by municipalities.
- JPSPN under MHLG is responsible for the policy development for MSW collection and disposal and recyclable items are collected through the 2 +1 collection scheme. In this scheme food waste collected twice a week and collected food waste is brought to landfill site. Recyclable item like scrap metal is collected once a week.
- In the municipalities which are not federalized, drop-off collection centers are established for recyclable including E-waste and small amount of E-waste is actually collected.

Possible Collaboration between DOE and MHLG for E-waste Collection

There is a possibility for the collaboration between DOE and MHLG for E-waste collection. For this to be happened, detail ruling and work division is necessary. What item is actually collected by what way should be identified.

6.1.2 Proposal for promoting sustainable E-waste collection and environmentally sound recycling by involving manufacturers

Collaborating with manufacturers is also important to promote sustainable E-waste collection and environmentally sound recycling. Especially sharing the regulatory framework developing process is effective as the manufacturers have knowledge on sustainable collection and environmentally sound recycling. So far DOE has been open for dialogues with stakeholders upon the request and now on it is better to proactively set regular consultation process with stakeholders rather than ad-hoc basis.

It is important to reflect the inputs made by stakeholders into the regulatory framework and even effective to appoint consulting members with some mandate to suggest the workable policy measures from the private manufacturer point of views.

6.2 JICA Cooperation Future Way Forward

It is pivotal to promote sustainable E-waste collection and environmentally sound recycling in order to accomplish integrated E-waste management in Malaysia.

In this data collection survey, various aspects have been surveyed to understand the current status and difficulties being faced for managing E-waste and establishing proper mechanism through the consultation with DOE, DOE regional offices, recyclers, retailers, manufacturers and among others.

Through this survey, high expectation has been shown especially from DOE for the continuation of the support by JICA for establishing E-waste management mechanism.

As mentioned in the previous section, proposals were made for the draft legal framework of the E-waste management in Malaysia.

In order to realize the proposals, various concrete measures need to be formulated as well as data analysis to identify the rational, creating understanding among the stakeholders as well promoting capacity in the responsible authorities. Also organizing an entity to operationalize the proposals and promote the necessary actions is also important and necessary.

Having considered abovementioned points, appropriate actions way forward by JICA are described below. These are put together through the consultation with Malaysia government, particularly DOE and relevant stakeholders concerned with E-waste management.

- Establishing sustainable E-waste collection system
- Promoting environmentally sound recycling
- Materialize draft legal framework
- Training course for promoting the understanding on practical E-waste management mechanism
- Identifying future necessary actions and prioritizing them
- Pilot verification

Further details are described below.

6.2.1 Support for Establishing Sustainable E-waste Collection System

For promoting proper management of household generated E-waste, it is a prerequisite to establish the effective collection mechanism for E-waste. It is normal case that E-waste are scattered in wider places such as individual house.

According to the draft E-waste management framework proposed by DOE, primary E-waste collection is made through multi channels. This included retailers who deliver new products and take back old ones, daily door-to-door collection service by the municipalities and other charitable organization collecting channels.

a. Developing Specific Measures for Effective Incentives

In the possible support, it is expected to study effective incentive measures to materialize the multi channel collection and managing rule scenario as well as find out the feasibility. As voucher incentive is not employed in the draft framework, other type of incentives for retailers should be considered such as allowing them for requesting the collection cost from the consumers or providing some other subsidy for their collection activities.

Furthermore, it is expected to support appropriate rule setting to impose compulsory take-back from the generating sources as well as compulsory hand-over to the designated formal recycling chain.

b. Further Study on Informal Sector

Managing informal sector is also important for establishing E-waste collection. In the legal framework, formalizing informal sector has been proposed by introducing registration mechanism. In addition to it, rules are necessary to be imposed on the registered collectors to avoid the E-waste to be channelized to the informal chain. Monitoring and enforcing activities to ensure the registered collectors are conducting right jobs are also very important. In order to formalize the informal sector, comprehensive activities are effective and necessary besides to introducing registration mechanism. To this end, further survey to understand the activities conducted by informal sectors is necessary to find out the most suitable and practical measures to promote its formalization and prevent the activities causing environmental pollution.

c. Developing Primary Collection Mechanism through the Cooperation with Retailers

It is also vital to study the most effective and convenient primary collection for the consumers. As the formal business establishment, retailers can potentially offer the closest and the most convenient touch-points for consumers. In the JICA pilot project conducted in Penang, promoting primary collection through retailers was proven as the effective collection method. Having considered this lesson, further support is appropriate to identify more sustainable and effective collecting measures.

d. Secondary Collection Site Necessity and Its Geographical Location and Scale Identification

Depending upon the scale of E-waste generation amount and characteristics of the items such as size, weight, bulkiness, etc, it is appropriate to find out whether there is a necessity to establish the secondary transferring station for effective logistics of the collected E-waste through the primary channel. Geographical location and scale considering the E-waste generation quantity should also be established.

6.2.2 Promoting Environmentally Sound Recycling

a. Identifying Environmentally Sound Recycling Requirement Applied to Recycling Facilities and Appropriate Treating Capacity Scale and Geographical Location

In addition to the sustainable collection mechanism, promoting environmentally sound recycling of E-waste is also important. Thus, proper recycling requirement for the collected E-waste needs to be established. Possible support can be provided to identify how such requirement can be reflected in the rules or guidelines. Also identifying capable recycling facilities among the DOE licensed facilities is also important. Similarly, identifying appropriate and necessary quantitative capacity by the E-waste recycling facilities among the DOE licensed facilities, considering E-waste generating amount is also important.

b. Analyzing on Environmentally Sound Recycling Cost

Depending upon the type and characteristics of items, applying technology for the treatment can vary such as CFC for coolant and insulation extraction and distraction. Having considered this, appropriate requiring cost should be analyzed to conduct environmentally sound recycling and proper pollution control and how the cost should be shared among the stakeholders such as consumers, recycling facilities and manufacturers. Potential support can be provided for this work.

For example, lead contained glass used in the CRT TVs, CFC used for coolant and insulation used in the refrigerator are to be analyzed to identify the environmentally sound recycling and proper residual material disposal cost. Such analysis is conducted considering the recycling requirement to be placed for the recycling process to identify the amount of the additional cost to be born by the involving stakeholders. Revenue to be generated by selling the recovered material such as steel, aluminum and copper and reusable items should also be considered. A normal case is the revenue solely cannot absorb the additional cost to be required for the environmentally sound recycling.

For this reason, appropriate measure should be discussed for the subsidy to be provided from the fund in order for the recycling facilities to conduct the environmentally sound recycling.

The recycling technology to be applied depends on the requirement set under the regulation and the amount of E-waste actually collected as well as the condition of the market for the recovered materials through the treating activity on the E-waste. The amount of E-waste that can actually be collected and to be fed to the recycling facility matter as this affect the investment and operation of the facility.

c. Recycling Fee Collecting Criteria

Support can also be provided for deciding who should shoulder the proper recycling cost and how. The criteria and charging mechanism should also be elaborated including the management of the recycling cost (fee) collected from the stakeholders.

6.2.3 Materialize Draft Legal Framework

Regarding the outcomes obtained through the various potential supports from JICA, it is also important to reflect them into the actual legal framework and operationalize them. To this end, support can be provided to create effective and practical regulatory structure.

a. Identifying Responsibilities Division by Each Stakeholders

Support can be provided to identify the role and responsibilities for involving stakeholders such as imposing compulsory take-back of the E-waste on retailers if requested by generator and handing over the collected ones to licensed recycling facilities as well as the responsibility by the manufacturers for their production and recycling activity. In the draft framework proposed by DOE, some responsibilities by involving stakeholder already defined. Based on this, its effect and feasibility should also be discussed including if there are any additional responsibilities and roles to be imposed.

b. Developing Managing Entity to Implement the Scheme

Measures in the legal framework should be sustainable, practical and functional. To this end, main responsible entity who implements the designed measures is necessary. Especially activities implemented by manufacturers in Japan Home appliances recycling system can be a good role model. They are responsible for secondary logistics for the collected E-waste by the retailers, conducting environmentally sound recycling, collecting recycling fee from consumers and its management and managing the transaction data collected through E-waste manifest. These activities are vital within the framework in order to operationalize the mechanism to bring tangible outcomes. In Malaysia, this type of role and responsibility identification is necessary and the support can also provided for this aim.

c. Managing Fund

According to the draft framework proposed by DOE, recycling fee to be used for promoting environmentally sound recycling is charged and collected by the fund. While the current plan is that fund is to be managed by the government, other options can also be identified for more effective operation of the fund. The role of the fund should also be defined such as managing the transaction data collected through E-waste manifest and matching the data with fee paid by the generators so that the collected fee can properly managed.

d. Data Management System for E-waste Collection and Management

According to the draft framework proposed by DOE, manufacturers and recyclers are supposed to provide the data with regards to the production, sales and recycling. Support can be provided how to utilize the data to be collected and its management. Simultaneously it is important to identify the criteria for the date to be collected and its rational reason for the collection.

Furthermore, it may be effective to establish a system where the traceability of the collected E-waste can be identified to ensure the proper treatment by the final receiving facilities without any leakage during the process.

For identifying the E-waste after becoming the E-waste that is subject to the regulation, identification label is necessary. The E-waste manifest used in Japan Home Appliances law can be a good model as the manifest has several carbon copies and one of each becomes sticker type of transaction data slip describing the type, name and generator information to be directly placed on the E-waste.

6.2.4 Overview of the Necessary Activities way Forward

After planned measure to promote the comprehensive E-waste management are established, each responsible stakeholders are to play their expected role and responsibility along with the designed activities are to be implemented.

In order to that happened, it is important for the responsible body to ensure the proper collection of the targeted E-waste and environmentally sound recycling of the collected E-waste. Needless to say, the requiring cost is born and collected for ensuring the actual operation of the system. Therefore, it is vital to create a body to implement and manage the necessary activities under the regulation.

Having considered all the mentioned elements, the necessary activities way forward are summarized in the diagram shown below. Through the listed activities, the entity, technology, material to be treated, money to incentivize and promote the sustainable collection and environmentally sound recycling and operationalizing measures and rules are systematically identified. These activities need further elaboration and prioritization.

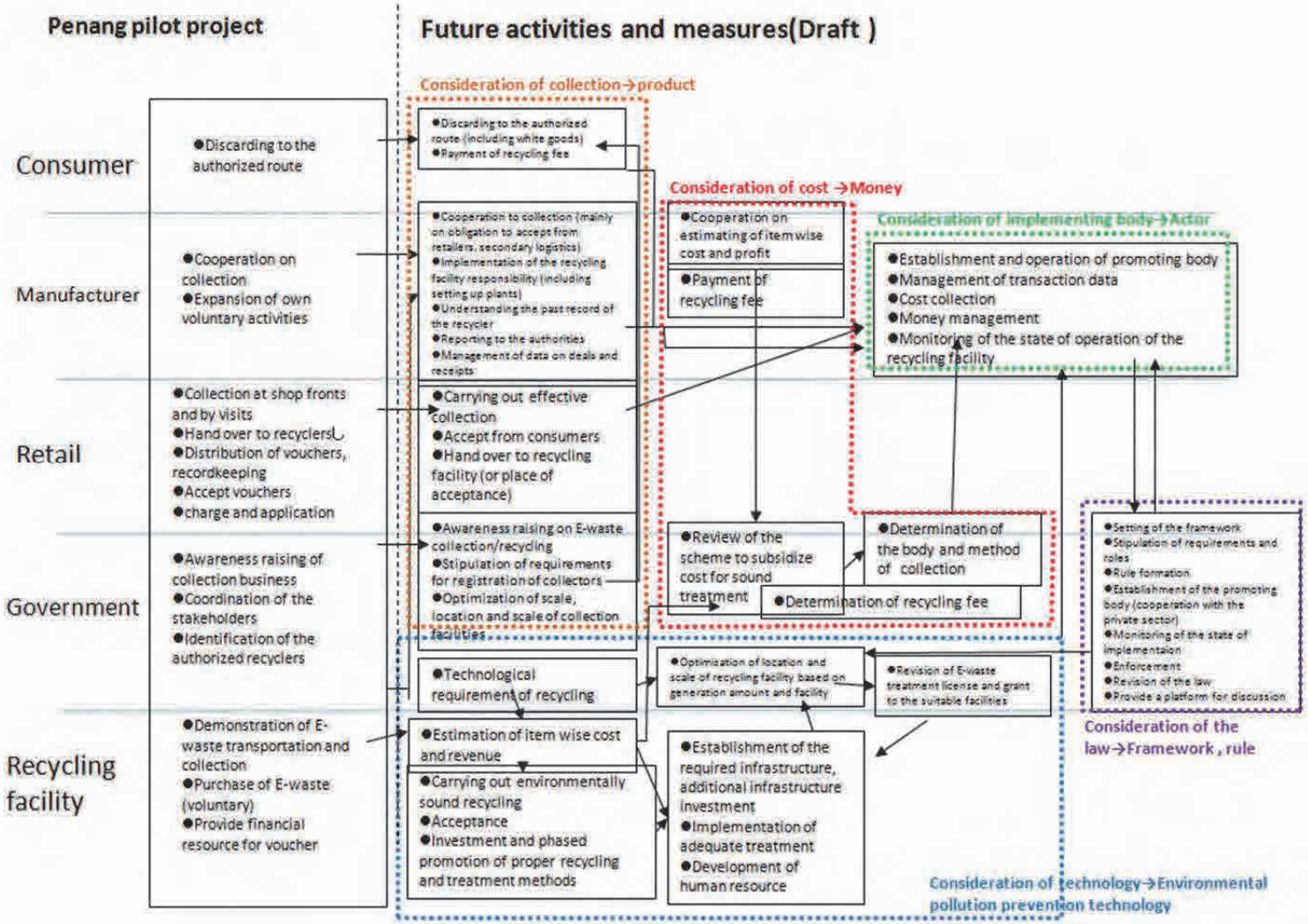


Figure 6-13 Overview of the Necessary Activities Way Forward

6.2.5 Support for conducting Pilot Verification

For promoting the sustainable collection and environmentally sound recycling, each stakeholder roles and E-waste, data and monetary flow are mentioned above. Here the stakeholder responsibilities are summarized in the table below. Even though these roles are identified, considering the feasibility, it is desirable to verify whether the identified roles are appropriate, functional, and effective enough to bring the tangible outcomes. Necessary alteration and improvement is necessary if any before start the implementation of the regulation. Therefore, it is to be verified whether the fee is smoothly collected and used for its original purpose, materials are collected for proper recycling activities in the pilot verification.

Table 6-3 Roles Played by Involving Stakeholders

Entity	Expected roles
Consumer	• Proper discard of E-waste • Pay recycling fee • Filling out the manifest and discharging E-waste along with the filled manifest
Retailer	• Taking back the E-waste from consumers(primary collection) • Handing over the collected E-waste to licensed recycling facility • Submitting collection data
Recycling facility	• Obtaining proper license • Taking back the E-waste handed over by retailers • Conducting environmentally sound E-waste • Submitting data on received and recycled E-waste
Manufacturer	• Secondary logistics • Establishing centralized secondary E-waste collection center • Conducting environmentally sound E-waste or necessary support for the implementation • Bearing the recycling fee • Submitting necessary production data

The recycling date submitted and fee paid are brought in to the managing entity. In case this managing entity is led by manufacturers, this is responsible for implementing practical activities under the regulation while government body is responsible designing the overall regulatory framework.

In the previous pilot project conducted in Penang, covered scope was on the collection of E-waste until its reception by the recycling facility, this proposing pilot verification covers entire range of E-waste from its generation, collection, transportation, reception and recycling as well as residual material disposal of the E-waste. Through this, all the proposed measures are verified its feasibility and effectiveness.

6.2.6 Training Course for Promoting the Understanding on Practical E-waste Management Mechanism

So far a number of proposals have been made for the possible support in order to accomplish the comprehensive E-waste management. Along with the mentioned support proposals, it is even more effective to provide the practical training course to further enhance the understanding the proven effective policy measures employed in other countries and applicability to Malaysia case.

Following training can be proposed for the capacity development.

The training is aimed for providing practical course to understand the effective policy measures. The participants are expected to be from legal development and implementing body, retailer, recyclers, LGU and other stakeholders. Through the course, participants are supposed to understand the possible policy options to overcome the potential difficulties in Malaysia.

- To understand the role and responsibility by involving stakeholders under the legal framework including its rationale, background, and aim.
- To understand the function of organization called RKC (Home Appliances Recycling Center) operated by manufacturers and management method for the fee collected from consumers and data management
- To understand how responsible government department for E-waste management law monitors the progress and identify the difficulties. For example, find out whether the retailer fulfills the hand over responsibility to designated licensed recycling facility and inspection.
- To understand how retailers conduct the primary collection from the consumers, manage transaction data, hand over the collected E-waste and how the secondary logistics are conducted. In addition to that, how the data is transacted to inform the completion of recycling to the managing entity and how the data is managed.

Furthermore pros and cons study can also be done about previously introduced cases in such countries as China, India, Australia and Europe cases to learn the most suitable measures that can be applied to Malaysia case. Trainee to be invited should be well balanced from both decision making management body and front line implementing body.

6.2.7 Support for Disseminating relevant information for Neighboring Countries

a. Identifying Advantage of Malaysia practices

Practice being promoted toward comprehensive E-waste management in Malaysia is also conducted in other neighboring countries like Indonesia and Thailand such as legal framework development and other relevant measures.

In Malaysia, there are stakeholders who can actually conduct the collection and recycling of the E-waste from household. The potential of the retailer has for the possible primary collection channels have been proven to be effective in the pilot project. Some recycling facilities are also potentially capable for environmentally sound recycling even though they are operated in certain limited location like Penang where electronic industries exist. The developing framework along with relevant actual operation can be considered to be relatively advantageous as compared with neighboring countries.

The officers in the responsible government department for E-waste management legal framework have actually expressed their interest in learning more about the work being conducted in Malaysia and possible application of some of the measures to their national context. This shows the work progressed in Malaysia can be a good role model for neighboring countries.

b. Expected Regional Spreading Effect

Therefore it can be beneficial to create a session for officers in neighboring to learn Malaysia practices and progress as well as to understand their status and difficulties objectively to come up the necessary measures to be developed for their own countries in the mentioned training.

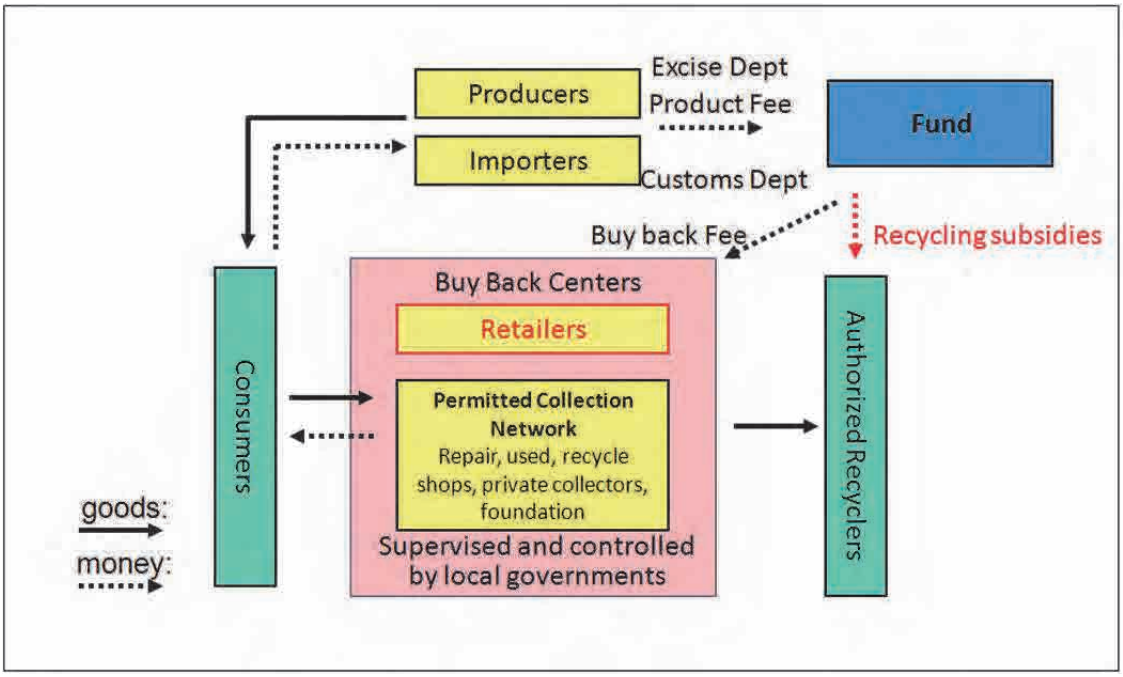
Through this type of work, Malaysia has potential positive impact to promote sustainable collection of E-waste and environmentally sound recycling in neighboring countries as well. Thus work progressed in Malaysia is potentially influencing in the region.

7 Proposed Actions for Development of E-waste Management Mechanism in Thailand

Based on the current situation and challenges of the E-waste management in Thailand, a draft collection model of household E-waste and measures to achieve a sustainable E-waste management are proposed in this section.

7.1 Proposed E-waste Collection Model Applicable to Thailand

In Thailand, as stated in the above sections, there is already a collection model proposed by the draft Royal Decree. The JICA Study Team made few additions to this model based on the experiences obtained in the Penang Pilot Project. The overview of the proposed collection model is shown below.



Note: Based on the draft collection model proposed by PCD, JICA Study Team made few addition (those in red)

Figure 7-1 Proposed E-waste Collection Model in Thailand

The collection model proposed by the draft Royal Decree is based on EPR recycling system, which reflected Thailand's current situation including product fee paid by the producer and importer, purchase of E-wastes from consumers by the buy-back centers that is supervised and controlled by the local administrative bodies, and recycling and treatment by licensed recycling facilities. In order to maintain effectiveness and sustainability of the system, the following items clarified in Penang Pilot Project and in this study are considered as challenges; therefore, it is important to make necessary additions to the proposed model.

- Regarding the primary collection from households, although the draft Royal decree proposed repair, recycling shops, private collectors, and charity organizations to be buy-back centers, it is very clear from Penang Pilot Project and from the experiences in Japan that collection by big retailers is very effective. It is necessary to promote big retailers to be buy-back centers.
- According to the draft Royal Decree, product fee is only used to pay for purchase of E-wastes; however, environmentally sound recycling and treatment cannot be covered by the value recovered from collected E-wastes. It is necessary to use product fee to support subsidy

for the recycling facilities, and the necessary cost for environmental measures should be examined periodically and should be adjusted if necessary.

- Regarding management and operation of the E-waste recycling mechanism, there are many tasks, such as setting up product fee's rates, monitoring of recycling fund's operation, approving of process applications from recycling facilities, etc. Many of the tasks are complicated, detailed, and large in amount. Therefore, it is necessary to establish a managing and operating institution for the E-waste recycling system in Thailand.

7.2 Proposed Action for Improvement of E-waste Management in Thailand

7.2.1 Actions for Establishment of Sustainable E-waste Collection Model

To build a sustainable collection model, the following proposals are effective: to promote proper discard by the consumers with activities to raise public awareness, to collect through multi-channel to raise efficiency, to establish secondary collection center for wide regional collection system, and to found an agency to manage and operate the entire system.

Proper discard by the consumer (households and offices)

- Although PCD has conducted many promotion activities to raise public awareness on proper E-waste discard, consumers' awareness is still low and many of them continue to donate or improperly discard E-wastes. Since raising public awareness takes long time, promotion activities should be conducted continuously; at the same time, inform consumers that improper treatment of E-waste cause environmental concerns and harm human health in order to persuade consumer behavior toward environmentally conscious direction.
- Local governments and local community organization, such as TIPMSE, are conducting environmental education and promoting source separation; they can be one of the agents to lead proper discard to formal E-waste collection channels.

Primary collection

- From the experiences of Japan and Penang Pilot Project, collection of E-wastes by the retailers at the time of product's delivery proved to be very effective. Currently, since any private company is not lawfully permitted to collect E-wastes from households, there are no buy-back activities in Thailand; however, the collection through retailers should be considered as one of important collection route. Therefore, it is necessary to enact a law to allow private companies to conduct collection from households.
- In addition, the collection scheme proposed by PCD already emphasizes primary collection role to repair, used, recycle shops, private collectors, charity organizations, etc. It is necessary to consider effectiveness and challenges of each collection routes.

Formation of the secondary collection sites

- In order to determine formation of Take-back Centers as secondary collection sites, transportations from households to Take-back Centers and from Take-back Centers to recycling facilities will be reviewed for determining effective locations. At this time, transportation costs, regional populations, economic status, availability of highways are considered for a wide regional collection system.
- In order to prevent those who collected E-wastes in primary collection from selling E-wastes to informal sectors, collectors are required to take all the E-wastes collected will be transported to Take-back Centers.
- In order to prevent primary collectors to sell collected E-wastes to informal sector, primary collectors bear compulsory transfer responsibility to the take-back centers.

Sustainable management and operation of the entire system

Regarding management and operation of the E-waste management mechanism, PCD's proposed collection scheme does not have any reference; however, the necessary tasks are not very few, such as determining the Product fees, monitoring operation of the recycling fund, auditing treatment application from the recycling facilities. Therefore, establishing a management and operational body under this mechanism is recommended. This body is based on the WEEE Committee, consists of stakeholders, such as PCD, DIW, MPH, private companies, citizen groups, etc. They will administer reviews regularly.

7.2.2 Actions for Promoting Environmentally Sound Recycling of E-waste

A tentative E-waste management scheme was proposed to PCD on June 4th, 2014.

First, experiences and challenges of Thailand's trials in the past are summarized below.

Source: Discussion with PCD, Jun. 4, 2014, JICA Study Team

Figure 7-2 Experiences and Challenges of Thailand's Trials regarding E-waste Management in the Past

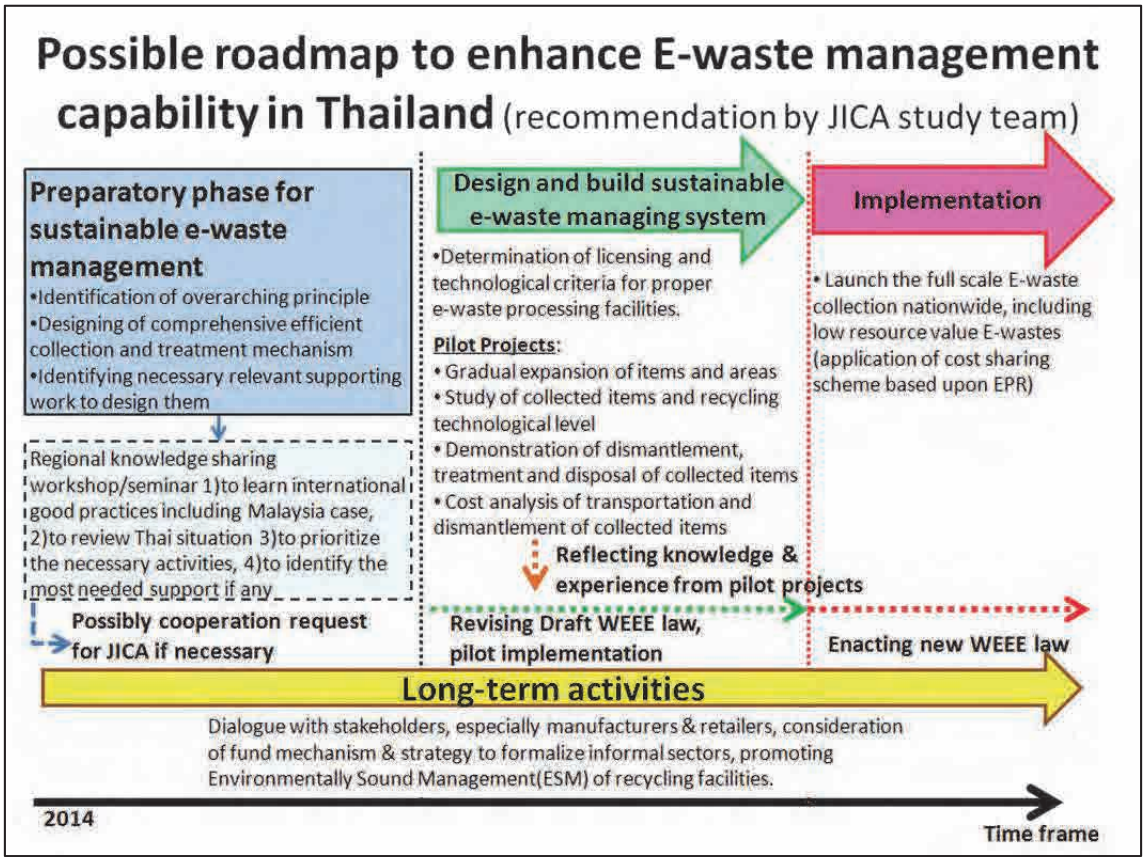
Table 7-1 Experiences and Challenges of Thailand's Trials regarding E-waste Management in the Past

Items	Trials in the past	Challenges for the future
Promotion of public awareness	・ Activities, such as "WEEE can do" project rose awareness and recognition of E-wastes.	・ It is necessary to continuously promote awareness among stakeholders, such as producers, retailers, consumers, and recyclers.

Items	Trials in the past	Challenges for the future
Pilot project	・ A pilot project called “WEEE can do” has been conducted with limited items in a limited area. ・ A pilot project on fluorescent lamp and capacity building of local governments on hazardous waste has been held.	・ Expansion of targeted items. ・ Implementation of a pilot project, not only focusing on collection but also inclusive of environmentally sound recycling and treatment
Formulation of law	・ Drafted a law, which includes foundation of the fund system ・ 10 priority product groups has been specified. ・ A study which included consideration of product fee and buy-back has been conducted. ・ Inventory of E-wastes has been created.	・ It is necessary to build a comprehensive and sustainable E-waste management system.

Consideration of a step-by-step approach based on a road map

For the future consideration of E-waste management, a step-by-step approach for necessary measures described below might be useful.



Source: Discussion with PCD, Jun. 4, 2014, JICA Study Team

Figure 7-3 Step-by-step Approach to E-waste Management in Thailand

Clarification of the objectives

There are already many activities conducted in Thailand; however, it is not very clear that these activities are conducted under what objectives with what roles. Since management of E-wastes requires many stakeholders, if the overall objectives are clarified, each stakeholder’s role and necessary tasks will be also clarified.

Cooperation among the stakeholders

Regarding the establishment of E-waste management system in Thailand, PCD is in charge of environmental pollution protection, DIW is in charge of management and monitoring of manufacturers, and MPH and local governments are in charge of management of hazardous waste from households. Regarding collection of E-wastes, retailers are important contact points with consumers, recycling facilities are important in terms of environmentally sound treatment. There are many stakeholders involved, and these stakeholders needs to cooperate and fulfill their own responsibilities.

According to PCD, a managing organization, called "WEEE Committee" already exists; it is important to utilize WEEE Committee effectively to promote cooperation among stakeholders.

Determination of priorities among necessary tasks for establishing collection/treatment mechanism

Currently, regarding the establishment of E-waste management system in Thailand, each stakeholder is following their own schedules and conducting activities separately. Now, consideration of collection, transportation, fee collection, payment from funds, recycling/treatment technology, development of law, etc. is needed; it is important to determine the priorities among these tasks by examining required time, cost, stakeholders, supports from overseas, possibility of domestic handling, etc.

Cost analysis of transportation and dismantlement

In Thailand, local municipalities and educational institutions have experimental experiences of collection, such as WEEE can do project. However, there is only rough theoretical estimation of required transportation, recycling, and treatment fees of collected E-wastes; any transportation, dismantlement and segregation experiment has not been conducted in real situation. It is necessary to conduct these experiments in order to determine effective transportation system and optimal location of storages, to determine necessary costs for environmentally sound treatment for each product, to calculate actual profits from sales of recovered resources, to determine necessary subsidies from the fund, etc.

Consideration of technological requirements of E-waste treatment facilities and licensing system

In Thailand, those facilities, which dismantle white goods are small in size and only conduct manual dismantlement. There is no facilities that mechanically dismantle large items such as refrigerators. Therefore, it is necessary to consider technological requirements of E-waste treatment facilities in order to safely and properly process these large items without causing any delay to avoid piling up unprocessed E-wastes. These technological requirements must adopt step-by-step approach. When the collection amount is rather small in the beginning, it is only necessary to secure proper storage. When the collection amount becomes large enough, implementation of large treatment equipments should be considered.

Currently, there is only DIW's factory code 106, which allows treatment of factory wastes. It is necessary to establish a licensing system specialized for E-waste treatment. These approved facilities under the E-waste recycling mechanism must have proper treatment equipments for lead-containing glass, mercury and chlorofluorocarbon in order to process white goods.

Also, it is necessary to build an information system to store information, such as processed E-waste amounts, sources of the E-waste received, amount, types and buyers of recovered materials, etc.

Awareness-raising activities

It is necessary to conduct awareness-raising activities in Thailand to promote proper discard from households since there is no law on how to discard unwanted E-wastes. It is important to emphasize the financial incentives received from handing over to buy-back centers. It is also important to raise awareness by emphasizing environmental pollution and health deterioration resulted from handing over E-wastes to informal sector.

In addition to federal and local governments, citizen groups which promote 3Rs among communities are crucial in these awareness-raising activities.

Also, capacity-building of local government staffs is important to effectively execute awareness-raising activities useful to establishment of a recycling system.

7.3 Applicability of Experience of the Penang Project into Thailand

Common ground and applicability of Pang Project

- In Thailand, like any other developing countries, such as Malaysia, unwanted E-wastes are traded with values. Therefore, it would be very difficult to change the existing informal sectors' route to a new formal route unless start purchasing E-wastes, such was the case in Penang Pilot Project.
- Take-back of E-wastes by retailers are not common in Thailand; however, many large-size home appliance retail stores and general retail stores are wide spread, and almost all the white goods are purchased at these large stores, similar to the case in Malaysia. It is a pre-condition that the law which approves collection of E-wastes from household by private sector is enacted; a pilot collection project, similar to the pilot project in Penang, utilizing retailer's take-back channel will be implemented.

Similarity to EPR based E-waste collection system considered by Malaysian government

- The primary objectives of the draft E-waste regulation in both countries are to address emerging E-waste issues and to clarify responsibility of household E-waste which was gray area between two legal frameworks, laws for hazardous waste management and for general waste management. Hence, experience and knowledge accumulated through DOE's drafting process will be good reference for PCD.
- Similarly, the following provisions are not included or clarified in PCD's draft E-waste regulation, and will be a good reference for further revising process.
- E-waste's multi-channel collection with local governments, concessioners, charity organizations, etc.
- Registration of E-waste collectors (it could be a policy instrument to formalize informal sector)
- Collection by big retailers
- Technological requirement for recycling facilities where E-wastes from households are treated.
- Calculation of subsidies for recycling facilities

Difference of condition with Malaysia and specificity of Thailand

- In Thailand, there are experiences of pilot collection and awareness-raising activities, and a draft law on E-waste is already proposed. Therefore, it is not necessary to start from the beginning, such is the case in Malaysia. In Thailand, it is necessary to contemplate on those experiences and activities in the past, to clarify the overarching objective of E-waste management scheme, and to identify each stakeholders' roles before proceeding to the next phase.

- Thailand with the population more than twice of Malaysia, many pays close attention to the recycling industries because of its size. However, those recycling facilities with DIW's licenses only manually dismantle wastes from factories. It is necessary to identify the recyclers who will be a part of a new home appliance recycling scheme.
- Currently in Thailand, unlike Malaysia, there is no formal facilities that recover precious metals from E-wastes. Thus, it is necessary in Thailand to consider establishing facilities for precious metal recovery when the collection volume becomes large enough.

7.4 Proposal for the Future JICA Support

In the discussion with PCD on June 4th, 2014, the draft E-waste regulation was proceeding according to WEEE Management Strategy by WEEE Committee. Once the draft regulation passes the National Environmental Board's examination, it will be passed to the Cabinet Board for consideration. PCD also expressed interest in conducting a pilot project since the new regulation is based on EPR. Activities to establish a framework of the E-waste Management system continues in the future.

Considering the findings of this study, it is effective for JICA to provide the possible support described below.

Possible support regarding establishment of a sustainable E-waste collection system

(1) Provision of effective collection method

In case of Thailand, since take-back by retailers at the time of new product's purchase is not common, it is important for formation of E-waste collection how to cooperate with collection activities of existing informal sectors, temples, and charity organizations. Merits and demerits of each collection methods, such as collection at retailers, collection by collection boxes, collection at temples, and collection by door-to-door by trucks and tri-cycles, should be examined. Including the possibility of these multi-channel collection, effective and efficient collection method should be considered.

Possible support for promoting environmentally sound recycling

(2) Provision of information regarding technological requirements of E-waste treatment facilities

In Thailand, those facilities, which dismantle white goods are small in size and only conduct manual dismantlement. There is no facilities that mechanically dismantle large items such as refrigerators. Therefore, it is necessary to prepare technological requirements for E-waste treatment facilities in order to ensure environmentally sound recycling that is safe to human health. The knowledge on proper treatment of lead-containing glass, mercury, and chlorofluorocarbon, which is earned from the experiences of Japan's Home Appliance Recycling System, will be provided.

(3) Cost Analysis of E-waste dismantlement

Along with the steps stated in the technological requirements for E-waste treatment facilities, the calculation of subsidies paid by the product fee will be examined jointly. The cost required during the step in which manual dismantlement with proper storage of untreatable items is quite different from the cost required during the step in which lead-containing glass, coolant and insulation CFCs are treated. Costs at each steps for each products will be calculated.

Possible support to enhance effectiveness of the regulations

(4) Provision of inputs or advice for PCD's draft EPR regulations

It is recommended that JICA to provide appropriate advice for PCD's draft E-waste regulations, similar to the case of Malaysia. Stakeholders' roles, technological requirements of recycling facilities, calculation of product fees and subsidies for proper treatment are needed to be considered. With the experience of implementation of the Home Appliance regulation in Japan, a system design most suitable to Thailand will be introduced to PCD.

(5) Joint regional workshop or joint training for information and knowledge sharing

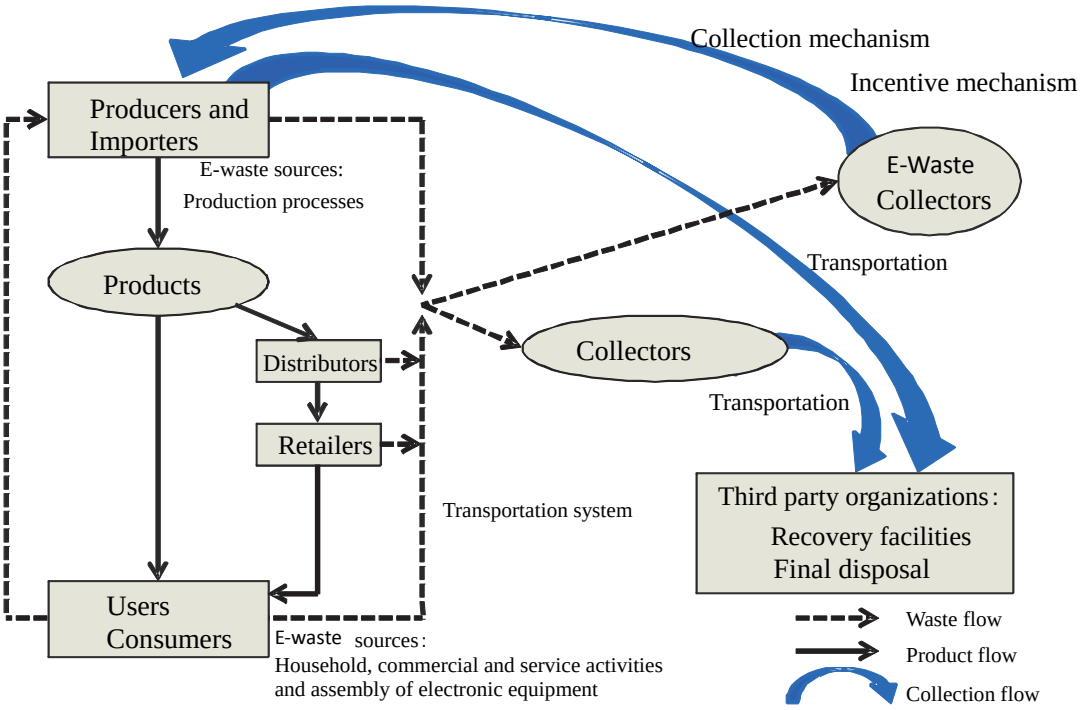
To organize a workshop with other neighboring countries' officials is beneficial to all attendees since by sharing countries' experiences of adopting an E-waste management system, such as Malaysia's and Indonesia's, attendees can learn all the success to follow and challenges to avoid. At the discussion with PCD, PCD expressed that they would like to attend such workshop and present the findings of this study and make it as an opportunity to request cooperation from JICA.

Also, the study suggests that JICA should organize joint training program in Japan and invite key officials of the government in Malaysia, Thailand and Indonesia. It would be good capacity development for government official to understand the difficulties Japan faced for enforcement of the Home Appliance Recycling Law and how to address issues. To this ends, it is recommendable to arrange a visit to E-waste recycling facilities, national and local government authority, manufacturers, and retailers who are actively involved in Japanese E-waste recycling system.

8 Proposed Actions for Development of E-waste Management Mechanism in Indonesia

8.1 Proposed E-waste Collection Model Applicable to Indonesia

The ideal E-waste collection model is the one which can ensure sustainable collection and promote environmentally sound recycling. The following figure is the E-waste collection model considered by KLH.



Source: Materials provided by KLH

Figure 8-1 Conceptual Drawing (1) of E-waste Management Based on EPR in Indonesia

Please note that the above concept diagram was depicted by KLH in the early stage of their consideration of new E-waste management mechanism. As seen above, important concepts such as collection by producers, importers, and retailers as well as incentive mechanism for stakeholders has already been considered. To ensure effectiveness and sustainability of the overall collection system, the following items should be also integrated into the above model.

Since primary E-waste collection is largely carried out by informal sector, it is necessary to to monitor their activities (through registration etc.) and to provide them with a role to hand over collected E-wastes to the licensed facility rather than eliminating their activities.

It is likely that E-wastes traded by repair shops or secondhand EEE shops and then flowed into informal channel. Therefore, those shops also need to be given a role in the above collection model and obligate them to hand over E-waste to the formal channel.

Although only small amount of E-waste is now collected by local government, it is important to examine feasibility to utilize temporary storage facility (TPS) managed by local government in order to establish wider-area collection model.

It is essential to legally define role of stakeholders in the above collection model and introduce proper incentive mechanism to encourage them to behave as expected by KLH.

8.2 Proposed Actions for Improvement of E-waste Management in Indonesia

8.2.1 Actions for Establishment of Sustainable E-waste Collection Model

To turn the concept model above into reality, the following activities need to be carried out:

Promoting proper E-waste discard by consumer (household and office)

To carry out awareness raising activities through seminar or mass media campaign in order to enhance public understanding of E-waste issues and collection mechanism and to encourage public citizens to discard E-waste to formal channel.

To develop and promote good practices of E-waste discard by households and to establish an award system for those practices in cooperation with municipal collection of local government, environmental education program of local community (e.g., Kampung) or social contribution activities conducted by woman group association or NGOs.

To obligate the buildings/officies of the governmental organizations or public entities to hand over their used EEEs to the licensed E-waste recycling faciliities since it is expected that improvement of household E-waste collection rate takes long time. Showing government's commitment would gain public understanding of E-waste collection mechanism. Moreover, green discard would ensure material supply for the licensed recycling facilities.

Development and enhancement of primary E-waste collection

To take measures to monitor and visualize activities of informal sectors and to integrate the existing informal activities into formal sectors (not to eliminate informal activities). In this sense, registration system of collectors or collection centers currently being considered by Malaysian DOE could be a good reference.

To introduce manifest system and develop mechanism to obtain quantitative data of E-waste trade/flow. It could ensure that E-wastes are flowed into formal channel and recycled or treated in the licensed facility.

To legally stipulate role of retailer and reconditioning industry to hand over collected E-waste to the licensed facility in addition to the municipal collection, and to examine and introduce incentive mechanism for stakeholders to obtain their active involvement. Similarly, it is necessary to introduce appropriate incentive mechanism (or award system) for EEE manufactures to encourage their voluntary E-waste collection. This kind of "multi-channel approach" should be promoted.

Development of secondary collection

To study the current status of collection activities carried out by "waste bank" (e.g., traded items, or scale and location of business, etc.) and to examine feasibility if it could function as secondary E-waste collection center in local community in cooperation with municipal governments. Waste bank might be able to buy back E-waste from informal sector to formal recycling flow. Incentive or supporting measures for waste bank should be evaluated.

To examine economically feasible and effective nationwide E-waste collection system. Indonesia is a vast archipelago country, but currently the licensed facilities are located mostly in Java islands. It takes long time and requires huge investment to develop E-waste recycling facility all over Indonesia. Hence, it is necessary to analyze scenario to transport locally collected E-waste to the facilities in Java Island in cost effective way. Utilization of TSP (temporary storage site managed by local government) should be taken into account for consideration of the scenario.

Sustainable management and operation of overall E-waste management mechanism

To establish an administrating body (or committee) which is responsible for setting up targted recycling rate, operation of recycling fund (if established), and monitoring or evaluating performance of stakeholder's activities. This administration body may consist of the relevant key players, including KLH, other ministries (e.g., Ministry of Industry), industry association or citizen

group and its rule or responsibility should be specified in the new E-waste regulation.

To review the status of achievement of recycling rate and compliance status of responsible stakeholders after new E-waste regulation comes into force. as the case of Japanese Home Appliance Recycling Law. This review work should be conducted by the administrating body above and more effective measures should be examined regularly based on the result of data analysis.

8.2.2 Actions for Promoting Environmentally Sound Recycling of E-waste

To address issues of environmental pollution or health damage caused by E-waste, promotion of environmentally sound recycling is equally important as enhance collection capacity.

Stepwise approach

It is quite important to take realistic approach to improve E-waste collection system and promote recycling in a stepwise manner. Since it is unrealistic to target all items uniformly, pilot collection and recycling should focus on ICT equipment, which has high resource value and can be dismantled or recycled at the existing licensed facilities, at the initial stage. Similarly pilot collection should be initiated at the metropolitan city such as Jakarta where large volume of E-waste is generated, and then expand project area step by step. Experience or know-how accumulated through the pilot project should be summarized as "lessons learned" and it should be reflected to KLH's drafting process of new E-waste regulation. This kind of approach would be more realistic and feasible considering the current situation of Indonesia.

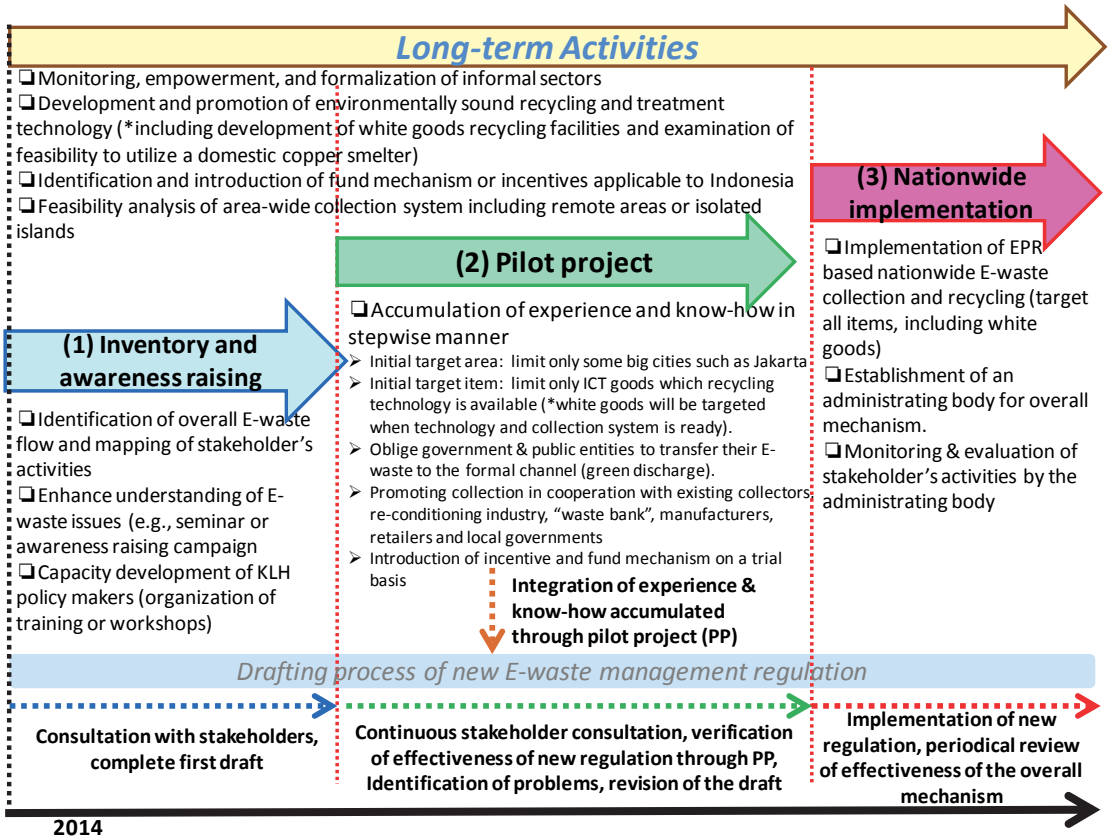


Figure 8-2 Stepwise Approach for Promoting Environmentally Sound Recycling of E-waste in Indonesia

Cost burden for recycling and treatment of E-waste

The draft E-waste regulation does not have concept of EPR fee collection from EEE producers and importers as considered by Malaysia DOE. Rather, KLH considers providing incentive to

encourage voluntary collection by producers. However, unlike ICT goods, white goods have low resource value and need high investment cost for development of necessary recycling infrastructure. To achieve environmentally sound recycling of those white items, it is necessary to examine mechanism for collecting fee from society and managing collected fee for promoting effective recycling. The operation system of recycling fund differs country by country (e.g., government control type or privately owned fund, etc.). Based on the experience of other countries, KLH might need to examine the fund mechanism applicable to the current situation in Indonesia.

Moreover, it is quite necessary to calculate specific and realistic recycling fee based on the cost information for collection, transportation, recycling and treatment of E-waste, provided by the existing licensed recyclers. It is rather realistic that the E-waste regulation should define only overall concept for cost sharing, and then specific recycling cost for the targeted items are to be determined or specified by implementation rule promulgated by KLH or Governor's decree of local government.

Precious metal recovery in Indonesia

Currently, there is no recycling facility which has technical capability to recover precious metal from electronic scraps or waste printed circuit boards (PCBs) and it is worthwhile to examine possible measures to introduce and promote metal recovery technology in Indonesia. To this ends, it is practical to figure out chemical composition of electronics, identify BAT (Best Available Technology) of recycling applicable to Indonesia, and to develop technical guideline for material recovery from E-waste targeting local governments and recyclers. Furthermore, as long-term strategy, it is also recommendable to identify challenges to utilize Gresik copper smelter as precious metal recovery facility and examine specific measures to address the difficulties.

8.3 Applicability of Experience of the Penang Project into Indonesia

Common ground and applicability of Pang Project

In Indonesia, some retailers conduct a campaign for "trade-in" service which customers are given discount when they purchase a new product as in the case of Malaysia. If cooperation of retailer (such as Electronic Solution) is obtained, the pilot collection project utilizing retailer's take-back channel could be established as implemented in Penang, Malaysia.

Although scale and technical capability differs, there are some E-waste recycling facilities licensed by KLH. Those facilities mainly focuses on intermediate treatment such as dismantling and do not conduct precious metal recovery. Generally the licensed facilities are environmentally conscious and cooperative to KLH's activities. Therefore they could be a key player and active involvement for the future pilot collection project could be expected.

Similarity to EPR based E-waste collection system considered by Malaysian government

The primary objectives of new regulations currently being drafted in Malaysia and Indonesia are to address emerging E-waste issues and to clarify responsibility for household E-waste collection which used to be a gray area between two legal framework (law for hazardous waste management and for general waste management). Therefore, experience and knowledge accumulated through DOE's drafting process could be good reference for KLH.

Similarly, the following provisions are not included or clarified in the draft regulation of KLH and could be good reference for further drafting process.

Responsibility of stakeholders

EPR fee collection and establishment/operation of recycling fund

Registration of E-waste collectors (it could be a policy instrument to formalize informal sector)

Technical requirement for E-waste recycling facility

Difference of condition with Malaysia and specificity of Indonesia

GDP per capita in Indonesia is relatively lower than Malaysia, particularly, contrary to Penang, where upper-middle class is majority. The cycle for replacement of EEEs in Indonesia, particularly white goods, is longer since it is still unaffordable for low income people to purchase brand new product and it is common for them to use up EEEs until it becomes non repairable. Moreover, Indonesia is a vast country and household does not face space scarcity problem so often. Therefore it is also common to keep E-waste at home even it is unfunctional without discard. This tendency is particularly true in rural area and it seems that time span for replacement of EEEs is relatively longer in Indonesia if compared with other countries.

It is likely that a large amount of E-wastes is flowed into informal flow by re-conditioning industry. Therefore it is necessary to have clear understanding of activities of this industry and specify clear role or responsibility in the new regulation.

Indonesia is larger than Malaysia, however number of the E-waste recycling facilities licensed by the governments is lower. Therefore, it is important to examine area wide E-waste collection system which strategically establishes secondary collection points, which may include the use of the existing temporary storage facilities managed by local government.

In contrast to Malaysia which is centralized and federalized country, enforcement power of law and regulation is decentralized in Indonesia. It is expected that new E-waste regulation only defines overall framework and detail implementation rule might be further specified in local ordinance or governor's decree. Therefore support for drafting process of local governments and capability building of local government officers would be equally important.

The licensed facilities currently only work on intermediate process (dismantling and separation of E-waste) and there are no facilities which have capacity to recover precious metal from PCB scraps unlike Malaysia. On the other hand, Indonesia has one of the few large scale copper smelter in South East Asia with high level of technology. Currently it does not accept electronic scraps but, if it can be utilized as metal recovery facility, Indonesia might be able to establish an unique nationwide resource circulation system.

8.4 Proposal for the Future JICA Support

The Deputy IV (B3 waste management division) of KLH intends to invite opinion from the public and to incorporate a wide range of views into the new E-waste management regulation. To this ends, with cooperation JICA Study Team, KLH organized "the Workshop of E-waste Management Framework in Indonesia" in April 29th, 2014[104]. The Deputy IV is required to submit the draft E-waste management regulation to the legal unit of KLH by the end of 2014, and then further discussion with stakeholders will be carried out at the legal bureau meeting to be established in KLH.

It is critical to support for KLH's activity for establishment of effective E-waste management mechanism by providing the relevant useful information such as lessons learned from EPR based E-waste management in other countries (including Malaysia), experience of Japanese Home Appliance Recycling Law and views of Japanese manufacturers.

According to the presentation made by KLH at "the Workshop of E-waste Management Framework in Indonesia", following items are necessary tasks to be taken for drafting effective E-waste management regulation in the future.

[104] KLH also organized "National E-waste Stakeholder Meeting" in May 26th 2014 as back-to-back meeting with the 7th Working Group Meeting of the Partnership for Action on Computing Equipment (PACE) established under the framework of the Basel Convention. It invited not only national stakeholders, but also PACE members, including national competent authority, Basel Convention Regional Center (BCRCs) and industry. Through workshop KLH explained idea of new regulation and invited many comments from participants.

- Information collection of sustainable and implementable policy measures implemented in other countries (including definition of terms and role and responsibility of stakeholders)
- Identification of incentives to encourage EEE manufacturers to start EPR and development of effective incentive mechanism
- Analysis of cost necessary for environmentally sound management based on the type of E-waste
- Coordination with local governments to disclose E-waste management system and establishment of program to encourage community-based E-waste collection
- Support coordination among EEE manufacturers, re-conditioning industry and local government for establishment of collection point
- Data analysis for chemical composition in E-waste for promoting E-waste recycling technology
- Preparing guideline for environmentally sound recycling and treatment of E-waste

Taking the KLH's needs above and challenges identified through this study into account, it is desirable that JICA supports the following activities in cooperation with support from other donor agencies. [105]

(1) Identification and mapping of stakeholders involved in E-waste collection and recycling

Although KLH has established "preliminary inventory of E-waste", there is no detail data of E-waste flow which is necessary for design of implementable system applicable to the present condition of E-waste collection and recycling in Indonesia. Based on the findings from this study, the following detail survey should be further conducted in cooperation with research institutions such as ITB (Institut Teknologi Bandung) who have research experience in this field;

- Identification of number of players involved in E-waste collection and recycling (e.g., scavengers, aggregator sorters, recyclers, or "waste banks"), and description, scale and location of their business in the major cities such as Jakarta, Surabaya or Medan.
- Quantitative data analysis of E-waste flow (particularly in informal sector)
- Study on the reality of E-waste collection, dismantling, resource/metal recovery carried out by informal sectors
- Study on the status of E-waste collection outside of the major city (particularly, remote area or isolated islands)

(2) Provision of inputs or advice for drafting new E-waste management regulation

KLH needs a support for drafting new regulation to make it more effective and implementable as described above. Therefore, to provide KLH with appropriate advice for its drafting process by JICA in a timely manner is recommended. Especially, provisions for (1) rule and responsibility of stakeholders, (2) cost burden, and (3) incentives for stakeholders are critical for the effectiveness of new regulation.

Please note that the Deputy IV responsible for drafting E-waste regulation in KLH needs to submit the first draft by the end of Year 2014, hence, it is necessary to grasp the progress of the KLH's work and provide advice in a timely manner.

(3) Provision of information regarding experience EPR based E-waste management system of Japan and other countries.

Relating to advice on drafting process above, it is necessary to provide information related to the

[105] It would be possible to work with the activities for tackling E-waste issues undertaken by BCRC-SEA or other partnership established under the framework of the Basel Convention, such as MPPI or PACE. Moreover, UNIDO (United Nations Industrial Development Organization) also showed interests in supporting E-waste management in Indonesia at the Workshop of E-waste Management Framework in Indonesia.

KLH's drafting process in order to make the overall system more effective. To this ends, it is suggested to summarize the outline and advantage/disadvantage of Japanese Home Appliance Law as well as other EPR based recycling mechanism implemented in other countries such as China, Republic of Korea, Taiwan and Western countries. Applicability to the situation of Indonesia and the expected impact on the ongoing business should be also analyzed.

(4) Cost analysis on environmentally sound management (ESM) of E-waste by the type of product

Japan has experience to conduct detail cost (and benefit) analysis for collection and recycling of E-waste by the type of products before establishing the Home Appliance Recycling Law. KLH also recognizes that extra cost for ESM is necessary, particularly for bulky white goods, thus KLH is now asking for support for cost analysis for donor agency.

The licensed E-waste recycling facilities are in general environmentally conscious from a standpoint of corporate social responsibility (CSR) and are very cooperative to KLH's efforts for drafting new E-waste regulation unless heavy burdens are solely imposed on the recyclers. KLH should request those recyclers to provide information for extra cost necessary for transportation, development of new recycling infrastructures and operation of new facility by the type of white goods. Based on the available data, social cost for ESM of white goods should be calculated and then examine (1) who pays cost, (2) how to collect the fee from society, and (3) how to manage collected fee (e.g., establishment of recycling fund, etc.) with a support from JICA.

(5) Joint workshop or joint training with other ASEAN countries

Among other ASEAN countries, Malaysia and Thailand have started to examine EPR applicability to the countries in advance of Indonesia and KLH is keen to learn the experience of the neighboring countries. Therefore providing KLH with face-to face meeting opportunity with government the officials in other ASEAN courtiers who are in charge of EPR would be supportive to KLH. It would be useful to organize joint workshop in Peneng where the pilot project was implemented for the purpose of exchange of information and opinion regarding the difficulties and possible policy measures for developing E-waste management mechanism. Furthermore, it is recommendable to arrange a visit to retailers or recycling facilities in Penang in order to enhance understanding good practice of E-waste collection in Malaysia. It is expected that other ASEAN counties would also introduce EPR base E-waste recycling law/regulation and it would be even beneficial for EEE manufacturers who have production base in ASEAN countries if legal requirements or responsibilities imposed on them are harmonized.

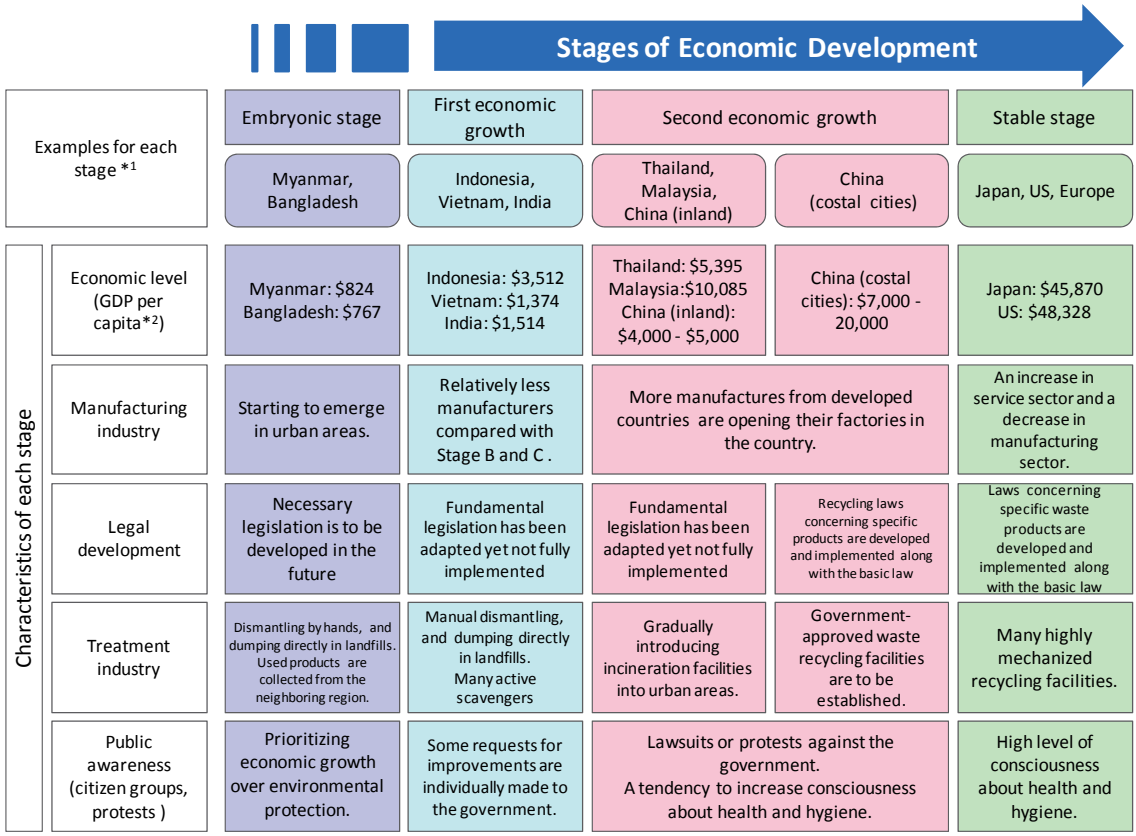
Moreover, the study suggests JICA organize joint training program in Japan and invite key officials of the government in Malaysia, Thailand and Indonesia. It would be good capacity development for government official to understand the difficulties Japan faced for enforcement of the Home Appliances Recycling Law and how Japan has addressed the issues. To arrange a visit to E-waste recycling facilities, national and local government authority, manufacturers, and retailers who are actively involved in Japanese E-waste recycling system are recommended.

9 Proposal for Measure to Expand Cooperation with ASEAN Countries

9.1 Present condition and Challenges for E-waste Management in other ASEAN Countries

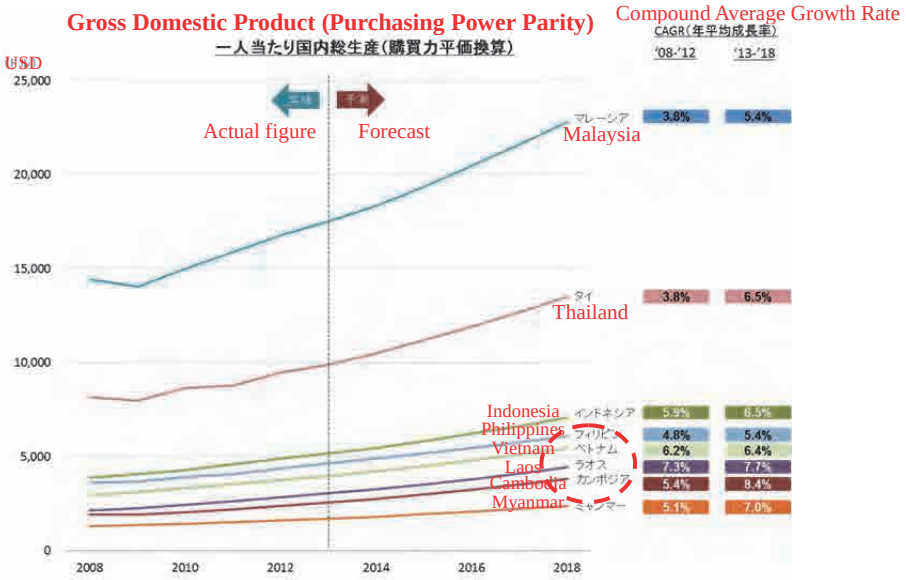
9.1.1 Present condition

In this section, present condition and challenges of Cambodia, the Philippines and Vietnam are summarized. The reason why three countries are targeted is that those countries are classified as being in the "Initial growing phase" among the ASEAN countries with urbanization and economic development already being a certain level. The GDP per capita for 2011 has been reported to be about USD 1,000 - 2,000.



*1 It is an overview according to the study conducted in 2012 and in certain cases, it may not be applied or has been changed over the years.
*2 Data of the year 2011 from IMF, October 2012

Figure 9-1 Differences in the Waste Treatment and Recycling Market between Japan and Asian Emerging Nations



Source: Based on IMF World Economic Outlook Database

Figure 9-2 Trend of GDP per Capita in the Respective ASEAN Countries

In these countries, basic laws and regulations on solid waste management and recycling have been developed. However, the enforcement of these laws and regulations is not sufficient and recycling infrastructure is also limited to simple manual dismantling and segregation and landfill disposal.

The current situation of E-waste management from the viewpoint of laws/regulations and recycling is summarized below.

a. Cambodia

In Cambodia, there are no laws/regulations in place on the collection and recycling of E-waste, but there is a plan to formulate a Sub Decree on E-waste Management under the Law on Environmental Protection and Natural Resource Management.

Ministry of Environment, Government of Cambodia has called on a support on formulation of a law as a part of the project named "Environmentally Sound Management of E-waste in Asia and the Pacific" conducted under the framework of the Basel Convention and has made relevant preparations.

The recycling of E-waste is limited to activities by the informal sector and no recycling facilities are developed.

b. The Philippines

In the Philippines, there is no law/regulation on the collection and recycling of E-waste. However, as it has a large population and the penetration rate of small electrical and electrical equipments (EEEs) is becoming higher, the collection and recycling of E-waste has been identified as an important political agenda. For example, "Gathering Basic Data on Electronic Waste in Metro Cebu: A Case Study on the Philippine Setting" has been carried out.106 Furthermore, the Solid Waste Management Board set up under the mayor of the Cebu City has allocated the recycling of E-waste as a high priority waste. A feasibility study concerning t E-waste recycling has been carried out by Japanese companies.

106 "Regional Workshop on E-waste Management", Osaka, Japan 6-9 July 2010 (http://gec.jp/gec/jp/Activities/ietc/fy2010/e-waste/ew_1-7.pdf)

According to the Environment Management Bureau (EMB) under Department of Environment and Natural Resources (DENR) of the Philippines, 17 facilities have obtained licenses as recycling facilities as of September 2012.[107]

c. Vietnam

In Vietnam, Decision No.50/2013 of the Prime Minister on prescribing retrieval and disposal of discarded products (50/2013/QD-TTg) has been published on August 9th, 2013. It specifies the rights and responsibilities of the collection and treatment activities of waste products in Vietnam for the importers, recyclers, consumers and the relevant authorities relating to the target products. The enforcement is scheduled to start from 2015. The target products will be IT equipments like PCs and cell phones, small AV equipments and batteries at the initial stage. From January 2016, target will be extended to include TVs, refrigerators, washing machines and air conditioners.

Facilities of E-waste are located in urban areas and at industrial parks. The former state-owned waste management company is conducting the collection, manual dismantling and segregation of E-waste. A licensing system for the treatment and recycling of E-waste exists and 18 facilities have obtained licenses nationally as of October 2012.[108] The majority of the facilities carry out shredding and segregation. Interest of Japanese companies in the field of E-waste management is high and several feasibility studies have also been carried out. [109]

9.1.2 Challenges

The main challenges relating to E-waste management is summarized below. The common challenges shared among three countries are (i) lack of regulation relating to sustainable E-waste collection and (ii) environmental pollution caused by environmentally unsound recycling by informal sector.

Table 9-1 Challenges of E-waste Management of Three ASEAN Countries

Countries	Cambodia	Philippines	Vietnam
Informal sector	As no authorized recycling facilities exist, almost all the E-waste is recycled by the informal sector. The manually dismantled parts or components are sold domestically and some are also exported.	In urban areas, trade of imported used EEEs is common. Valuable metals are recovered from E-waste by using solvents. The used solvent is disposed and is causing soil contamination. Non valuables such as lead glasses are improperly landfilled and may be causing environmental pollution.	There are many craft villages, which collect, segregate and recycle resources including E-waste. The villages purchases recyclables directly from households competing with the formally authorized recycling facilities.
Primary collection	Mostly conducted by the informal sector.	Voluntary collection campaigns are carried out at some shopping malls where collection is limited to small items like cell phones. Collection of bulky white goods is not carried out by the formal route. There is no mechanism to secure a sustainable cost bearing.	Mostly conducted by the informal sector.

[107] "International Workshop on Management of Waste Electrical and Electronic Equipment", Taiwan, 15-20 October 2012 (http://www.emb.gov.ph/hazardous/treater.pdf)

[108] "Policy Update from Vietnam"from Vietnam VEA (http://www2.epa.gov/sites/production/files/2014-05/documents/vietnam.pdf)

[109] For example, "Survey of recycling of electronic waste in Vietnam" was conducted by Mitsui Mining and Smelting Company ltd.

Countries	Cambodia	Philippines	Vietnam
Recycling facility	No recycling facilities exist for both household E-waste and electronic scraps generated from industrial processes.	No recycling facility for white goods exists. Mechanism for sustainably bearing cost for environmental measures does not exist.	There are some facilities to recycle electronic scraps from industrial processes, but recycling facilities for white goods do not exist. Mechanism for sustainably bearing cost for environmental measures does not exist.
Awareness raising	No active activities exist.	Awareness raising activities like collection campaigns are carried out at some shopping malls	No concrete, active activities exist.
Formulation of legal framework	Sub-Decree on E-waste management is now being prepared and being drafted.	Law/regulation relating to hazardous waste management regulates the collection and recycling of E-waste but there is no legal framework for household E-waste.	Law relating to the E-waste management will be enforced from January 2015. The manufacturers will be obligated to establish collection centers.

9.2 Proposal for Approach to Expand Cooperation with ASEAN Countries

9.2.1 Precondition

a. Necessary Condition for E-waste Collection from the Experience of Penang Project

The main lessons learnt from the pilot project conducted at Penang Malaysia, is summarized below.

- The fact that retailers can function effectively as a primary E-waste collection channel from consumers was demonstrated.
- Raising awareness of consumers that improper recycling of E-waste results in environmental pollution and e waste should be discarded to the formal collection route was achieved.
- Vouchers that were used as incentives to promote E-waste recycling was effective to a certain extent
- The financial resource for the voucher was obtained through purchase by recycling facilities
- As handing over the collected E-waste to the recycling facilities is not obligated by the law, flow of the collected items to informal sector was also observed.
- In the existing recycling facilities, technology to recycle white goods in an environmentally sound manner was not adequately in place.

From the lessons stated above, the following factors are necessary to achieve a sustainable collection and environmentally sound recycling of E-waste.

- Securing function of primary collection.
- Incentives to promote collection from consumers.
- Securing environmentally sound treatment and recycling of the collected E-waste.
- A fair cost bearing and sharing mechanism that makes a sustainable collection and recycling possible.
- Clarification of responsibilities and roles of stakeholders
- Formulation of regulations that cover the above.

b. Information Necessary for Examining Measures to Expand Cooperation with ASEANC Countries

The following information is necessary when JICA examines possible measures to expand cooperation with ASEAN countries in the field of E-waste management. These items are the necessary conditions for attaining a sustainable collection of E-waste and environmentally sound recycling. By collecting information on these items, it would be possible to identify the current status and challenges in the respective ASEAN countries, the needs for JICA support, which can then be useful to determine the content and scale of the technical cooperation.

Table 9-2 Information Necessary for Examining Approach to Expand Cooperation with ASEAN Countries

Items	Information that needs to be collected and items need to be studied
Primary collection	In the respective countries, there are various collection methods in place like E-waste collection along with periodic collection of domestic waste or collection at religious facilities. It is necessary to identify the existing collection practice and actors involved in primary collection.
Incentive	Study who bears the cost when effective incentives are provided to promote collection of E-waste from consumers, and evaluate the sustainability of the existing method.
Securing treatment and recycling	Study the presence of facility to properly recycle collected E-waste, and its scale, capacity, and items treated. Also study the presence of governmental licensing system and its requirements. It is also desirable to investigate the status of collection and recycling by the informal sector.
Cost bearing mechanism	Study the applicable cost bearing and sharing mechanism to promote sustainable collection and environmentally sound recycling
Role of the stakeholders	Clarify the roles of each individual in order to form a systematic framework and hence the roles and responsibilities of the stakeholders should be studied.
Others	The progress of formulation of laws/regulation that covers the above points (including identification of the political will to formulate the laws/ regulation and allocation of resource/staffs for drafting process) Is the amount that needs treatment sufficiently available (generation amount, flow) The stance of electrical and electronic equipment manufacturers

Regarding the method of collecting information, it is desirable to utilize various channels such as regularly-scheduled meetings involving the local JICA office.

9.2.2 Proposal for Measures to Expand Cooperation with ASEAN Countries

a. Necessary Conditions and Challenges for Expansion of Cooperation with ASEAN Countries

The followings condition would be necessary when JICA expands the technical cooperation in the field of E-waste managing to other ASEAN countries.

- Grouping:
  While the status of E-waste management is different among ASEAN countries, there are some similarities and hence they can be divided into some groups (e.g., advanced group and some follower group). It is important to provide the adequate level of collaboration/cooperation based on the level of E-waste management of the respective groups.
- Utilization and dissemination of experience of the advanced country:
  The advanced group, which has more experience and capability, can act as a model for the

follower group. It is hoped that the country in the advanced group, which has the most advanced legal framework and technology for E-waste management, to become a core country and to share its experience and know-how with neighboring countries. Malaysia, where the pilot project was conducted, has the experience and other countries have shown interest in its activities. Hence, sharing of experience and knowledge of Malaysia would be beneficial for all the countries in the region.

- Identification of the needs:
  It is important to identify the condition of each country and top priority challenges. It is also important to understand the level of recognition of the governmental authority and other stakeholder in the respective countries in terms of E-waste issues and to identify their needs. This is important when preparing the proposal for the future cooperation.

b. Possible Measures to Expand Cooperation with ASEAN Countries for E-waste Management

The proposal is shown in the figure below.

As the economic level varies from one country to another, the amount of E-waste generated is also different and hence the underlying challenges of each country also differ. Therefore, the countries where cooperation will be extended should be grouped according to their economic level and the cooperation should be carried out in a stepwise manner.

The first phase is the stage where E-waste issues become obvious, but no concrete action is taken to tackle the issues. Hence the measures required for the countries at the first phase will be centered on identification of the challenges in detail and raising awareness of the stakeholders including government officials responsible for formulating E-waste management policy. The possible activities are to collect information and identify needs and level of awareness through fact finding surveys and policy dialogue between the local JICA office and the relevant government official. It would be effective if JICA organizes seminars or workshops on awareness-raising in collaboration with other bodies to show JICA`s willingness to support E-waste management.

In the second phase, challenges of E-waste are more clearly identified and therefore relatively swifter actions are required. The countries at the second phase will focus on combining voluntary activities with regulatory measures to establish effective policy measures. Furthermore, in order to ensure environmentally sound treatment and recycling in a large scale, it would be effective to develop recycling business. Hence it is necessary to establish a licensing system, determine the technological requirements and develop other necessary infrastructures.

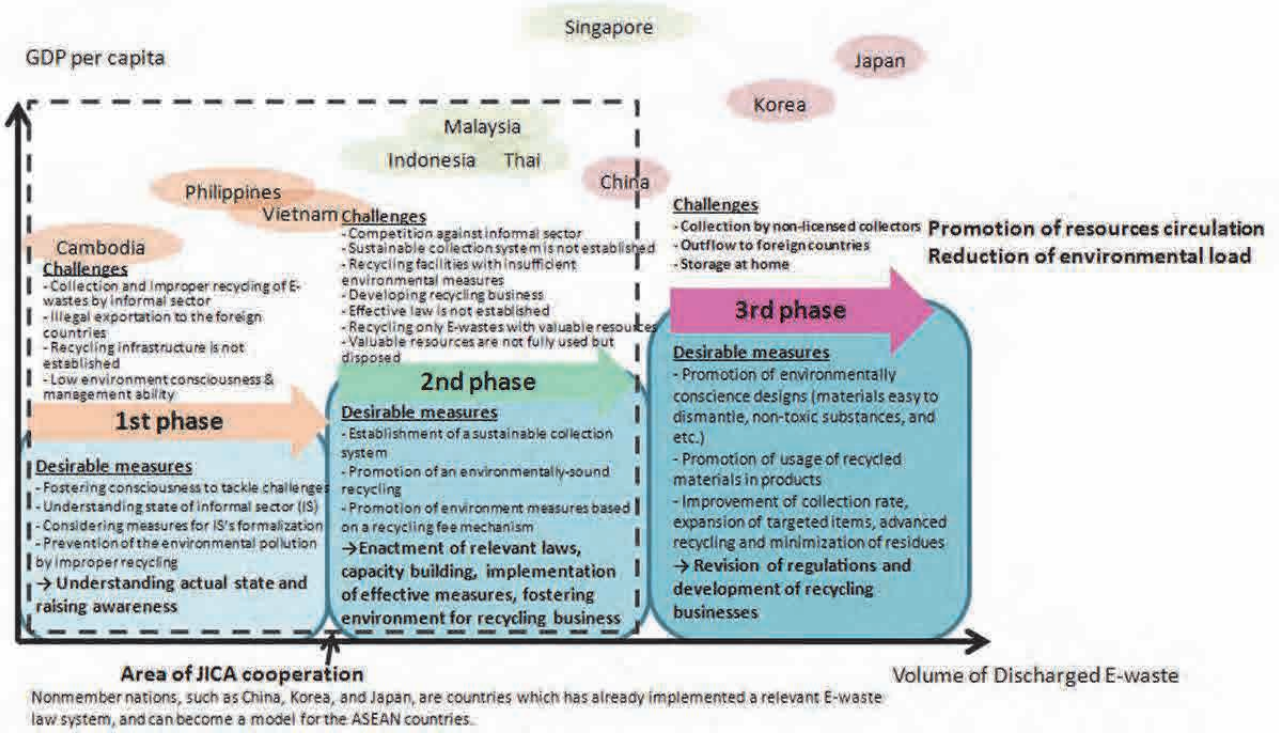


Figure 9-3 Proposal of a Multi Stage Collaboration with ASEAN Countries

The ASEAN region has a large population and many countries have shown a rapid economic growth. In the region, EEEs such as smart phones, PCs and bulky white goods are becoming very common. At the same time discarded EEEs are increasing and are expected to become a serious issue in the future. In some areas, environmentally unsound treatment and recycling has already caused environmental pollution and adverse health impacts.

As E-waste is generated from products that are used every day, the E-waste issue is becoming a concern even in the emerging nations and it is expected that the need to tackle this problem will only become greater in the future. In this field, Japan has the experience of systematically formulating a regulatory framework and Japanese manufacturers and recycling enterprises have the know-how and experience and are superiorly placed to tackle this problem. In order to prevent environmental pollution and adverse health impacts from E-waste and to produce business opportunities for private sector which has recycling technology and know-how, it is important for JICA to expand its collaboration on E-waste management to the ASEAN countries.

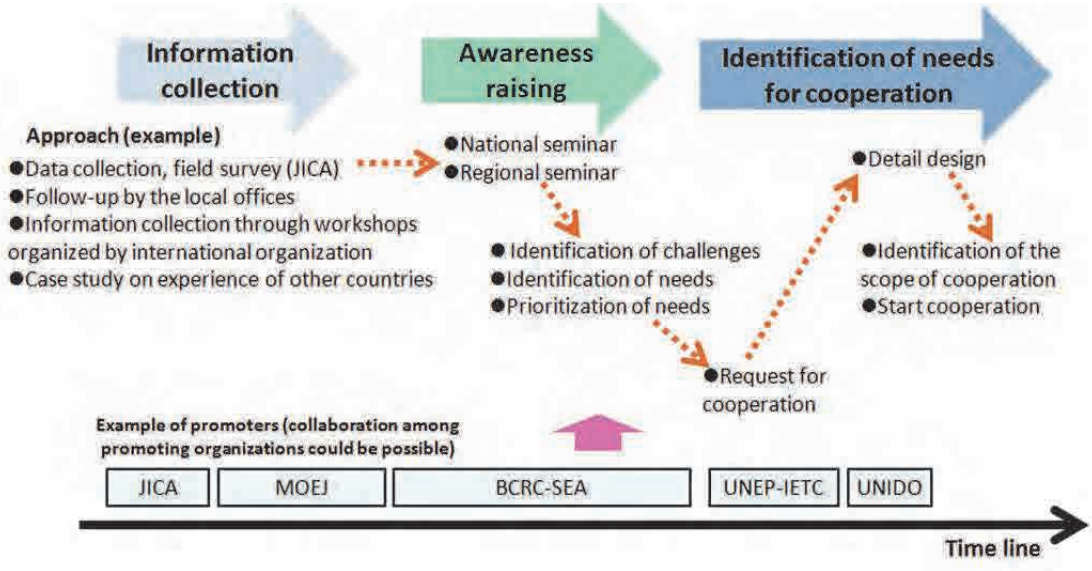


Figure 9-4 The Concept Diagram for Stepwise Actions to Be Taken for Expanding Cooperation with ASEAN Courtiers

9.2.3 Possible Cooperation with Other Donor Agencies and International Bodies

In order to promote environmentally sound recycling and a sustainable collection of E-waste in the ASEAN countries, JICA could collaborate with the following schemes to consider support for the ASEAN Countries in the field of E-waste management.

Table 9-3 Support by JICA and Potential Coordination Schemes

Leading body	Scheme	Major activities	Participating ASEAN Countries
Ministry of the Environment, Japan (MOEJ)	Regional 3R Forum in Asia [110]	Promotion of high level policy dialogues on 3R(reduce, reuse, recycle), dialogues and coordination on 3R projects with countries and international bodies, donor agencies, dissemination of 3R national strategies	Brunei, Cambodia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, Vietnam
	The Asian Network for Prevention of Illegal Transboundary Movement of Hazardous Wastes [111]	Sharing of information and knowledge on ESM of Hazardous Wastes (mainly E-waste) and effective implementation of the Basel convention [112]	Brunei, Cambodia, Malaysia, Philippines, Singapore, Thailand, Vietnam
Basel Convention	ESM project on E-waste in the Asia Pacific region	Implementation of various projects under the Basel Convention for capacity development on ESM of E-waste (Implemented on the basis of proposals from the various countries)	Project previously implemented by Cambodia, Indonesia, Malaysia, Thailand, Vietnam and BCRC-SEA

[110] Regional 3R Forum in Asia (http://www.env.go.jp/recycle/3r/en/forum_asia/index.html)
[111] The Asian Network for Prevention of Illegal Transboundary Movement of Hazardous Wastes (http://www.env.go.jp/en/recycle/asian_net/)
[112] Annual workshop of the Asian Network covers the state of E-waste recycling facilities in Asia, discussions on policies relating to ESM capacity development and various activities of the Asian countries. (http://www.env.go.jp/en/recycle/asian_net/Project_N_Research/PDF/asia%20ESM%20paper.pdf)

Leading body	Scheme	Major activities	Participating ASEAN Countries
	Mobile Phone Partnership Initiative (MPPI)	Preparation of a guideline on the collection, environmentally sound repair and recycling of used mobile phones.	Parties of the Basel Convention, Regional Centers, mobile phone manufacturers, recyclers
	Partnership for Action on Computing Equipment (PACE)	Collection of used computer appliances, Formation of a guideline on environmentally sound repair and recycling,, implementation of a pilot project[113]	Parties of the Basel Convention,, Regional Centers, PC manufacturers, recyclers
United Nations University (UNU)	Solving the E-waste Problem (StEP)[114]	Formulation of a comprehensive, realistic and scientific based solution of E-waste problem , E-waste academy (capacity development initiative)	Industry, government, international organizations, NGO, Academia (participants from ASEAN countries is not known)
UNEP	UNEP/IETC[115]	Promotion of waste management global partnership, Organizing workshop on information sharing relating to issues like challenges to take back system of E-waste[116].	Governments (Including ASEAN countries), EEE manufacturers, academia
UNCRD[117]	—	Formulation of 3R National Strategy in Asia, Investigation of measures against illegal transboundary movement of E-waste and for promotion of ESM	Governments (Including ASEAN countries), academia
OECD	Global forum on Environment[118]	Preparation and revision of guidance manual on EPR, Examining the application of EPR in the developing countries.	OECD and respective governments, academia, industrial bodies

In addition to the scheme above, the Basel Convention Regional Centre for South-East Asia (BCRC-SEA) is a center based in Jakarta and has a lot of experience of organizing workshops and conducting training relating to capacity development on E-waste management. Moreover, BCRC-SEA has a network of the competent authority responsible for hazardous waste management in the respective countries and has knowledge on the problems and policies of E-waste in the South East Asian countries. Hence, it will be very effective for JICA to coordinate with organizations like BCRC-SEA to utilize their resources when conducting awareness raising activities on E-waste issues and sharing good practice in the South East Asian region.

[113] The "National Stakeholder Meeting on E-waste", organized by KLH and BCRC-SEA -PACE members- was held as a back-to-back meeting with the 7th PACE working group meeting held at Jakarta during 27-29 May, 2014.Discussions were held between PACE members(governments, international organizations, and industry) and domestic stakeholders in Indonesia on the E-waste management regulation proposed by KLH.

[114] Solving the E-waste Problem (http://www.step-initiative.org/)

[115] UNEP International Environmental Technology Centre. (http://www.unep.org/ietc/) UNEP/IETC is based in Osaka, Japan. It acts as the central UNEP organization in the field of waste management

[116] Multi-stakeholder policy dialogue on E-waste management (http://www.unep.org/ietc/OurWork/WasteManagement/MeetingsWorkshops/E-wasteworkshopJuly2012/tabid/79644/Default.aspx)

[117] UNCRD (United Nations Centre for Regional Development) is based in Nagoya and in relation to E-waste has conducted a workshop on the Mekong sub region. (http://www.uncrd.or.jp/index.php?page=view&type=13&nr=4&menu=308)

[118] Indonesian and Malaysian governments also took part in the forum that was held at Tokyo in June 2014 (http://www.oecd.org/environment/waste/gfenv-extendedproducerresponsibility-june2014.htm)

9.2.4 Cooperation with Other Networks

a. Cooperation with Network of Researchers

In order to design a system to promote the model for collection and recycling of E-waste to the South East Asian countries based on Malaysia's experience, it is necessary to analyze the current status and future predictions of the generation and flow of E-waste and the cost associated with recycling and treatment in the respective countries. The National Institute for Environmental Studies (NIES) of Japan periodically organizes workshops on research work relating to E-waste problems. Researchers from IDE-JETRO/Japan (Institute for Developing Economies under Japan External Trade Organization), IGES/Japan (Institute for Global Environmental Studies), Chulalongkorn University/Thailand, Bandung Institute of Technology/Indonesia have also participated in these workshops and shared their latest research works. It is important to coordinate with the network of researchers like these and to conduct further studies in order to design a system for sustainable E-waste management.

b. Cooperation with Network of Manufacturers.

The EEE manufacturers play an important role in the formulation and implementation of E-waste management system. Japanese and Western manufacturers of PC, cell phones, white goods, OA equipments have established a group called Inforcomm and Technology Industry Group (ICT Group) in Singapore. The ICT Group is following the trend of regulations relating to environmental measures as well as collection and recycling of E-waste. The ICT Group also presents a unified voice in relation to the draft E-waste management regulation being drafted in Malaysia, Thailand, Indonesia and other Asian countries. Furthermore, there are cases when the E-waste collection campaigns are carried out in coordination with the company representatives of the respective countries. For example, even after the completion of the Penang pilot project, E-waste has been collected by Japanese companies and this activity was initiated by the person in charge of environmental affairs of a Japanese EEE manufacturer that is a part of Singapore based ICT group.

Hence, it is important to gain the cooperation of these industrial bodies for considering various measures relating to effective and practical E-waste management, providing recommendation to other countries, and raising public awareness through E-waste collection campaigns.

Annex

Annex

List of E-waste Full Recovery Facilities in Malaysia

State	Company	Contact Information
JOHOR	Chemalaya Sdn. Bhd.	Plo 128 Jalan Rimba 3 Tanjung Langsat Industri Complex , Pasir Gudang , Johor
	Estalco Sdn. Bhd.	Plo 616 Jalan Miel 1, Jalan Keluli 9, Kawasan Perindustrian Meil 4 , Pasir Gudang , Johor
	Hydro Metal (M) Sdn. Bhd.	Plo 59, Jalan Perak 1, Kawasan Perindustrian Pasir Gudang, 81700, Pasir Gudang , Pasir Gudang , Johor
	Infinity Recovery Sdn. Bhd.	No. 2, Jalan Cenderai 24,Taman Perindustrian Kota Puteri , Masai , Johor
	KHT Recycle Sdn. Bhd.	Ptd 34286 Jalan Wawasan 8 Kaw. Per. Sri Gading , Seri Gading , Johor
	Lima Jaya Paper Trading Sdn. Bhd.	No. 643, Jalan Idaman 3/9, Taman Desa Idaman, , Senai , Johor
	Metahub Industries Sdn.Bhd.	Lot 2247 & 2248, Jln Seelong Jaya 8, Seelong Jaya , Senai , Johor
	SMC Technology Sdn. Bhd.	Plo 31, Jln Perindustrian Pontian , Pontian , Johor
KEDAH	Hi-Tech Full Recovery (M) Sdn. Bhd.	Lot 4169, No 14, Lorong Perusahaan 3, Kaw Ind. Padang Meha, Kedah , Alor Setar , Kedah
MELAKA	Krubong Recovery Sdn. Bhd.	(2625 & 2630) Pt.1671 & Pt 1676,Kawasan Perindustrian Krubong , Melaka , Melaka
	Meriahtek (M) Sdn. Bhd.	No 1, Jalan Ttc 30, Lot 4827, 4828, 4831 & 4832, Taman Teknologi Cheng,Mukim Cheng , Melaka , Melaka
	Syp Recovery & Recycling Sdn. Bhd.	Lot 2833-2834, Kawasan Perindustrian Bukit Rambai, Mukim Tanjung Minyak, Melaka , Melaka , Melaka
	Victory Recovery Sdn. Bhd.	Lot 2211, 2212, 2213 & 2214, 2215,2216 Jalan Pk 11 Kawasan Perindustrian Krubong , Kerubong , Melaka
NEGERI SEMBILAN	Ega Recycling Sdn. Bhd. (Full Recovery) (Nsu)	Lot 29, Jalan Permata 1/1,Arab Malaysian Industrial Park , Nilai , Negeri Sembilan
	Kualiti Kitar Alam Sdn. Bhd.	Lot H.S. (D) 20487 P.T. 3292 Ldg Tanah Merah A3 Division Mk Jimah , Port Dickson , Negeri Sembilan
	Xantara Sdn. Bhd. (Pydt Bt)	Lot No. 3992 & 3993, No. 21 & 22 Lorong 3/1 Kawasan Perindustrian Senawang , Senawang , Negeri Sembilan
PERAK	Petromine (M) Sdn. Bhd. (Lot 25)	Lot 300735, No 25, Kawasan Perindustrian Gopeng, Fasa 3, 31600 Gopeng , Ipoh , Perak
	Sun Soon Yik Recycle Plastic & Metal Sdn. Bhd.	Lot 137249 & 137250 Halal Perusahaan Menglembu 16 , Ipoh , Perak
P.PINANG	Century Surf Sdn Bhd (Plot 157a)	Plot 157a, Lorong Perindustrian Bukit Minyak 7, , Bukit Mertajam , Pulau Pinang
	DD World Corporation Sdn Bhd (Fomerly Known As Quantum Refin	Plot 75, Jalan Perindustrian Bukit Minyak Taman Perindustrian Bukit Minyak , Bukit Mertajam , Pulau Pinang

State	Company	Contact Information
	Cycle Trend Industries Sdn. Bhd. (Bukit Minyak)	No. 1001, Plot 209b, Jalan Perindustrian Bukit Minyak Kawasan Perindustrian Bukit Minyak, , Bukit Mertajam , Pulau Pinang
	Jaring Metal Industri Sb	No 10 Jalan Iks Juru Jaya 14100 Simpang Ampat , Simpang Ampat(P) , Pulau Pinang
	Ming Engineering Plastic Sdn Bhd	Plot 71, Lorong Perindustrian Bukit Minyak 14 , Bukit Mertajam , Pulau Pinang
	Preference Megacycle Sdn. Bhd. (Plot 80a)	Plot 80a, Lorong Perindustrian Bukit Minyak 16 Kawasan Perindustrian Bukit Minyak , Bukit Mertajam , Pulau Pinang
	Reclaimtek (M) Sdn. Bhd.	Plot 88a, Jalan Perindustrian Bukit Minyak Kawasan Perindustrian Bukit Minyak , Bukit Mertajam , Pulau Pinang
	Shan Poornam Metals Sdn. Bhd.	Plot 34 (No. 1479), Lorong Perusahaan Maju 6 Kawasan Perusahaan Perai, Fasa 4 , Perai , Pulau Pinang
	TES-AMM (Malaysia) Sdn. Bhd.	No 2005, Tingkat Perusahaan 1 Kawasan Perusahaan Perai , Perai , Pulau Pinang
	Twinkle Metal (M) Sdn. Bhd.	No 1449, Lorong Perusahaan Maju 8, Plot 96, Kawasan Perusahaan Perai 4 , Perai , Pulau Pinang
SARAWAK	DNS Waste Management Sdn.Bhd.	Lot 880, Block 237 Knld, Kota Sentosa Industrial Park, Jalan Batu Kitang 93250 Kuching , Kuching , Sarawak
	Vita Recycle Sdn. Bhd.	Lot 1227, Blok 8, Demak Laut Industrial Park, Phase 11 A, Jalan Bako, 93050 Kuching Sarawak , Kuching , Sarawak
SELANGOR	ALH Industries Sdn Bhd	Lot 7832, 7833, 7834, 7835, Jalan Batu Tiga, Bukit Cherakah , Shah Alam , Selangor
SELANGOR	Benchmark Vista Sdn. Bhd.(Lot No. 6,Solok Sultan Hishamuddin	Lot No. 6, Solok Sultan Hishamuddin 7, Bandar Sultan Sulaiman, Selat Klang Utara, , Pelabuhan Kelang , Selangor
	Jaring Metal Industries Sdn Bhd (No.7, Shah Alam Selatan 2)	No.7, Jalan Sungai Kayu Ara 32/37 Taman Berjaya, Seksyen 32 , Shah Alam , Selangor
	Matsuda Sangyo (Malaysia) Sdn. Bhd.	Pt 511, Lot 62773 (Plot B), Persiaran Hulu Selangor, Seksyen 26, , Shah Alam , Selangor
	Metal Recovery Industries Sdn Bhd (Klang Utara)	Lot 6251-B, Batu 5 1/2, Jalan Kapar , Klang , Selangor

Agenda of the workshop

Agenda of the workshop

Sustainable Mechanism for Environmentally Sound Management of E-waste in Malaysia
(January 16, 2014)
Palm Garden Hotel in Putrajaya, Malaysia

1. Opening session(9:00-9:30)

- Remarks by DOE
- Roll call of the participants
- Objectives and expected goals of the workshop

Objectives of the workshop -To discuss what elements and measures to be in placed in the regulation for sustainable E-waste management in Malaysia -To provide the proper inputs for the E-waste model -To discuss what relevant activities are required for sustainable E-waste management

2. Session 1(9:30-12:00) (*Coffee Break 10:00-10:30)*

- Updates on the post Penang project and new projects in 5 states by DOE (9.30-10.00)
  - Current situation of the Penang project
  - Good practices and difficulties in the replicating projects in 5 states
  - Future direction of the projects

- Survey findings and issue raising by JICA Study Team(10.30-11.30)
  - Overall survey findings and explaining two incentive based collection models
  - Explaining what the good elements and shortcoming of the project

- Discussions(11.30-12.30)
  - How the E-waste collection model should be?
  - What are the difficulties?
  - What can be improved to promote the collection?
  - How the model can be more sustainable?

Dismiss for Lunch 12:30-14:00

3. Session 2 (14:00-16:00) (*Coffee Break 15:00-15:15)*

- Updates on EPR management regulation model and its schedule by DOE (14.00-14.30)
  - ✧ Explaining main comments made by stakeholders such as local governments, recyclers and industries

- Sustainable mechanism for E-waste and what model to follow by JICA Study Team
  - ✧ Overall framework concept and goals
  - ✧ Stakeholder responsibilities
  - ✧ Rule to be set in the regulation
  - ✧ Operational measures
  - ✧ Suitable elements in the mechanism

- Discussion on how the E-waste model should be
- E-waste models in other countries by JICA Study Team (if necessary)

4. Wrap-up session 16:00-17:00

- Discussing and identifying what to donext (developing to-do list)
  - ✧ Supporting work such as cost analysis

- ✧ Guidelines for collection and ESM of E-waste
- ✧ Action plans (activities along with the regulatory framework development)
- ✧ Roadmap
- ✧ Other relevant measures

- Discussing the development process
- Discussing way forward /future direction on sustainable E-waste management mechanism in Malaysia
- Discussing what relevant activities are required for sustainable E-waste management
- Recommendations

Dismiss at 17:00

Summary of the workshop
***only for internal use between DOE and JICA**

Sustainable Mechanism for Environmentally Sound Management of E-waste in Malaysia
January 16, 2014 9:00-16:30 Palm Garden Hotel in Putrajaya, Malaysia

Attendees:

DOEHQ	Datin Paduka Che Asmah Ibrahim, Khiruddin Bin Mohamad Idris, Nor Iwani Basri, Hazni
DOE Penang	Badlishah Bin Ahmad
DOE Johor	Sharifah Zakiah Bt Syed Sahab
MITI	Sofia
EPU	Irene Chung
JPSPN	Fadli
JICA Malaysia Office	OKUBO Kyoko, YOSHIZAWA Shinobu, Florence Tan Li Chin
JICA Study Team	KIKUHARA Junya, LC THENG, Makoto YAMASHITA, Osamu SAKAMOTO

Highlights of the workshop:

Overall regulatory framework:

- Regulatory framework was determined that involves stakeholders such as retailer, collector, manufacturer, recycler (dismantling facilities), recovery facility and DOE.
- Requirements for collector, recycler, and recovery facility as well as ESM (Environmentally Sound Management) criteria of E-waste for recycler and recovery facility need to be stipulated by DOE and documented in the form of guidelines.

Collection element:

- Collection center is to be set up for collecting E-wastes from consumers and collectors.
- E-waste collectors can be retailers, concessionaires, charity organizations, NGOs, and small collectors as long as they are registered based on requirements, which will be set by DOE.
- Small-scale collectors will continue the E-waste collection activity; however, they are not allowed for dismantling of E-waste. They are only allowed for selling them to formal recycler (dismantling facility).
- Reuse or reconditioning of the discarded E-waste is considered no issue as long as they do not cause secondary pollution.

Financial element:

- In the view of shared responsibility, consumers, manufacturers and recyclers all will bear the overall recycling cost required (Recycling fee from consumers, EPR fee from manufacturers and registration fee from collectors and recyclers).
  -It is necessary to examine precisely how much these fees should be.
- A recycling fund will be set up with the fees collected from the above three parties, then provide subsidy to licensed recyclers (mainly doing dismantling work).
  - It is necessary to consider how to set up such a fund, by referring to some other

existing fund structure available in Malaysia (such as the Employee Provident Fund)

- No refund to consumers is planned; however, some incentives to consumers are necessary, up to the market players such as retailers, collectors.

Recording/reporting element:

- Manufacturers have to provide the sales data regularly and information on hazardous substance contents and sales volume.
- Recyclers (dismantling facility) have to report what items, which brand, how many items have been received and recycled.
- Recovery facilities have to report the inventory of processed E-waste covered under the regulation.

Time lines:

- Formulate the first draft of the principle law by the first quarter of 2014, and to be submitted to Attorney General Chamber office for review.
- Supporting work such as guidelines development and cost analysis is preferably to be conducted in parallel for further brush up of the details before going to public comments and actual implementation.

Requiring assistance:

- Various activities such as guidelines development and analysis for appropriate E-waste recycling and transportation costs are some of the important & key activities which require the assistance, preferably from JICA.
- In order to apply for JICA's assistance, it is advisable for DOE to consult and notify both environment and international sections of EPU in advance to facilitate prompt consideration and necessary action taken for the request for technical cooperation for fiscal year 2014.
- Due to the budgetary constraint, the request may not be fully accepted and therefore prioritizing activities and the planning strategically on how the request to be made should be well considered.

Other matters:

- Involvements of other ministries, such as JPSPN, MITI, Ministry of Finance, etc. are necessary to establish the regulatory framework with EPR model, which ensures a sustainable mechanism for environmentally sound management of E-waste.
- In order to notify the industries, DOE will arrange informative meetings with representatives from industries, such as FMM (Federation of Malaysian Manufacturers) and JACTIM (Japanese Chamber of Trade & Industry, Malaysia).

<u>To-do list</u>:

- To brush up the proposed system framework diagram
- To conduct supporting work, such as cost analysis for developing a feasible regulation
- To assist in development of guidelines for sustainable and environmentally sound collection, recycling and recovery of the E-waste
- To assist in development of activity plan along with the regulatory framework

development, which includes;

-Identifying responsibilities for all the stakeholders

-Requirements for various activities

-Establishing reporting and monitoring procedures

- To organize stakeholder consultation meetings with manufacturers and others (can be happened now on)
- To study other available model on the proposed recycling fund, the way of managing the fund and institutional setup etc.