UNEP

E-WASTE
VOLUME III

WEEE/E-WASTE "TAKE BACK SYSTEM"

UNITED NATIONS ENVIRONMENT PROGRAMME

Disclaimer

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the United Nations Environment Programme concerning the legal status of any country, territory,
city or area or of its authorities, or concerning delimitation of its frontiers or boundaries. Moreover, the views expressed do not necessarily represent the decision or the stated policy of the United Nations Environment Programme, nor does citing of trade names or commercial processes constitute endorsement.

E-waste

Volume III: WEEE / E-waste "Take-back system"

Compiled by

United Nations Environmental Programme
Division of Technology, Industry and Economics
International Environmental Technology Centre
Osaka

Preface

Waste Electric and Electronic Equipment (WEEE) or E-waste is one of the fastest growing waste streams in the world. In developed countries, it equals 1% of total solid waste on an average. The increasing “market penetration” in developing countries, “replacement market “in developed countries and “high obsolescence rate” make WEEE/E-waste one of the fastest waste streams. There is a pressing need to address E-waste management particularly in developing countries. The presence of valuable recyclable components attracts informal and unorganized sector. The unsafe and environmentally risky practices adopted by them pose great risks to health and environment.

For effective WEEE/E-waste management, we need to quantify and characterize this waste stream, identify major waste generators. And assess the risks involved. A scientific, safe and environmentally sound management system, including policies and technologies, need to be developed and implemented.

International Environmental Technology Centre (IETC) of Division of Technology, Industry and Technology (DTIE) of United Nations Environment Programme is assisting member countries on Integrated Solid Waste Management (ISWM). IETC is also focusing on WEEE/E-waste management as a part of ISWM. As an initial step, to build the capacity, IETC has produced two manuals on WEEE/E-waste to assist the member countries and their cities to develop the inventories and WEEE/E-waste management systems.

Two manuals have been published on “E-waste Inventory” and “E-waste Management”. The first manual was prepared as a guidance document to support WEEE/E-waste inventorisation and assessment risks involved. The second manual gave guidance to develop and implement WEEE/E-waste management system.
These manuals are available at :
http://www.unep.org/ietc/Portals/136/Publications/Waste%20Management/EWasteManual_Vol1.pdf
http://www.unep.org/ietc/Portals/136/Publications/Waste%20Management/EWasteManual_Vol2.pdf

The third manual of this series was created to serve as guidance for the practitioners and decision makers in understanding, planning, designing and implementing WEEE/E-waste take-back schemes at a national and local level.
In order to support development of policy framework and capacity building on WEEE/E-waste at national and local level, a training workshop on WEEE/E-waste management was held in Osaka, Japan, on 13-15 July 2011. This workshop was attended by national governments, international organizations, the private sector and civil society. The outcome of the workshop identified a need to build the capacity and policy framework on WEEE/E-waste “take back” system and financial mechanism to sustain this system. The results of the review and comments received have subsequently been reflected in this document. Along with the previous two manuals, it will assist stakeholders in understanding the various aspects of take-back system for E-waste including the financial mechanism and policy framework. With the lessons learned from case studies of different countries, it could be utilized for building and implementing a successful WEEE/E-waste management chain. The case studies are included as learning materials.

This manual is aimed as a living document and practitioners and policy makers are highly encouraged to provide their feedback, which will be incorporated into its next edition.
We thank Mr. Amit Jain, an expert on WEEE/E-waste, who is main author for this publication. We also thank Ms. Naoko Tojo, Associate Professor, Lund University, Global Environment Centre Foundation (GEC) and other individuals and entities for their efforts and time to provide comments and contributed studies. We also thank participants of WEEE/E-waste workshop on “Take-back System for WEEE/E-waste Management” in Osaka, Japan.

Table of Contents

List of Tables

List of Figures

Acronyms

ADB	Asian Development Bank
AEHA	Association for Electrical Home Appliances
APME	Association of Plastic Manufacturers in Europe
ARF	Advance Recycling Fee
ASEM	Advisory Services in Environmental Management
ATF	Authorized Treatment Facility
B2B	Business to Business
B2C	Business to Consumer
B&W	Black and White
BATRRT	Best Available Treatment, Recovery and Recycling Techniques
BPO	Business Process Organization
BCRC	Basel Convention Regional Centre
CPU	Central Processing Unit
CRT	Cathode Ray Tube
CFC / HCFC	Chlorofluorocarbon / Hydrochloroflorocarbons
HFC / HC	Hydrofluorocarbons / Hydorcarbons
CSO	Civil Society Organizations
CTV	Color Television
DCF	Designated Collection Facility
DEFRA	Department of Environment, Food and Rural Affairs
DfR	Design for Recycling
DTIE	Division of Technology, Industry, and Economics
EEA	European Environment Agency
EEE	Electrical and Electrical Equipment
EH&S	Environmental Health and Safety
EIC	Environmental Information Centre
EMPA	Swiss Federal Laboratories for Material Testing and Research
EOL	End of Life
EPR	Extended Producer Responsibility
ESM	Environmentally Sound Management
EST	Environmentally Sound Technologies
EU	European Union
FR	Flame Retardant
GDP	Gross Domestic Product
IC	Integrated Circuit
ICT	Information and Communication Technology
IETC	International Environmental Technology Centre
IRGSSA	IRG Systems South Asia Pvt. Ltd.
ISWM	Integrated Solid Waste Management
IT	Information Technology
Kg	Kilogram
LCD	Liquid Crystal Display
L/D	Length/ Diameter
MCIT	Ministry of Communication and Information Technology, India
MFA	Material Flow Analysis
MIT	Massachusetts Institute of Technology
MNC	Multi National Companies
MOU	Memorandum of Understanding
MoEF	Ministry of Environment and Forest, Government of India
MPPI	Mobile Phone Partnership Initiative
MSWI	Municipal Solid Waste Incineration
MT	Metric Tonnes
NCR	National Capital Region
NGO	Non Governmental Organization

ODS	Ozone Depleting Substance
OEM	Original Equipment Manufacturer
PC	Personal Computer
PCB	Printed Circuit Board
PCB-capacitors	Poly chlorinated biphenyl - capacitor
PRO	Producer Responsibility Organizations
PVC	Poly Vinyl Chloride
PWB	Printed Wire Boards
ROHS	Restriction on Hazardous Substance
RPM	Revolutions per Minute
SAEFL	Swiss Federal Agency for Environmental, Forests and Landscapes
SBC	Secretariat for Basel Convention
StEP	Solving the E-waste Problem
TV	Television
UNCTAD	UN Conference on Trade and Development
UNEP	United Nations Environment Program
USA	United States of America
Vs	Versus
WEEE	Waste Electrical and Electronic Equipment

Executive Summary

Recognizing the rapidly emerging and serious issue of Waste Electrical and Electronic Equipment (WEEE) or E-waste management, this manual on WEEE/ E-waste has been prepared as a guidance document to support development and implementation of WEEE/E-waste management system. This manual has been prepared based on data from secondary sources including publications from scientific journals, reports and web sites.

The challenges of the WEEE/E-waste management that the countries are facing involve the design of WEEE/E-waste take-back system along with the financial mechanisms to sustain it.

Countries that already have WEEE/E-waste regulations often encounter difficulties when putting the regulations in practice. The difficulties are derived from lack of mechanisms in the flow of WEEE/E-waste in the WEEE/E-waste life cycle. They feel the need to plan and adopt the most effective collection and transport systems to accompany the regulatory systems.

This manual covers essential components to plan, design and implement a take-back system at local and national level.

For the take-back system, the efficient collection and transport of WEEE/E-waste can be achieved by surveying the waste trade and material flow and identifying necessary mechanism to minimize handling, to use adequate means, etc.

The fundamental principle for development of E-waste policies/laws/regulations is based on the conceptual life cycle of WEEE/E-waste. Regulatory systems and identification of stakeholders and their responsibilities are important as they provide foundation and underpin the take-back schemes.

The financial viability of all the stage of WEEE/E-waste management chain is vital for its implementation. Therefore, the allocation of economic responsibilities should be defined and should find its application that best matches the country's conditions. Examples can be drawn from current models for financing E-waste tack-back activities in use.

Finally, case studies and information is provided on different approaches and regulations that will enhance the practitioner's knowledge in WEEE/E-waste management, especially the take-back mechanism in both developed and developing country contexts.

Chapter 1: Introduction

1.0 Introduction

The United Nations Environmental Programme (UNEP) through the Division of Technology, Industry, and Economics (DTIE) of the International Environmental Technology Centre (IETC) is implementing integrated solid waste management (ISWM) based on the 3Rs (reduce, reuse and recycle) in urban areas of the Asia-Pacific region as well as Africa and Latin America. This project aims to promote identification and implementation of environmentally sound technologies (ESTs) within the elements of the ISWM chain, including collection, segregation, transport, treatment, disposal and recovery and recycling. ISWM covers all types of waste, including domestic, municipal and industrial waste electrical and electronic equipment (WEEE) and electronic and electrical waste (E-waste), in an integrated manner. UNEP-DTIE-IETC also focuses on electronic waste (WEEE/E-waste) management as a part of its Integrated Solid Waste Management Project. This work complements the global and regional work on WEEE/E-waste being implemented by UNEP as well as by the Secretariat of the Basel Convention (SBC) and other secretariats of multilateral environmental agreements.

Against this backdrop, two manuals, (i) a WEEE/E-waste Assessment Manual and (ii) a WEEE/E-waste Management Manual, have been prepared and pilot tested in Asia. In order to support the development of a policy framework and capacity building on E-waste at the national and regional levels, a regional workshop on E-waste management for countries in Asia was organized by UNEP-DTIE-IETC in Osaka, Japan on 6-9 July 2010. This workshop was attended by representatives of central governments, international organizations, the private sector and civil society. The workshop identified the challenges involved in designing WEEE/E-waste take-back systems along with the financial mechanisms to sustain the systems. The workshop highlighted that the majority of countries that already have WEEE/E-waste regulations in place are struggling to design optimum WEEE/E-waste take-back systems.

In this context, a draft of a third manual, addressing WEEE/E-waste take-back systems, was developed as a continuation to manuals 1 and 2 in the series. This draft manual was presented at a regional workshop organized by UNEP-DTIE-IETC in Osaka, Japan on 13-15 July 2011. The draft manual was subsequently revised and recompiled to reflect the results of a peer review as well as comments received. Reflecting the compilation of this manual over time, references within this manual to the EU's WEEE Directive are to the WEEE Directive of 2003 (2002/96/EC), rather than the recast Directive that came into force in 2012.

This third manual focuses on WEEE/E-waste collection, transport and the financial mechanisms for funding these efforts. The various components of this manual are given below.

1.1 Objectives

This manual is intended to build the capacity of practitioners and decision makers to guide and assist them in understanding, planning, designing and implementing WEEE/E-waste take-back schemes for use by cities or other localized areas or for use at a nation-wide level.

1.2 Scope

The scope of this manual covers descriptions of various components including regulatory systems and collection and transport systems, along with financial aspects and case studies of schemes currently underway. Each component comprises a chapter, with guidance notes and examples at the end. This manual was prepared through collecting data from scientific journals, reports, web sites and other secondary sources. A case study-based approach has been adopted to provide the practitioner examples of schemes currently being implemented to facilitate adoption, whether by a city or other localized area or by a country. This manual should find application in all countries that have initiated WEEE/E-waste projects.

1.3 Format

The manual has six chapters. Chapter 1 overviews the rationale for developing this manual and then describes the manual's objectives, scope and format. Chapter 2 provides an overview of WEEE/E-waste management. This chapter surveys WEEE/E-waste trade as well as its mechanisms and material flow and then explores components of WEEE/E-waste management, with particular focus on collection and transport systems and mechanisms. The chapter highlights key elements of WEEE/E-waste collection and transport systems as well as the mechanisms by which these systems operate. Chapter 3 outlines the regulatory systems underpinning take-back schemes in various countries and identifies their notable features while also examining the common elements that provide the foundation for designing take-back schemes. Chapter 4 delineates the primary modes for collection and transport and their associated mechanisms and then identifies stakeholders and their responsibilities. Chapter 5 describes different models for financing E-waste take-back activities currently in use and then overviews the allocation of economic responsibilities in countries seeking to design potential take-back system architectures. These models identify relationships between stakeholders (i.e. between producers, other actors within the compliance scheme such as waste collectors and transporters and final users) and the level of responsibility held by the system managers. Major guidance on each model is provided through the design of a financial or economic instrument together with how it is applied within the model. Chapter 6 provides two take-back system case studies, one in a developed nation (Europe) and one in a developing nation (Thailand).

Chapter 2: General Overview of WEEE/E-waste Management

2.0 Introduction

WEEE/E-waste is a complex mixture of hazardous and non-hazardous waste requiring specialized segregation, collection, transport, treatment and disposal. Against this backdrop, this chapter overviews the collection and transport systems as key components driving the overall efficiency of WEEE/E-waste management systems. In this context, there is a need to understand WEEE/E-waste segregation, collection and transport as parts of an overall WEEE/E-waste management system described earlier in UNEP's *E-waste Manual 2*. Since collection and transport are involved in each step of the material flow during WEEE/E-waste trade, each has been summarized below, followed by a description of the components of WEEE/E-waste management and elements of WEEE/E-waste collection and transport systems. These elements form the basis of WEEE/E-waste take-back systems. The stakeholders involved are also noted below, followed by guidance notes.

2.1 Mechanism of WEEE/E-waste Trade

Three elements encapsulate the mechanism of WEEE/E-waste trade, specifically:

1. Material flow
2. Life cycle
3. Geographical boundary

The following sections provide the basis for understanding the role of WEEE/E-waste collection and transport within waste management, from WEEE/E-waste generation through its transformation into new materials.

2.2 WEEE/E-waste Life Cycle

Figure 2.1 depicts the conceptual life cycle of electrical and electronic equipment (EEE).

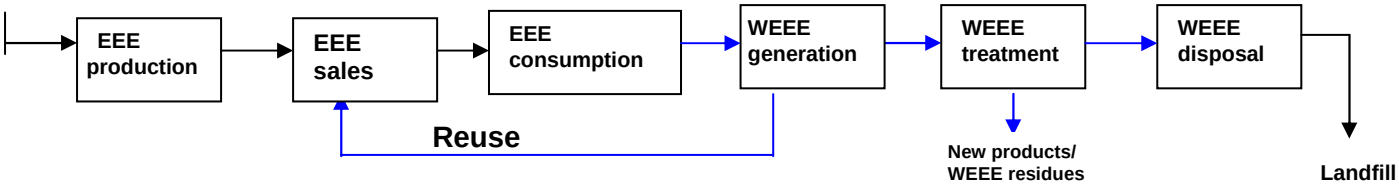


Figure 2.1: Conceptual life cycle of electrical and electronic equipment[1]

[1]Compiled from UNEP, 2007. *E-waste Volume 1, Inventory Assessment Manual,* Figure 3.1: Conceptual Life Cycle of Electrical and Electronic Equipment

The establishment of a material flow within a geographical boundary assists in identifying networks or chains that connect different phases of the life cycle of electrical and electronic equipment with associated stakeholders. Once the chain becomes established, the material flow balance—that is, the input or output balance in each phase—forms the basis of quantifying WEEE/E-waste in the life cycle, with collection and transport being major factors impacting the input/output balance. The arrows in blue indicate the role of collection and transport as factors within the input or output balance.

2.3 WEEE/E-waste Material Flow Model

The WEEE/E-waste material flow model developed by the European Topic Centre on Waste and Material Flows shown in Figure 2.2 highlights various phases of waste management. The model's noteworthy features are that:

1. The model is based on the unit process approach, in which a unit process represents processes or activities.

2. The material flow model considers all unit processes and flows within a defined boundary. Arrows indicate the flow of material linking the unit processes.

3. There are two different kinds of unit processes: Type 1 receives material without any alteration and has no conversions. Therefore, the input is equal to the output for instant use and collection of electrical and electronic equipment. In Type 2, a conversion of materials takes place, thus creating new materials (products, waste, etc.) e.g. treatment of WEEE/E-waste including dismantling/ incineration/ smelting etc.

4. The boundary is the interface between the existing system and the external environment or other systems

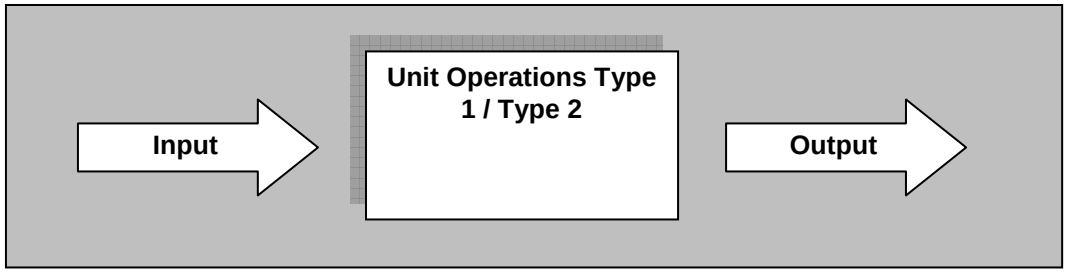


Figure 2.2: Conceptual WEEE/E-waste material flow model[2]

[2]EEA Copenhagen, 2003. *Waste from electrical and electronic equipment (WEEE) – Quantities, dangerous substances and treatment methods*

Phase I:

Unit operations, processes and activities: Production and sales of electrical and electronic equipment, including the import, export and input of equipment for re-use and in the repair of WEEE/E-waste.

Phase II:

Unit operations, processes and activities: Consumption of electrical and electronic equipment and the use of electrical and electronic equipment in households, offices and industries.

Phase III:

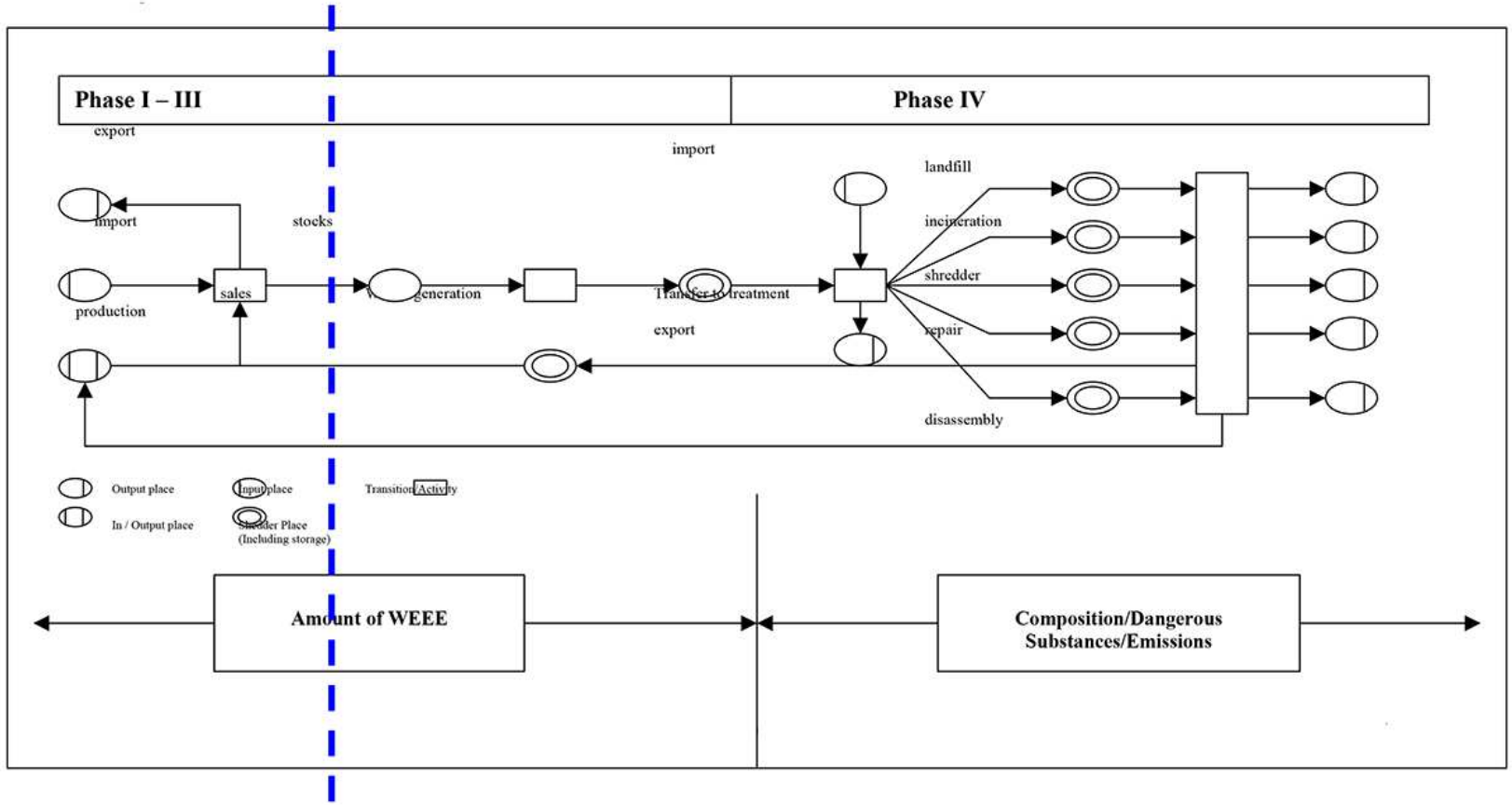
Unit operations, processes and activities: Collection of end-of-life electrical and electronic equipment, including transfer to treatment and disposal sites as well as the import and export of such equipment.

Phase IV:

Unit operations, processes and activities: Treatment and disposal alternatives for WEEE/E-waste, e.g. repair, decontaminating, dismantling, shredding, landfilling and incineration.

Collection and transport are thus major aspects of each of the four phases. Therefore, collection and transport in the course of the material flow become major factors in the input and output functions of each phase under the four-phase model. Figure 2.3 indicates the major roles of collection and transport in blue arrows in Phase III and to a limited extent in Phases II and IV. These roles are broken down in Table 2.1.

Figure 2.3: The Four-Phase Model[3]



[3] Prepared from EEA Copenhagen, 2003**.** *Waste from electrical and electronic equipment (WEEE) – Quantities, dangerous substances and treatment methods*

Table 2.1: Phase-wise life cycle of electrical and electronic equipment[4]

Phase II – Consumption	
The design of the model in phase II based on mass consumption of EEE. *After a certain time span (average life time 't') the end-of-life goods are passed on for collection.* It is assumed that during consumption no losses occur and no conversion of material takes place. The model does not consider the servicing of equipment, replacement of parts, etc. Therefore Input = Output.	Input/output for consumption: Input (t) = output sales (t) – export (t) Output (t) = WEEE generated (t)
Phase III – Collection	
The design of the model in phase III requires that a mass or large number of EEE be collected after the consumption period. It is assumed that during collection no losses occur and no conversion of material takes place. The import of WEEE/E-waste must also be considered.	Input/output for collection: Input (t) =WEEE generated after consumption (t) + import of end-of-life EEE (t) Output (t) = end-of-life goods transferred to disposal/treatment/reuse [possibilities 1 ….n (t)] + export (t)
Phase IV – Treatment and disposal	
The design of the model in phase IV requires that a mass or large amount of WEEE/E-waste be collected and transferred to the various treatment and disposal activities. During this phase, a conversion or transition of WEEE/E-waste takes place, thus creating new materials (fractions, components, dangerous substances). In phase IV the model has to be designed for each specific type of treatment and disposal, taking into account the material input and the conversion of the material. Output depends on the conversion and transition of the material and leads to specific transfer factors.	Note: Treatment and disposal comprise one, two or even successive steps using different technologies. The formula for this phase can be developed depending on the level of treatment and disposal.

The major factors relevant to collection and transport identified in the phases contained in Table 2.1 are given below.

- *Phase II (Consumption)* – End-of-life goods

[4] EEA Copenhagen, 2003. *Waste from electrical and electronic equipment (WEEE) – Quantities, dangerous substances and treatment methods*

- *Phase III (Collection)* – A mass or large number of goods; during collection no losses occur and no conversion of material takes place.

- *Phase IV (Treatment and disposal)* – The design of the model in phase IV requires a mass or large amount of WEEE/E-waste collected and transferred to the various treatment and disposal activities.

It may be noted that all the mathematical formulations related to these factors during the three phases given in Table 2.1 are functions of time. Therefore, these formulations require the following data for a particular geographical region, city, or country with respect to time. The time factor could be daily, monthly, annually or historically.

1. Local WEEE/E-waste generation data
2. Imported WEEE/E-waste data
3. WEEE/E-waste collected and transported
4. WEEE/E-waste transferred for disposal, treatment, or reuse

Table 43 of the *2008 Review of Directive 2002/96 on Waste Electrical and Electronic Equipment* – Study No. 07010401/2006/442493/ETU/G4, gives an example of collection performance based on these factors. The amount of E-waste generated locally and imported always exceeds the amount of WEEE/E-waste collected and transported.

The same table indicates that the collection efficiency of WEEE/E-waste varies across countries in the EU, Switzerland, Norway and Japan when benchmarked against the target of 4 kg/inhabitant. The benchmark value was estimated to be approximately 25% of the average WEEE/E-waste generation in EU. This indicates that the collection and transport systems for WEEE/E-waste are dependent upon WEEE/E-waste generation as well as with WEEE/E-waste targets set for collection and transport during a specific time period. Further, the performance of treatment, reuse and disposal is dependent on collection efficiency.

2.4 Components of WEEE/E-waste Management

Phases II, III and IV of the material flow model define the three major components of WEEE/E-waste management systems, namely:

1. WEEE/E-waste collection, sorting and transport systems
2. WEEE/E-waste treatment system
3. WEEE/E-waste disposal system

WEEE/E-waste collection, sorting and transport systems are the key link between WEEE/E-waste generation and treatment, reuse and disposal and these systems' operational efficiency is dependent on their management systems and the stakeholders responsible for their management. Their respective management systems consist of producer and retailer take-back

systems, municipal collection systems and recyclers' and dismantlers' collection systems. The responsible stakeholders may be producers, municipalities, recyclers or dismantlers, transporters and collection centres. Since WEEE/E-waste is hazardous in nature, it is collected, sorted, stored and transported under controlled conditions. Each municipality or WEEE/E-waste management department has its own WEEE/E-waste collection and storage centers. The collection means will vary in accordance with distances, rural or urban patterns, and the size of the collected items. Some categories will require specific collection methods like flatbed collection (for fridges and other reusable household appliances). Therefore, an understanding of the various elements of collection and transport systems is required before such systems can be designed and implemented.

2.5 Elements of WEEE/E-waste Collection and Transport Systems

Efficient WEEE/E-waste collection and transport systems will ensure reuse, recycle and adequate WEEE/E-waste management, including avoiding damaging or breaking components that contain hazardous substances.

- accessibility and efficiency of the collection facilities
- minimization of movement of collected items
- minimization of manual handling
- the means by which hazardous substances are removed
- separation of reusable appliances
- adequacy and consistency in the information provided to users.

A literature survey reveals that in the EU, WEEE/E-waste in general is sorted or separated into five groups as given below, in accordance with the waste's material composition and treatment categories. Such separation facilitates collection, recycling and data monitoring for compliance.

Group 1: Refrigeration equipment — Due to usage of ozone depleting substances, such equipment is separated from other WEEE/E-waste.

Group 2: Other large household appliances — Because these appliances are shredded with end-of-life vehicles and other light iron, they are separated from other waste.

Group 3: Equipment containing cathode ray tubes (CRTs) — The CRTs need to remain intact for health and safety reasons. Therefore, TVs and computer monitors are collected separately from other waste and handled carefully.

Group 4: Lighting (linear and compact fluorescent tubes) — Lighting needs to be deposited in a special container (due to mercury) to ensure it does not contaminate other waste or be recycled.

Group 5: All other WEEE — This equipment can be collected in the same container because it does not pose special challenges during recycling nor does it involve special health or safety concerns.

Figure 2.4 indicates the mapping of different components of the collection and transport systems onto the conceptual life cycle of electrical and electronic equipment. The major options of the collection and transport systems are given below.

Option 1: Producers' take-back systems cover the entire life cycle of electrical and electronic equipment, starting from EEE production and extending until WEEE/E-waste disposal.

Option 2: Retailers' take-back systems form a subset of the producers' take-back systems.

Option 3: The municipal collection and transport system range starts with WEEE/E-waste generation and ends with WEEE/E-waste disposal. This system does not include the upstream of EEE consumption.

Option 4: The recyclers' or dismantlers' collection and transport system range starts with WEEE/E-waste generation and ends with WEEE/E-waste disposal.

Table 2.2 gives examples of combinations currently in use in the EU under extended producers' responsibility.

Table 2.2: Allocation of responsibility in the EU for the collection of WEEE from private households[5]

Member state	Physical responsibility	Financial responsibility
Austria	D/M/P	D/P
Belgium (Brussels)	D/M	D
Bulgaria	P	P
Cyprus	P	P
Czech Rep.	D/P	D/P
Denmark	M	M
Estonia	D/P	D/P
Finland	D/M/P	P
France	D/M/P	D/P
Germany	M	M
Greece	P	P
Hungary	P	P
Ireland	D/M	D//P
Italy	D/M	D/M
Latvia	P	P
Lithuania	D/M/P	P
Luxembourg	D/M	D/M
Malta	D/P	D/P
Netherlands	D/M	D/M
Poland	D	D
Portugal	D/M/P	D/P
Romania	M	M
Slovakia	D/P	D/P
Slovenia	D/M	D/M
Spain	D/M	P
Sweden	P	P
UK	D/P	D/P

D = Distributor/retailer; M = municipality; P = producer (Note that these definitions vary under the national and European approaches)

Table 2.2 indicates that physical responsibility for collection and transport of WEEE/E-waste may lie exclusively with distributors/retailers, municipalities or producers, or it may lie with various combinations of these three. Similarly, financial responsibility, i.e. responsibility for financing the establishment and operation of the collection and transport infrastructure, may rest exclusively with one of the three, or it may rest with various combinations of the three.

[5] 19 August 2007. *The Producer Responsibility Principle of the WEEE Directive, Final Report*, Table 9 – http://ec.europa.eu/environment/waste/weee/

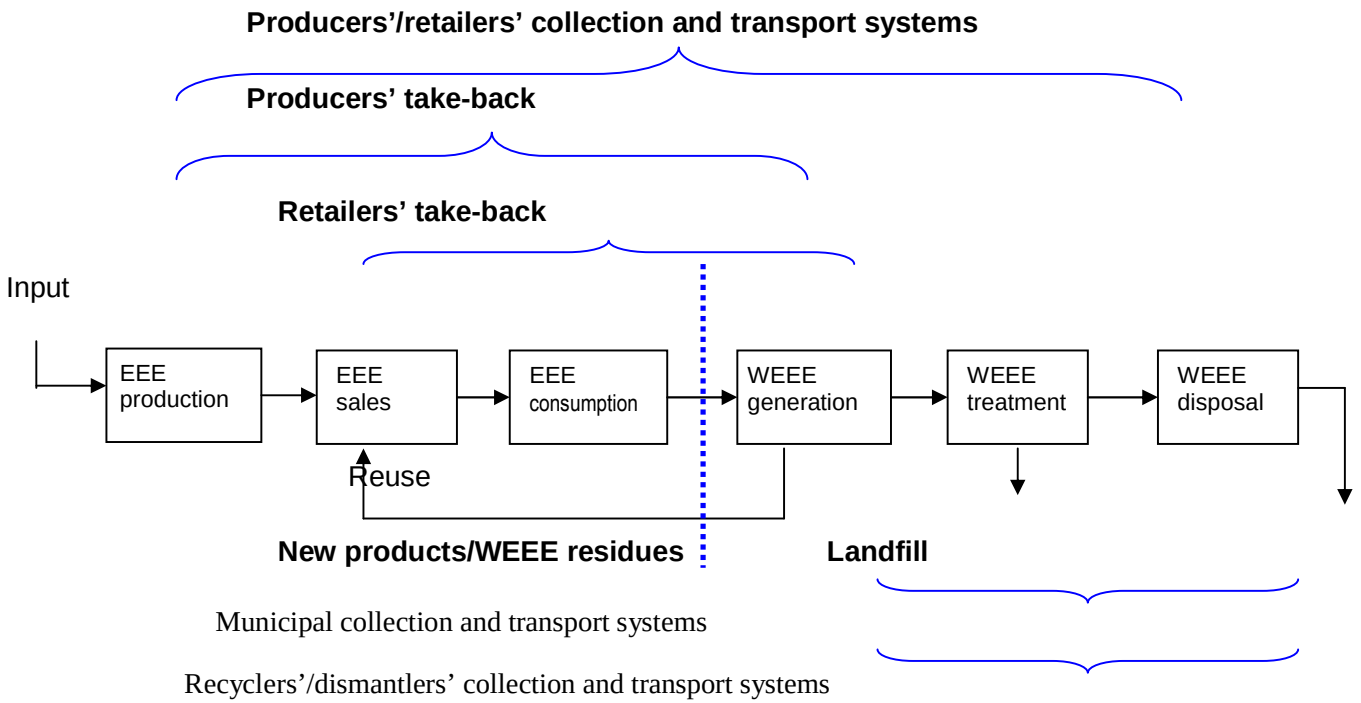


Figure 2.4: WEEE/E-waste collection and transport systems[6]

[6] Compiled from UNEP, 2007, *E-waste Volume 2*

2.6 Major Stakeholders

Major stakeholders along the flow include importers, producers/manufacturers, retailers (businesses, government and others), consumers (individual households, businesses, government and others), traders, retailers, scrap dealers, dissemblers/dismantlers and recyclers. At each step in the flow, a business transaction defines the movement of the electronic or electric item. Each of these stakeholders is overviewed below.

Manufacturers, distributors and retailers

WEEE/E-waste from this sector comprises defective electrical and electronic equipment (EEE) generated during the production process. It also includes defective EEE under guarantee procured from consumers as replacement items or items which fail quality tests. Manufacturers are responsible to take back these items under extended producer responsibility.

Importers

Huge quantities of WEEE/E-waste like monitors, printers, keyboards, CPUs, typewriters, projectors, mobile phones, PVC wires, etc. are imported. These items include all ranges, models and sizes and include functional as well as junk materials.

Individual households

Most households do not sell obsolete WEEE/E-waste directly to the scrap market. The preferred practice is to exchange it at a retailer upon purchasing a new computer, or pass it to relatives or friends. In the former case, it is the retailer's responsibility to dispose of the computer.

Business sector and the government

The business sector (government departments, public or private sector, MNC offices, etc.) was among the earliest users of IT and IT products and today it accounts for a sizable amount of total installed ICT equipment. The incompatibility of old systems with present needs and requirements prompts entities in this sector to pass the obsolete electrical and electronic equipment to dismantlers or recyclers, who pick up these items through auctions or other standard business practices.

Dissemblers/dismantlers

Immediately after securing WEEE/E-waste from various sources, dismantlers decide which items ought to be dismantled and which should be retained for resale. This decision is based on the resale potential of second-hand products. The not-for-resale WEEE/E-waste item components find their way to storehouses for dismantling. During dismantling, each item is dismantled in accordance with the building blocks described in section 3.1 of *WEEE/E-waste Manual 1* and segregated, leading to different WEEE/E-waste fractions.

Recyclers

In developed countries, recycling operations may be combined with the dismantling operation in integrated facilities, or alternatively, dismantlers may carry out the operation and segregate the fractions to send them to large-scale smelters for material recovery. Generally these

stakeholders are not concentrated in a single place, but spread over different areas, each handling a different aspect of recycling.

Individual households and the business or government sector are the consumers of EEE and therefore the generators of WEEE/E-waste. Since the behavior of these two types of consumers differs, the collection mechanism also differs, even though the regulatory regime governing the process is the same.

2.7 Guidance Notes

Objective: The major objective of these guidance notes on WEEE/E-waste management is to assist in the assessment of collection and transport requirements under WEEE/E-waste management in a city or other geographical region. This assessment will serve as a foundation for planning and implementing a formalized WEEE/E-waste take-back system in that city or geographical region.

Guidance procedure: The guidance procedure includes completing the following seven steps.

Step 1: Determine the WEEE/E-waste trade value chain within a city or geographic region using the guidance notes provided in *WEEE/E-waste Manual 1*. The output of this step will give complete background information on current WEEE/E-waste management.

Step 2: Determine existing and future WEEE/E-waste inventories on an item-by-item basis within a city or geographic region using the guidance notes provided in *WEEE/E-waste Manual 1*. The output of this step will give a baseline and establish the collection target for the anticipated WEEE/E-waste to be collected, segregated, transported, treated and finally disposed of. Establishing the target is a major task since it requires the concurrence of major stakeholders (e.g. producers, recyclers, etc.) and other stakeholders identified in section 2.6.

Step 3: Determine the content of WEEE/E-waste inventory on an item-by-item basis, using guidance notes described in *WEEE/E-waste Manual 1*. The output of this task will give information on the quantity and type of hazardous WEEE/E-waste that needs to be collected, segregated, transported, treated and finally disposed of.

Step 4: Determine the existing and proposed capacity requirements for the treatment and disposal of WEEE/E-waste quantities on an item-by-item basis. This information will provide a foundation for matching existing and proposed treatment capacity with collection and transport requirements.

Step 5: Determine the existing collection and transport options given in section 2.5 to address anticipated WEEE/E-waste quantities by using the template given in Table 2.3. It may be noted that certain elements of the collection and transport system are common to all countries. The objective of this step is to identify and map the options in order to design and implement a collection and transport system under a take-back mechanism.

Table 2.3: Collection and transport option analysis

WEEE/E-waste quantity	Options Option 1 (Y/N)	Option 2 (Y/N)	Option 3 (Y/N)	Option 4 (Y/N)
(e.g. 2012/4000 CRT	**N**	**N**	**Y**	**Y)**
Year/quantity				
Year/quantity				
Year/quantity				
Year/quantity				
Year/quantity				
Year/quantity				
Year/quantity				
Year/quantity				

Note: Indicate 'Y' for 'yes' and 'N' for 'no'

The outcome of this analysis will give insight into the type of collection system(s) in place and the major stakeholders involved within a geographical boundary (e.g. retailer take-back systems exist in some countries). After collection of the WEEE/E-waste, the retailers may store it and later divert it to recyclers or dismantlers. Identifying this type of linkage within the collection mechanism assists in further development of the WEEE/E-waste take-back mechanism.

Step 6: Determine the existing collection and transport infrastructure under each option and identify the cost of transport by using the template given in Table 2.4. This information provides an understanding of the following elements that are required when designing the collection and transport infrastructure.

- The area of the collection points vs. the volume of WEEE/E-waste currently being collected;
- The number and geographical distribution of collection points catering to different types of consumers; and
- The costs and who incurs those costs.

Table 2.4: Collection and transport infrastructure and costs

WEEE/E-waste quantity / options		
Option 1	No. of collection points	
	Total area (m^2)	
	Cost of transport ($/ton)	
Option 2	No. of collection points	
	Total area (m^2)	
	Cost of transport ($/ton)	
Option 3	No. of collection points	
	Total area (m^2)	
	Cost of transport ($/ton)	
Option 4	No. of collection points	
	Total area (m^2)	
	Cost of transport ($/ton)	

Chapter 3: Policy Framework for WEEE/E-waste Management

3.0 National and Social Policies, Laws, Regulations and Institutional Roles in Developed Countries

Policies, laws and regulations related to WEEE/E-waste management provide the institutional framework for its implementation. Countries in Europe and Japan have been forerunners in formulating and then institutionalising and implementing such policies, laws and regulations. The following sections describe policies, laws and regulations governing WEEE/E-waste management and highlight institutional mechanisms in place in selected developed and developing countries.

3.1 Scope of WEEE/E-waste under Different Jurisdictions

3.1.1 Scope of WEEE/E-waste under the WEEE Directive and the Basel Convention

E-waste policies, laws and regulations are based on the conceptual life cycle of electrical and electronic equipment (EEE) given in Figure 2.1.

The major features of policies, laws and regulations in this area are twofold: firstly, how WEEE/E-waste is defined, and secondly, the parts of the life cycle being targeted by the policies, laws and regulations. If a portion of the life cycle falls outside the geographical boundary of a country, then the WEEE/E-waste is governed by international conventions, notably the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. If all sections or blocks of the life cycle fall within the geographical boundary of a country, then national policies, laws and regulations govern the WEEE/E-waste management.

Globally, “WEEE” and “E-waste” are the most commonly used terms for electronic and electric waste. There is no internationally standardized definition of WEEE/E-waste, although a number of countries have come out with their own definitions, interpretations and usages of the term. The most widely accepted definition of WEEE/E-waste is that given in the EU directive, a definition which is followed by not only European Union member countries but also many other countries in Europe.

The definition under the EU Directive, together with the status of its transposition and variation across major EU countries, appears in Annexure 1, followed by the reference to E-waste in the Basel Convention. The WEEE Directive (EU, 2002a) describes E-waste as “electrical or electronic equipment, which is waste including all components, subassemblies and consumables, which are part of the product at the time of discarding.” Directive 75/442/EEC, Article 1(a) defines “waste” as “any substance or object which the holder disposes of or is required to dispose of pursuant to the provisions of national law in force.” “Electrical and electronic equipment” or ”EEE” means equipment dependent on electrical currents or electromagnetic fields in order to work properly, and equipment for the generation, transfer and measurement of such current and fields falling under the categories set out in Annex IA to Directive 2002/96/EC (WEEE). These are designed for use with a voltage rating not exceeding 1000 volts for alternating current and 1500 volts for direct current.

Annex IA to Directive 2002/96/EC (WEEE)

Categories of electrical and electronic equipment covered by this Directive:

1. Large household appliances
2. Small household appliances
3. IT and telecommunications equipment
4. Consumer equipment
5. Lighting equipment
6. Electrical and electronic tools (with the exception of large-scale stationary industrial tools)
7. Toys, leisure and sports equipment
8. Medical devices (with the exception of all implanted and infected products)
9. Monitoring and control instruments
10. Automatic dispensers

Annex IB to Directive 2002/96/EC (WEEE)

Products falling under the categories in Annex IA are given below.

1. Large household appliances: Large cooling appliances; refrigerators; freezers; other large appliances used for refrigeration, conservation and storage of food; washing machines; clothes dryers; dishwashing machines; cooking appliances; electric hot plates; microwaves; other large appliances used for cooking and processing food; electric heating appliances; electric radiators; and other fanning, exhaust ventilation and conditioning equipment.

2. Small household appliances: Vacuum cleaners; carpet sweepers; other appliances for cleaning; appliances for sewing, knitting, weaving and other processing for textiles; irons and other appliances for ironing, mangling and other care of clothing; toasters; fryers; grinders, coffee machines and equipment for opening or sealing containers or packages; electric knives; appliances for hair-cutting, hair-drying, tooth brushing, shaving, massaging and other body care appliances; and clocks, watches and equipment for the purpose of measuring, indicating or registering time units.

3. IT and telecommunications equipment: Centralized data processing; mainframes; minicomputers; printer units; personal computing; personal computers (CPU, mouse, screen and keyboard included); laptop computers (CPU, mouse, screen and keyboard included); notebook computers; notepad computers; printers; copying equipment; electrical and electronic typewriters; pocket and desk calculators; other products and equipment for the collection, storage, processing, presentation or communication of information by electronic means; user terminals and systems; facsimile machines; telex machines; telephones; pay telephones; cordless telephones; cellular telephones; answering systems; and other products or equipment of transmitting sound, images or other information by telecommunications.

4. Consumer equipment: Radio sets; television sets; video cameras; video recorders; hi-fi recorders; audio amplifiers; musical instruments; and other products or equipment for the purpose of recording or reproducing sound or image, including signals or other technologies for the distribution of sound and image other than by telecommunications.

5. Lighting equipment: Luminaries for fluorescent lamps with the exception of luminaries in households; straight fluorescent lamps; compact fluorescent

lamps; high intensity discharge lamps, including pressure sodium lamps and metal lamps; low pressure sodium lamps; and other lighting or equipment for the purpose of spreading or controlling light, with the exception of filament bulbs.

6. Electrical and electronic tools (with the exception large-scale stationary industrial tools): Drills; saws; sewing machines; equipment for turning, milling, sanding, grinding, sawing, cutting, shearing, drilling, making holes, punching, folding, bending or similar processing of wood, metal and other materials; tools for riveting, nailing or screwing or removing rivets, nails, screws; or similar uses; tools for welding, soldering or similar use; equipment for spraying, spreading, dispersing or other treatment of liquid or gaseous substances by other means; and tools for mowing or other gardening activities.
7. Toys, leisure and sports equipment: Electric trains or car racing sets; hand-held video game consoles; video games; computers for biking, diving, running, rowing, etc.; sports equipment with electric or electronic components; and coin slot machines.
8. Medical devices (with the exception of all implanted and infected products): Radiotherapy equipment; cardiology equipment; dialysis equipment; pulmonary ventilators; nuclear medicine; laboratory equipment for *in-vitro* diagnosis; analysers; freezers; fertilization tests; and other appliances for detecting, preventing, monitoring, treating, alleviating illness, injury or disability.
9. Monitoring and control instruments: Smoke detectors; heating regulators; thermostats; measuring, weighing or adjusting appliances for household or as laboratory equipment; and other monitoring and control instruments used in industrial installations (e.g. in control panels).
10. Automatic dispensers: Automatic dispensers for hot drinks; automatic dispensers for hot or cold bottles or cans; automatic dispensers for solid products; automatic dispensers for money; and all appliances which automatically deliver a variety of products.

The Basel Convention addresses the transboundary movements of hazardous wastes. It covers a wide range of wastes defined as “hazardous wastes” based on their origin and/or composition and their characteristics, as well as two types of wastes defined as “other wastes” - household waste and incinerator ash[7]. Annex VIII refers to E-waste, which is considered hazardous under Art. 1, para. 1(a) of the Convention, as follows.

A 1010: Metal wastes and waste consisting of alloys of any of the following:

- Antimony
- Arsenic
- Beryllium
- Cadmium
- Lead
- Mercury
- Selenium
- Tellurium
- Thallium

[7] http://www.basel.int/TheConvention/Overview/tabid/1271/Default.aspx

A 1020: Waste having as constituents or contaminants, excluding metal waste in massive form, any of the following:

- Antimony; antimony compounds
- Beryllium; beryllium compounds
- Cadmium; cadmium compounds
- Lead; lead compounds
- Selenium; selenium compounds
- Tellurium; tellurium compounds

A 1030: Wastes having as constituents or contaminants any of the following:

- Arsenic; arsenic compounds
- Mercury; mercury compounds
- Thallium; thallium compounds

A 1090: Ashes from the incineration of insulated copper wire

A 1150: Precious metal ash from incineration of printed circuit boards not included on list B

A 1170: Unsorted waste batteries excluding mixtures of only list B batteries; waste batteries not specified on list B containing Annex I constituents to an extent to render them hazardous

A 1180: Waste electrical and electronic assemblies or scrap containing components such as accumulators and other batteries included on list A, mercury-switches, glass from cathode-ray tubes and other activated glass and PCB-capacitors, or contaminated with Annex I constituents (e.g., cadmium, mercury, lead, polychlorinated biphenyl) to an extent that they possess any of the characteristics contained in Annex III. Annex IX contains the mirror entry, B1110 Electrical and Electronic Assemblies, which is given here:

- Electronic assemblies consisting only of metals or alloys.
- Waste electrical and electronic assemblies or scrap (including printed circuit boards) not containing components such as accumulators and other batteries included on list A, mercury-switches, glass from cathode-ray tubes and other activated glass and PCB-capacitors, or not contaminated with Annex 1.

A 1190: Waste metal cables coated or insulated with plastics containing or contaminated with coal tar, PCB1, lead, cadmium, other organohalogen compounds or other Annex I constituents to an extent that they exhibit Annex III characteristics.

A 2010: Glass waste from cathode-ray tubes and other activated glasses.

3.1.2 Scope of WEEE/E-waste in Other Jurisdictions

Australia

"National Waste Policy: Less Waste, More Resources," a policy developed in 2009, proposed the formulation of legislation based on "Product Stewardship." The Product Stewardship Act 2011 ("the Act") came into effect on 8 August 2011. The Act seeks to

address the environmental, health and safety impacts of products. The Act provides the framework for mandatory, co-regulatory and voluntary product stewardship. The Product Stewardship (Television and Computers) Regulations 2011 came into effect on 8 November 2011 and support a co-regulatory recycling scheme for televisions, computers, printers and computer products. The objectives of the Scheme are to:

- Reduce the amount of television and computer waste (particularly hazardous waste materials) for disposal to landfill;
- Increase recovery of resources from end-of-life television and computer products in a safe, scientific and environmentally sound manner;
- Ensure national coverage; and
- Ensure fair and equitable industry participation in the scheme.

The Regulations aim to increase the recycling of covered products to 80% in 2021-22. The Regulations apply to televisions, computers, printers and computer products. Computer products include both internal parts of computers (e.g. motherboards) and peripherals (e.g. keyboards). In order to precisely identify the products in question, Schedule 1 to the Regulations specifies 75 tariff/statistical codes of relevant products and associated descriptions. These are the codes used by importers in Customs import declarations. The Regulations set annual targets for recycling, which is defined as the initial stage of processing a product for the purposes of recovery of useable materials. The Scheme recycling target starts at 30% of waste arising in 2012-13 and will rise to 80% of waste arising in 2021-22.

Canada

Canada's WEEE/E-waste regulations are enforced at the provincial level. Alberta, British Columbia, Nova Scotia, Ontario and Saskatchewan have WEEE/E-waste regulations in place. Definitions or statements relevant to WEEE/E-waste and its disposal within these regulations are given below.

Alberta

Electronics Designation Regulation A.R.94/2004, published on 12 May 2004, entered into force from 1 October 2004 as an Appendix to the Environmental Protection and Enhancement Act. It defines "Electronics" as all electrical and electronic equipment or devices, whether intended for consumers, industrial or commercial use, and includes, without limitation:

- Televisions
- Computers, laptops and notebooks, including CPUs, keyboards, mice, cables and other components of the computer
- Computer monitors
- Computer printers, including printers that have scanning or fax capabilities or both
- Scanners
- Audio and video playback and recording systems
- Telephones and fax machines
- Cell phones or other wireless devices and
- Electronic game equipment

However, does not include electronics contained within and affixed to a motor vehicle.
PCBs to be treated when at a concentration level of 50 mg/kg or more.

Electronics have been defined as “designated material” for the purpose of Part 9, Division 1 of the Act and the “Designated Material Recycling and Management Regulation.” The term under this regulation used to refer to the disposal of WEEE/E-waste is “Disposal of Electronics.”

British Columbia
Schedule 3, “Electronic Product Category” was included in “British Columbia Recycling Regulation,” dated 7 October 2004 and amended on 16 February 2006. The electronic product category consists of “computers” that are designed for desktop use by an individual or as a server or to be portable, except hand-held devices, “desktop printers” and “televisions.” The electronic product category does not include computers and televisions that are part of or attached to vehicles, marine vessels or commercial or industrial equipment. “Computers” also includes computer monitors and computer peripherals, namely the keyboards, mice, cables and so on that attach to computers. “Desktop printers” refers to printers that will print on paper not exceeding 8.5 inches in width and do not include label printers. “British Columbia Stewardship Plan for End-of-Life Electronics,” a plan formulated in response to the above regulation, defines WEEE/E-waste as “end of life” electronics, with “electronics” meaning the electronic product category mentioned above.

Nova Scotia
The “Solid Waste-Resource Management Regulations” made under Section 102 of the Environment Act as amended on 22 February 2007 mention the “Electronic Products Stewardship Program” in Part II. The term “electronic products” means electrical devices or electronic equipment that are designated materials. “Designated materials” are listed in Column 1 of Schedule B and include the following electric and electronic items.
Televisions
- Desktop, laptop and notebook computers, including CPUs, keyboards, mice, cables and other components in the computer
- Computer monitors
- Computer printers, including printers that have scanning or fax capabilities or both
- Computer scanners
- Audio and video playback and recording systems
- Telephones and fax machines
- Cell phones and other wireless devices

The “Electronic Product Stewardship Program” refers to a program that establishes a process for the collection, transport, reuse and recycling of electronic products and, if no further options exist, the disposal of any residual electronic product components and incorporates the principles of a pollution prevention hierarchy by replacing the disposal of electronic products with reuse and recycling.

Ontario
The Waste Electronic and Electrical Equipment (WEEE) regulation under the *Waste Diversion Act, 2002* (WDA) was filed on 14 December 2004 and amended in 2009. The regulation designates seven categories of electronic and electrical equipment as waste and targets more than 200 items that could be designated, including computers, telephones, broadcasting equipment, televisions, CD players, children's toys, power tools, lawn mowers and navigational and medical instruments.

Saskatchewan
The “Waste Electronic Equipment Regulations” effective on 1 February 2006 and amended in 2009 under the Environmental Management and Protection Act, 2002, define WEEE/E-waste as “waste electronic equipment,” which means electronic equipment that the consumer no longer wants. “Electronic equipment” means any electronic equipment listed in Column 1 of Table 1 of those regulations and includes the following electronic equipment:
- Personal desktop computers, including the CPUs and all other parts contained in the computers

Personal notebook computers, including the CPUs and all other parts contained in the computers
Computer monitors, including cathode ray tubes, liquid crystal displays and plasma
Computer mice, including cables
Computer printers including dot matrix, ink jet, laser, thermal and computer printers with scanning or facsimile capabilities or both
Televisions (cathode ray tube, liquid crystal display, plasma and rear projection)

China
WEEE refers to electrical or electronic appliances discarded by the consumer as well as elements, parts, and components and consumable materials discarded in the process of manufacturing (Order No. 551, Order of the State Council of The People's Republic of China on Regulation for the Administration of the Recovery and Disposal of Waste Electrical & Electronic Products). E-waste is also covered under "Management Methods for Controlling Pollution Caused by Electronic Information Products Regulation," commonly referred to as the "China RoHS," promulgated on 28 February 2006 and effective from 1 March 2007. E-waste disposal is addressed under "control[ling] and reduc[ing]" pollution to the environment upon the disposal of Electronic Information Products[8].

India
E-waste (Management and Handling) Rules, 2011, dated May 2011, came into effect on 1 May 2012. Under this regulation, E-waste is defined as "waste electrical and electronic equipment whole or in part included in, but not confined to, equipment listed in Schedule 1 and scraps or rejects from their manufacturing process, which is intended to be discarded." "Electrical and electronic equipment (EEE)" means equipment that is dependent on electric currents or electromagnetic fields to be fully functional, including those used for generation, transfer and measurement of such currents and fields falling under the categories set out in Schedule 1. There are two categories of EEE in Schedule 1, consisting of 18 items as described in Schedule 2.

Japan
There is no specific definition of WEEE/E-waste set forth within the regulatory system. E-waste is addressed under laws to promote recycling within Japan. The two major laws covering a broad range of E-waste items are the Law for the Recycling of Specified Kinds of Home Appliances (Home Appliances Recycling Law), enacted in 1998 and the Law for the Promotion of Effective Utilization of Resources, enacted in 2000.

In the Law for the Recycling of Specified Kinds of Home Appliances (Home Appliances Recycling Law), E-waste is referred as "used consumer electric goods discarded by consumers". This law covers TVs, refrigerators and freezers, washing machines and dryers and air conditioners. In the Law for Promotion of the Effective Utilization of Resources, E-waste is covered under "used goods and by-products". This law covers personal computers (for home and office) and other electronic items. According to this law, "used goods" means any articles that are collected, used or unused, or are disposed of (except radioactive materials or those contaminated thereby). "By-products" means any articles obtained secondarily in the processes of manufacturing, processing, repairing or selling a product, in the process of supplying electricity, or in the process of construction pertaining to architecture and civil engineering (referred to as "construction work") except radioactive materials or those contaminated thereby.

Malaysia
WEEE/E-waste has been included as scheduled wastes in the "Environmental Quality (Scheduled Wastes) Regulations" 2005. These wastes have been categorized as "wastes

[8] Electronic information products refer to, those electronic radar products, electronic communication products, broadcast and television products, computer products, home electronic products, electronic measuring instrument products, electron special-purpose products, electronic devices and components products, electron application products, electronic material products and others and their fittings, made with electronic information technologies.

from electrical and electronic assemblies containing components such as accumulators, mercury switches, glass from cathode-ray tubes and other activated glass and PCB-capacitors, or contaminated with cadmium, mercury, lead, nickel, chromium, copper, lithium, silver, manganese or polychlorinated biphenyl." The guidelines classifying "Used Electrical and Electronic Equipment in Malaysia" include 27 items as E-waste under the "used" category.

Used electrical and electronic equipment or components are defined as E-waste if they meet any of the following criteria: (a) The item has a defect that materially affects the item's functionality. For example, the item does not: power up; have a functioning motherboard; perform basic input/output system (BIOS), perform internal set-up routines or self-checks; communicate with the host; print/scan/copy a test page or the page is not identifiable, readable, blurred or lined; or read, write or record/burn. (b) The item has physical damage that impairs its functionality or safety, as defined in the specification. (c) The item has a faulty hard disc drive, faulty random access memory (RAM) or a faulty video card. (d) Batteries made with lead, mercury, cadmium, lithium or nickel are unable to be charged or to hold power. (e) The item has insufficient packaging to protect it from damage during transport, loading or unloading operations. (f) The appearance of the equipment or components is generally worn or damaged, thus reducing the marketability of the equipment. (g) The electrical or electronic equipment or components are destined for recycling or recovery or disposal. (h) The electrical and electronic equipment or components are discarded, or are intended or are required to be discarded. (i) There is no regular market for the used electrical and electronic equipment or components. (j) The used equipment or components are old and outdated and destined for salvaging. (k) The equipment is end-of-life electrical or electronic equipment. (l) For importing purposes, the age of the electrical and electronic equipment or components is not more than three years from the date manufactured. (m) The item is a product/good partially produced by E-waste recovery facilities.

New Zealand
Although New Zealand has set forth no definition of WEEE/E-waste in its legislation, a definition does appear in Imports and Exports (Restrictions) Order (No 2) 2004. It states that "electronic waste" covers electronic items which are to be disposed of by recycling or final disposal. Such equipment includes:

Computer equipment including monitors and printers;
Mobile and landline telephones;
Fax machines;
Photocopying equipment;
Television sets;
Video recorders;
Printed circuit boards; and
Equipment containing cadmium, mercury or lead batteries.

Electronic equipment is also considered to be "waste" if it has any of the following:

a. A defect that materially affects its functionality (e.g. it does not power up); or
b. Physical damage that impairs its functionality or safety (e.g. the screen is broken or cracked); or
c. A faulty hard disk drive, RAM or video card; or
d. Batteries containing lead, mercury, cadmium, or liquid cathodes that are unable to be charged or to hold power; or
e. Insufficient packaging to protect it from damage during transport.

The Ministry has initiated a nationwide programme to encourage the recycling and safe disposal of unwanted televisions. Guidance is available on managing and handling WEEE, including proposed general standards and guidelines that should be adopted so there is good management of health, safety and environmental issues when reusing or recycling WEEE and information on where to get further information and advice.

Republic of Korea
Article 2 of the Act for Resource Recycling of Electrical and Electronic Equipment and Vehicles adopted on 2 April 2007 defines “waste electrical and electronic equipment” as electrical and electronic equipment which is classified as “waste” in accordance with Article 2, Section 1 of the Waste Management Act. “Electric and electronic equipment” means equipment or devices (including components and parts thereto) operated by electric currents or electromagnetic fields.

USA
According to the USEPA, electronic products that are “near” or at the “end of their useful life” are referred to as “E-waste” or “e-scrap.” Although recyclers prefer the term “e-scrap” since “waste” normally refers only to what is left after the product has been reused, recovered or recycled, “E-waste” is the most commonly used term.

3.2 Institutional Mechanisms

“Extended producer responsibility” (EPR) or “product take-back” forms the basis of policy frameworks in developed countries. The WEEE Directive provides a regulatory basis for collection, recovery and reuse/recycling targets in the EU. The development of legislation and compliance structures under the EU Directive is an ongoing process in all EU countries. Member states have to guarantee the achievement of minimum collection, recovery and reuse/recycling targets as specified in the directive. The fundamental principle of the WEEE Directive is “extended producer responsibility,” under which producers are responsible for WEEE/E-waste take-back. European countries not part of the EU follow the EU Directive or comply with more stringent standards for WEEE/E-waste management. The majority of these countries have regulations similar to the WEEE Directive.

Countries like Japan have regulations focused on “reuse, recycling and recovery.” Other countries like Canada, the USA and Australia are developing systems based on the similar principle of “extended producer responsibility.” The transposition of the EU Directive into the national laws of EU countries and the regulatory structures of other developed countries is summarized in Annexure 1.

The institutional mechanism under “extended producer responsibility” or “product take-back” for WEEE/E-waste management systems can typically be broken down into the three elements of collection systems, a national registry and logistics. The relevant stakeholders and their respective roles/responsibilities have been overviewed for each of these three elements. Annexures 1 and 2 describe the existing institutional mechanism in terms of these elements in developed countries until 2009. Major factors impacting the institutional mechanism are given below.

1. Regulations and the role and responsibility of different stakeholders under the regulation.
2. Total inventory of WEEE/E-waste to determine the economies of scale for institutional operations
3. Distances involved and other aspects of the geography of the country/area/region/city, with smaller distances reducing transport and logistics costs

4. Population size and density, with higher populations enabling greater economic efficiency and economies of scale
5. Cost of labour, as collection, sorting and treatment are highly labour-intensive
6. Length of time the mechanism has been in operation
7. Consumer behaviour with respect to recycling
8. The level of WEEE/E-waste recycling awareness in relation to specific product groups

3.3 Collection Systems

Regulations in each country form the basis of its WEEE/E-waste collection system. There are two generic categories of collection systems at the national level, a collective system (monopoly) and a competition-based clearinghouse system for managing WEEE/E-waste. The objective of both the systems is to provide WEEE/E-waste management services at reduced costs to the consumers, whether households or businesses, while fostering compliance through national-level efforts.

Collective Collecting & Recycling Systems

Collective systems are responsible for collecting and recycling all of, or a major part of, WEEE/E-waste within national boundaries. These systems are also responsible for the associated financing requirements. This is the most often adopted approach in countries with established WEEE/E-waste systems. While the legal status differs from country to country, these systems are generally run by nongovernmental, not-for-profit companies set up and owned by one or more trade associations. These systems are organized by product categories in order to maximize efficiency in recycling operations and identify markets for recycled materials and product reuse.

Clearinghouse Systems

Under a clearinghouse system, multiple partners (producers, recyclers, and waste management company can provide services on a competitive basis. The government ensures that there is a register of producers and it defines allocation mechanisms and reporting and monitoring systems. The responsibilities of a central national coordination body are to determine the collection obligation of each producer (via the national register) and to assign this obligation to the compliance scheme action on behalf of the producer. This body will also establish an allocation mechanism that enables compliance systems to collect WEEE/E-waste in an equitable manner from collection points throughout the area.

3.4 National Registries

Any registered company or agency which maintains a register of producers/recyclers/waste organizations and an inventory of WEEE/E-waste has been defined as a national registry. This body or agency can also determine the collection obligation of each producer and ensure equitable compliance. This body or agency could be a government entity or a non-profit organization recognized by, or supported by, the government for discharging the above-mentioned functions.

3.5 Logistics

There are three primary channels for WEEE/E-waste collection, all of which address "business to consumer" (B2C) and "business to business" (B2B) WEEE/E-waste collection. These channels are municipal sites, in-store retailer take-back schemes and producer take-back schemes. Generally, municipal collection sites are available for households to use to an unlimited extent free of charge, while take-back through retailers is usually free of charge, but may be dependent upon the purchase of a new product (both B2C and B2B). The direct producer take-back system may apply to larger commercial equipment and operates on a "new for old" basis (B2B). The conceptual details of collection systems have been described in section 2.5 of Chapter 2. However, national regulations are typically the major driver of the collection system.

3.6 National and Social Policies, Laws, and Regulations as well as Economic and Institutional Roles in Developing Countries

Table 3.1 summarizes policies, laws, regulations and institutional mechanisms in developing countries in which some level of WEEE/E-waste awareness exists. The table provides information on the status of two elements, specifically the existence of inventories and national legislation.

Table 3.1: Policies, laws and regulations as well as institutional roles related to WEEE/E-waste in developing countries

Country	Inventory	National Legislation
Asia		
Bahrain	Solid waste inventory available but no specific E-waste inventory	Lack of WEEE/E-waste legislation
Cambodia	Inventory conducted	Under planning
China	Inventory needs updating	EPR-based legislation has been prepared
India	Inventory needs updating	EPR-based draft regulation in place but lacks enforcement
Indonesia	Preliminary inventory needs updating	Under planning
Jordan	Preliminary inventory conducted	No legal framework
Kuwait	No inventory assessment	No legal framework
Lebanon	No inventory assessment	No legal framework
Malaysia	Initial inventory conducted	Legal framework without EPR
Oman	Initial inventory conducted	No legal framework
Pakistan	No inventory	No legal framework
Philippines	Initial inventory conducted	Under planning
Qatar	Inventory not available	Under preparation
Saudi Arabia	Inventory assessment initiated	No legal framework
Thailand	Initial inventory conducted	Draft prepared using EPR
UAE	Solid waste inventory available but no specific E-waste inventory	Planned and being prepared
Vietnam	Initial inventory prepared but	Under planning

Country	Inventory	National Legislation
	needs updating	
Yemen	Preliminary assessment conducted	No legal framework
Latin America		
Argentina	Initial inventory conducted	EPR-based regulation in place but needs enforcement
Brazil	Planning to conduct inventory	EPR-based regulation at federal level is under preparation
Chile	Initial inventory conducted	Under planning
Colombia	Initial inventory conducted	Under planning
Costa Rica	Initial inventory conducted	EPR-based regulation in place but needs enforcement
Mexico	Initial inventory conducted	Under planning
Paraguay	Planning to conduct inventory	Under planning
Peru	Initial inventory conducted	Under planning
Uruguay	Planning to conduct inventory	Under planning
Africa		
Algeria	Inventory assessment initiated	No legal framework
Benin	Initial inventory conducted	Under planning
Côte d'Ivoire	Initial inventory conducted	Under planning
Egypt	Inventory assessment initiated	No legal framework
Ghana	Initial inventory conducted	Under planning
Liberia	Initial inventory conducted	Under planning
Morocco	Inventory assessment initiated	No legal framework
Nigeria	Initial inventory conducted	Under planning
Rwanda	Inventory assessment initiated	Under planning
South Africa	Initial inventory conducted	Under planning
Tunisia	Inventory assessment conducted but lacks adequate data	Planned and prepared

The majority of developing countries have either planned or developed their regulations on the principle of EPR. These countries can learn from the constraints encountered or steps followed by countries implementing the EU Directive, while designing their regulations under EPR principles. Some of the major constraints in implementing the EU Directive are highlighted below.

3.7 Major constraints and steps in implementing the EU Directive

An analysis of the EU Directive transposition outcome in EU member states with regard to implementing EPR provisions, conducted on the basis of a literature survey, is summarized below.[9] This analysis gives insight into identification of constraints encountered and steps

[9]Sander, Knut et. al. 19 August 2007. *Final Report, The Producer Responsibility Principle of the WEEE Directive,* DG ENV. Study Contract No. 07010401/2006/449269/MAR/G4

taken by EU member states while institutionalizing a take-back mechanism under EPR principles. The following sections describe each of these items in terms of existing constraints and steps taken during implementation.

3.7.1 Definition of "Producer"

The definition of a "producer" is one of the most important issues, as it may cover manufacturers, importers, exporters and their relationship with distributors or retailers. Table 3.2 describes the status of importers and exporters in member states' legal texts.

A significant issue which has emerged is the interpretation of importers and exporters, namely, whether "importing" and "exporting" are considered as taking place even when occurring between two EU member countries (the "national approach"), or whether these terms refer only to trade in which one side is a non-EU member, thereby excluding intra-community trade (the "European approach"). Twenty-two member states obligate an EEE product's first importer into the national state as the "producer" in the absence of a manufacturer within the member state. "European" approaches are found in the legal texts of Finland, Spain and the UK.

Table 3.2: Interpretation of importers and exporters in the legal texts of EU member states[10]

Country	Legal clauses defining producers	Approaches
Austria	13(1) of Waste Management Act	National
Belgium (Brussels)	1(3)	National
Belgium (Flanders)	Part 1 Def.	National
Bulgaria	No definition found in the legal text reviewed	
Cyprus	2(1)	National
Czech Rep.	37g. (e)	National
Denmark	9i (2), Act no. 385 of 25 May 2005	National
Estonia	1 (5), Government Regulation 376-2004	National
Finland	3 (9), Government Decree 852/2004	European
France	3 (1)	National
Germany	3 (11)	National
Greece	3 (15)	Ambiguous
Hungary	2 (d-f)	Ambiguous
Ireland	3 (3)	National
Italy	3. (1) m	National
Latvia	202 (1), Waste Management Act	National
Lithuania	2 (18), (19), (32) Law on Waste Management	National
Luxembourg	3 (i)	National
Malta	3 (1)	National
Netherlands	1, Section 1 (j)	National
Poland	3 (13)	National
Portugal	3 (d)	National
Romania	3 (i)	National

[10] Sander, Knut, et. al. 19 August 2007. *Final Report, The Producer Responsibility Principle of the WEEE Directive,* Table No. 8, DG ENV. Study Contract N° 07010401/2006/449269/MAR/G4

Country	Legal clauses defining producers	Approaches
Slovakia	54a (10)	National
Slovenia	3 (20)	National
Spain	2 (c)	European
Sweden	3	National
UK	2 (1)	European

Since countries have legal jurisdiction within their own borders, under a national approach they can identify a legal agency within their national territory to be liable for WEEE financing obligations. With the national approach, an unfavourable consequence could be that in the absence of manufacturers in the country, multiple “producers” exist for the same product.

Identifying wholesalers as producers may not be useful in incentivising improvements in products and product systems, due to their lack of involvement in and control over product design.

3.7.2 Allocation of Responsibility for Collection of WEEE from Private Households

Collection and the financing of collection are the two major areas to which responsibilities must be allocated within WEEE/E-waste management. The allocation of responsibilities over these two areas within the EU has already been covered in Table 2.3 in chapter 2.

In EU member states, the WEEE Directive mandates separate collection of WEEE/E-waste from the rest of the waste stream in order to improve WEEE/E-waste management. The WEEE Directive distinguishes separate collection of WEEE/E-waste from private households and collection from non-households.

Regarding physical responsibility, the Directive does not explicitly identify who should be responsible for setting up the infrastructure. It requires distributors to accept WEEE/E-waste from consumers on a one-to-one basis when selling new products. Member states can deviate from this requirement when an alternative convenient procedure exists for consumers.

Concerning financial responsibility, producers are financially responsible for at least the collection from collection points onwards. Therefore, a gap exists in extending the producer responsibility to finance the collection from households to collection points.

Table 2.2 shows that municipalities are given both physical and financial responsibility in some countries. Participation of municipalities in the collection of WEEE/E-waste from households may disturb the “level playing field” and harm the interests of producers that choose to set up their own compliance schemes. This is because such producers may not be able to utilize collection sites that are potentially subsidized by municipalities.

3.7.3 Allocation of Responsibility for Collection, Treatment, Recovery, Recycling and Disposal of WEEE from Private Households Deposited at Collection Points

EU member states are unanimous in their assignment of responsibility to producers for this obligation and there are no deviations on this issue.

3.7.4 Financial Mechanism: WEEE from Private Households

Allocation of financial responsibility for WEEE/E-waste from households for both historical and new WEEE/E-waste is an important issue. The distinction between the financial mechanism to be applied for new WEEE/E-waste and historical WEEE/E-waste is that producers bear individual financial responsibility for new WEEE/E-waste but collective responsibility for historical WEEE/E-waste, spread across all producers in the market.

Three patterns have emerged related to individual financial responsibility for new WEEE/E-waste in the EU, as shown in Table 3.3.

Table 3.3: Financing patterns for new WEEE/E-waste in the EU[11]

Pattern 1: Financing the management of waste resulting from their own products In these countries, the legal text clearly states that producers are required to finance the management of waste resulting from their own products placed on the market after 13 August 2005.	Belgium (Brussels, Flanders) Cyprus Czech Republic Estonia Luxembourg Malta Netherlands Romania Slovakia
Pattern 2: Ambiguous expression of individual financial responsibility These countries do not appear to have formulated their legal text in such a way that individual financial responsibility is assigned explicitly. In many cases, producers' responsibilities for products placed on the market after 13 August 2005 are mentioned in the plural form. For instance, in Germany and Austria, producers are able to decide whether they are financially responsible individually or collectively for products placed on the market after 13 August 2005	Austria Belgium (Walloon) Germany Hungary Ireland Italy Lithuania Poland Portugal Spain Sweden
Pattern 3: Absence of individual financial responsibility In a number of countries, the allocation of financial responsibility for new WEEE/E-waste is determined by current market share, as with the financing mechanism addressing historical WEEE/E-waste.	Bulgaria Denmark Finland France Greece Latvia Slovenia UK

[11] Sander, Knut, et. al. 19 August 2007. *Final Report, The Producer Responsibility Principle of the WEEE Directive,* DG ENV. Study Contract N° 07010401/2006/449269/MAR/G4

3.7.5 Form of Financial Guarantee for Managing WEEE from Private Households

Since the WEEE Directive stipulates individual financial responsibility for new WEEE/E-waste, producers are required to finance the costs of waste management of their own products. Although producers can choose to fulfill their obligations collectively, they are not forced to finance the cost of other producers' WEEE/E-waste.

Since it cannot be assumed that all producers currently in the market will remain active when their products are collected as WEEE/E-waste, a financial guarantee is required to meet these costs in order to prevent a potential burden on society.

This guarantee can be the form of participation in a collective compliance scheme, a blocked bank account or recycling insurance to satisfy the guarantee requirement.

Recycling insurance or a blocked bank account as a financial guarantee are more costly than joining a collectively organised compliance scheme, especially for an individual system or limited brand compliance. In Germany, the guarantee can be based on a collective guarantee, which means that producers will be responsible for other producers' products in the event that one member exits the market.

3.7.6 Distance Sellers

The way in which distance sellers register in either the seller's or the end user's member state is not unified. The method of registration of sellers from another country than where the end user's are located,

3.7.7 Allocation of Responsibility for WEEE other than WEEE from Private Households

Producers are responsible for historical non–household WEEE/E-waste when they supply new products on an old-for-new basis. Producers are responsible for financing the costs of collection, treatment, recovery and environmentally sound disposal of WEEE/E-waste from users other than private households for products placed on the market after 13 August 2005.

- The majority of EU member states have determined that producers are responsible for accepting historical WEEE from end users upon the purchase of new products.
- If the end users of the historical WEEE/E-waste are not purchasing new equipment, the responsibility rests with the end user. However in Germany, France and the Netherlands, the end user is responsible for financing all B2B historical WEEE/E-waste management.

There is no explicit mention of the requirements for a guarantee for managing WEEE/E-waste generated by users other than private households. However, some EU member states have extended the financial guarantee requirement to B2B products, in addition to WEEE from private households.

3.7.8 Labeling of EEE – Producer Identification

Producer identification is important in order to facilitate implementation of the requirement that producers are responsible for financing the management of WEEE/E-waste generated from their own products. EU member states must ensure that any producer of an electrical or electronic appliance put on the market after 13 August 2005 is clearly identifiable by means of a mark on the appliance.

Problems arise because of lack of uniformity in the way in which member states define "producers." When the national definition of producer is applied, the identified producer in many circumstances will be local stakeholders that bring the EEE into the national market. In countries where a manufacturer has no operations, the "producer" is either the wholesaler or distributor, or in some circumstances, the retailer.

3.7.9 Producer Registration & Reporting

The WEEE Directive requires EU member states to draw up national registers and collect information on the amount of EEE put on the market as well as that which has been collected, reused, recycled and recovered within the member state, including exports. The largest concern raised by industry stakeholders is the lack of harmonization among the administrative functions of the national producer registers. Some industry stakeholders cite the need to adhere to up to 27 different reporting requirements.

- Reporting periods (frequency of reporting): Reporting of products put on the market varies from monthly, quarterly and biannual to annual reporting periods.
- Criteria for distinguishing between the B2C and B2B EEE which will end up as WEEE/E-waste
- Definition of "put on the market": In most EU member states, it is when a financial transaction subject to VAT occurs that products are "put on the national market" and sales are required to be reported by the producer who placed those products on the market.
- Reporting formats: The diversity of reporting formats can lead to increased administrative burdens for reporting data to national registers.
- Lack of a common definition of "weight": Divergence exists among member states in the definition of weight, which can cause an unnecessary administrative burden. Specifically, when a new product is launched in the market, the producer must physically weigh the product and its relevant components in order to fulfill the weight definition. A common definition would reduce this burden considerably and allow rationalisation of the enterprise resource planning software while enabling the development of a standard applicable for all products and member states.
- Who can register or report as a producer: In most EU member states, only legal entities having a presence in the country where products are placed on the market are entitled to register as a legally obligated producer. However, distant sellers may be based in other member states that oblige them to register in countries in which they sell products to end users. Therefore, companies selling to end users in countries which only allow actors based in that country to be "producers" cannot

meet their producer responsibility obligations in their home countries and are therefore unwilling free-riders.

- Harmonisation efforts: Operators of national registers have established the European WEEE Registers Network (EWRN). So far the group has been concentrating on establishing contact with all functioning registers and it is beginning to address options for registers to harmonise and apply consistent practices in approaching a number of key issues.

3.8 Lessons from Overseas Product Stewardship Schemes

It is frequently noted that no single approach to product stewardship can simply be copied or introduced in any country for a given product.

Some of the lessons derived from North American and European schemes include that:

- Program objectives must be clearly defined;
- Collaborative approaches may be helpful in advancing programs;
- Any market intervention should be transparent, justified and fair and support competition;
- Effective stakeholder engagement in program design will ensure smooth implementation, and existing or planned waste and recycling systems should be taken into account;
- A robust process for establishing fee structures is essential to ensuring the perception of fees as fair, reasonable and based on actual program costs. The establishment of fees is an ongoing process and must be revisited; and
- Most manufacturers active in global markets tend to achieve consistent standards that have generally been established in Europe.

The lessons derived from Asian schemes include that:

- Effectively designing financial incentives is vital to the success of a scheme. Emphasis on sales-based targets do not encourage re-use or design for the environment;
- A coordinated mechanism which creates incentives and obligations for various players along the supply chain can promote resource efficiency;
- Convenience strongly influences consumer behavior, especially with regard to collection and transport.
- Impacts on competition should be considered—there is a need to balance growth of the recycling industry against the potential for forming monopolies;
- Participation of manufacturers in the physical management of their end-of-life products is a significant factor in the success of EPR schemes. Schemes that assign only a financial responsibility for end-of-life goods to the manufacturer are less effective in improving efficiency and reducing the cost of resource recovery;
- Accounting for non-participants is important. For instance, consumers in Japan pay more for disposing of goods manufactured by non-participants; and

- End-of-life consumer goods should not be viewed as worthless ”waste” but as cost-effective sources of material.

3.9 Elements of the Take-back Mechanism

Some major elements of the take-back mechanism that have emerged from regulatory frameworks based on extended producer responsibility are given below.

1. Definition of WEEE/E-waste
2. Items covered under WEEE/E-waste
3. Cut-off date for implementation
4. WEEE/E-waste inventory
5. Definition of producer, importer, exporter, distributor, collection point, dismantler, recycler, disport, etc.
6. Physical and financial responsibility for WEEE/E-waste collection from consumers other than private households
7. Physical responsibility for the collection of WEEE/E-waste from private households and the points or stakeholders from which this responsibility starts (e.g. responsibility starts when the WEEE is dropped off at collection points)
8. Assignment of responsibility for the collection, treatment, recovery, recycling and disposal of WEEE/E-waste from private household deposited at collection points
9. Assignment of financial responsibility for the collection of WEEE/E-waste from private households
10. Type of financial mechanism (e.g. individual financial responsibility or collective financial responsibility for both historical and new WEEE/E-waste from private households)
11. Form of financial guarantee for managing WEEE/E-waste from private households
12. Status of distance sellers and their registration
13. Assignment of responsibility for WEEE/E-waste generated by consumers other than private households
14. Labeling of EEE for producer identification
15. Producer registration and reporting (e.g. reporting periods, criteria for distinguishing between B2B and B2C EEE, definition of “put on the market” and reporting formats)

Clarity regarding the above elements will assist in developing the WEEE/E-waste management system architecture. An example of mapping of the above elements has been described in Table 3.5 while analyzing WEEE/E-waste regulations in India. A copy of these regulations can be found on the home page of the Ministry of Environment [12] (http://www.moef.nic.in).

[12] Ministry of Environment and Forestry, India
http://www.moef.nic.in/downloads/rules-and-regulations/1035e_eng.pdf

Table 3.4: Responsibilities of stakeholders for collection, transport, storage and disposal of E-waste

Stakeholder	Area of responsibility											
	Collection		Take-back/setting up of collection centres		Registration authorization	Filing of annual return	Annual inventory handled	Transport to				Financing
	Manufacturing/ refurbishing	End of life	Individual	Collective				Producer	Collection centre	Refurbisher/ Dismantler/ Recycler	TSDF facility	
Producer	√	√	√	√	√ (Rule 11)	√ (Form 3)	√ (Form 2)		√	√	√	√
Distributor			√		√ (Rule 5 Form 4)	√ (Form 3)	√ (Form 2)	√	√			
Refurbisher	√				√ (Rule 6 Form 4)	√ (Form 3)	√ (Form 2)	√	√	√		
Collection centre			√	√	√ (Form 1)	√ (Form 3)	√ (Form 2)					
Consumer									√			
Bulk consumer						√ (Form 3)	√ (Form 3)	√	√	√		
Dismantler					√ (Rule 13)	√ (Form 3)	√ (Form 3)			√	√	
Recycler/ reprocessor					√ (Rule 13)	√ (Form 3)	√ (Form 3)			√	√	

Note: A check mark (√) indicates "Yes."

Information box

Summary Analysis of E-waste (Management and Handling) Rules, 2011
(Ministry of Environment and Forests, Government of India)

These rules are based on the principles of "Extended Producer Responsibility" (EPR). EPR defines the responsibility of any producer of electrical or electronic equipment for their products beyond their manufacturing up to and including their environmentally sound management as their end-of-life products. These rules are applicable to every producer(s), collection centre(s), dismantler(s), recycler(s), consumer(s) or bulk consumer(s) involved in the manufacture, sale, purchase or processing of electrical and electronic equipment or components as specified in Schedule I and entered into force on 1 May 2012.

These rules clearly define electrical and electronic equipment (EEE) and E-waste. The definition of E-waste categorizes it into two broad categories: (i) information technology and telecommunication equipment and (ii) consumer electrical equipment and electronics. The IT and telecommunication equipment category contains fifteen items while the consumer electrical equipment and electronics category consists of four items. Historical and orphaned E-waste are also defined. Further, these regulations clearly define the terms "producer," "bulk consumer," "consumer," "dismantler" and "recycler." These form an integral part of the material flow chain. "Environmentally sound management of E-waste" means taking all the steps required to ensure that E-waste is managed in a manner that protects the health and environment against any adverse effects potentially resulting from the hazardous substances contained. "Facility" means any location meant for collection, reception, storage, segregation, refurbishing, dismantling, recycling, treatment or disposal of E-waste. "Disposal" is defined as any operation which does not lead to recycling, recovery or reuse and includes physico-chemical or biological treatment, incineration and deposition in a secured landfill. A "transporter" is defined as a person engaged in the off-site transport of E-waste by air, rail, road or water.

Salient features with respect to emerging regulatory scenarios

The WEEE/E-waste coverage under existing regulations extends to the following:

1. Definition of WEEE/E-waste in existing regulations;
2. Classification of WEEE/E-waste as per Schedule 1;
3. EEE in the local market to be ROHS-compliant by 2015;
4. Intact E-waste to be transported as normal EEE;
5. Responsibilities of producers, consumers, bulk consumers, collection centres, dismantlers and recyclers;
6. The components of WEEE/E-waste obtained after dismantling and recycling that are hazardous in nature will be collected and transported in line with the Hazardous Waste (Management, Handling and Trans-boundary Movement) Rules, 2008 and disposed to a treatment, storage and disposal facility (TSDF facility) if not recoverable, recyclable or reusable;
7. Ban on imports of WEEE/E-waste; and
8. Imports of only ROHS-compliant EEE in order to fulfill obligations under EPR.

Table 3.5 below summarizes the results of an analysis of major gaps in implementing new regulations.

1. The quantity of E-waste at the end of year 2012 is not known and it was not declared;
2. No target was fixed for collecting E-waste at the time of enforcement. Producers are not bound by any collection target. The quantities of E-waste to be channeled to the registered refurbisher and recycler are thus uncertain;
3. The quantity of EEE entering the market during the five to ten years prior to 2012 is unknown. This figure needs to be established in order to fix a target for producers while enforcing the new E-waste rules from 2012 onwards;
4. The rules contain no mandatory provisions for producers to declare the quantity of EEE placed in the market since 2012;
5. Forms 2 and 3 in the rules have no basis upon which to compare collection efficiencies during the first three to six years of implementation;
6. Producers are expected to channel E-waste through the entire material flow chain and incur all implementation costs. However, there are no economic instruments for recovering the cost of channeling this waste;
7. Mechanisms for implementing economic instruments in line with E-waste collection targets are non-existent and need to be developed;
8. There is no mechanism for tracking bulk consumers' purchases of EEE. Bulk consumers' filing of a related form (Form 3) appears to be more of a voluntary exercise than a mandatory one;
9. The assignment of orphan products among producers is not clearly delineated;
10. Dismantlers and recyclers are not responsible for collecting E-waste. There is no integration of dismantling and recycling with practices of the collection and transport mechanism; and
11. There is no centralized mechanism to monitor the collection, transport, dismantling, recycling and disposal of E-waste taken as a whole.

3.10 Guidance Notes

Objective: The major objective of these guidance notes is to assist policy makers and other stakeholders in drafting new regulations that address the WEEE/E-waste take-back mechanism. Six steps identified within the guidance notes for the definition of WEEE/E-waste given in *WEEE/E-waste Manual 1* have been integrated into new steps in order to provide a broad road map to assist in the development of enabling policy, laws and regulations as well as an institutional framework for WEEE/E-waste management.

Guidance procedure: The guidance procedure includes completing the following fourteen steps.

Step 1: Identify the environmental legislation or regulation that addresses municipal solid waste, hazardous waste or items related to trans-boundary movement of hazardous waste subject to the Basel Convention.

Step 2: Identify the sections and subsections of the legislation or regulation mentioning any item related to electrical and electronic equipment.

Step 3: Look for the following words in the legislation or regulation, along with their definitions and interpretation:

- Electrical and electronic equipment
- Electrical assemblies, components or products
- Discarding or disposal
- Used goods, scrap or waste
- Recycle or reuse
- Treatment

Step 4: Prepare a WEEE/E-waste definition reference matrix with respect to three drivers, such as definitions of "electrical and electronic equipment," "loss of utility" and "way of disposal."

Table 3.5 References to E-waste within regulations, with respect to identified drivers

Regulation	Drivers		
	Definition of electrical and electronic equipment? (Y/N)	**Definition of loss of utility? (Y/N)**	**Definition of way of disposal? (Y/N)**
Hazardous waste			
Non-hazardous waste			
Regulation related to Basel Convention			
Other regulation(s)			

Note: Y/N: Yes or No

E-waste drivers at national level ?

In case of "yes," specify the reference, its coverage and its application in domestic and trans-boundary trade.

Step 5: When WEEE/E-waste is referred to either directly or indirectly in any regulation, specify the roles and responsibilities of the following stakeholders.

- Generators and/or producers
- Exporters and/or importers
- Collectors and/or transporters
- Waste treatment operators
- Regulatory agencies (local/national)

Step 6: Identify gaps within the matrix and recommend tentative content, including the extent and coverage of what is termed "WEEE/E-waste."

Step 7: Identify EEE items within the WEEE/E-waste inventory that are manufactured within the country or imported or exported. This step will assist in defining the "producer."

Table 3.6 Chart to identify the producer

	Item					
	PC	TV	Cellphone	Refrigerator		
Manufactured (Y/N)						
Imported (Y/N)						
Exported (Y/N)						

Note: Y/N: Indicate 'Yes' or 'No'

Step 8: Based on steps 1 to 7, define producers, importers, exporters, distributors/retailers, collection points, dismantlers, recyclers and disposal.

Step 9: Carry out WEEE/E-waste policies, laws and regulations (e.g. EPR policies, the WEEE Directive and other national policies and items within the regulatory framework). Identify gaps with respect to existing environmental regulations (based on the results of steps 1 to 3) and recommend tentative content, including the extent and coverage of WEEE/E-waste policy, laws and items within the regulatory framework.

Step 10: Assign physical responsibility for the collection, treatment, recovery, recycling and disposal of WEEE/E-waste from private households and other consumers (e.g. commercial users).

Step 11: Assign financial responsibility (e.g. individual or collective financial responsibility for "new" and "historical" WEEE/E-waste) to the stakeholders addressed by the legislation or regulation.

Step 12: Map the proposed WEEE/E-waste regulations, including the associated responsibilities of stakeholders, using the format given below. Table 2.5 gives an example of this mapping for draft WEEE/E-waste regulations in India. The same template can be used or modified as appropriate, in keeping with the nature of the regulation concerned.

Step 13: Carry out a gap analysis with respect to the outputs of step 12.

Step 14: Organize workshops of major stakeholders like line ministries and government agencies (e.g. those with responsibilities in the areas of IT, electronics, consumer durables, electrical and other industries, environment, forests, finance, economy and commerce), industry associations, retailers' associations, municipalities, formal and informal recyclers, transporters, operators of incinerators and hazardous waste management facilities, and NGOs and CSOs to arrive at acceptable WEEE/E-waste policy, laws, and regulations as well as institutional mechanisms.

Table 3.7 Areas of Stakeholder's responsibility

Stakeholder	Area of responsibility											
	Collection		Take-back/setting up of collection centre		Registration authorization	Filing of annual return	Annual inventory handled	Transport to				Financing
	Manufacturing/ refurbishing	End of life	Individual	Collectively				Producer	Collection centre	Refurbisher/ dismantler/ recycler	TSDF facility	
Producer												
Distributor												
Refurbisher												
Collection centre												
Consumer												
Bulk consumer												
Dismantler												
Recycler/ reprocessor												

Note: A check mark (√) indicates "Yes."

Chapter 4: WEEE/E-waste Collection and Transport under Take-back Schemes

4.0 Introduction

An efficient WEEE/E-waste collection and transport system will encourage reuse and recycling while helping to ensure adequate WEEE/E-waste management, including avoiding damaging or breaking components that contain hazardous substances. Therefore, WEEE/E-waste collection and transport under a take-back system requires technical intervention at each step along the material flow chain. This intervention has been described in terms of collection systems consisting of collection channels, system architecture and management and the infrastructure required to support it. This chapter includes guidance notes that provide a broad framework to assist in the design and development of technical specifications for WEEE/E-waste collection and transport systems.

4.1 Collection Systems

The following sections overview WEEE/E-waste collection systems in terms of WEEE/E-waste collection channels and methods of collection. Relevant examples are also cited.

4.1.1 Collection Channels

The three major WEEE/E-waste collection channels being successfully implemented are municipal collection sites, retailer take-back, and producer take-back. The collection system used under each of these collection channels is summarized below.

4.1.1.1 Retailer Take-back and Storage

In this collection channel, consumers can take back WEEE/E-waste to retail stores selling similar products. This can include giving back a product only upon purchasing a new product or take-back might be allowed without any purchase. Return of the older product is sometimes done at the point of home delivery and installation of the new item by the retailer or distributor. Where available, this service is usually free to private households.

4.1.1.2 Producer Take-back and Storage

In this collection channel, WEEE/E-waste is taken back by producers either directly at their facilities or at pre-determined collection centres and then fed into the WEEE/E-waste system. This usually applies to larger commercial equipment and operates on the principle of “new equipment replacing the old.”

4.1.1.3 Municipal Collection and Storage

In this collection channel, consumers, including businesses, can leave WEEE/E-waste at municipal sites. A number of sorting containers and or pallets are provided at the collection site according to the product scope and the logistical arrangements made with recyclers and transporters. This collection mechanism is usually free of charge for household WEEE/E-waste, but charges sometimes apply to waste generated by businesses.

4.1.1.4 Other Collection Channels

Other collection channels include collection points where consumers and or businesses can leave/drop off WEEE/E-waste at specially-created sites/centers. These can be specialized sorting centers controlled by the collective system, producer responsibility organisations (PRO) or, more commonly, third-party sites whose operators may be remunerated for providing space. A number of sorting containers or pallets are provided according to the product scope and the logistical arrangements made with recyclers and transporters. This is usually free of charge for household WEEE/E-waste, but charges sometimes apply to waste generated by businesses.

Common collection methods includes permanent drop-off sites with regular hours; special collection events; retail stores; regular curbside pickup and, as needed, scheduled pickup. These methods are combined by the system architect to develop the collection channel.

The majority of schemes in Europe operate around municipal collection systems. ICT Milieu in Denmark and El Kretsen in Sweden use this channel exclusively. Others, such as Recupel in Belgium, NVMP in the Netherlands and Elretur in Norway encourage retailer participation. Some non-EU schemes, such as SWICO in Switzerland, have achieved high levels of collection through retail chains.

Municipal solid waste collection sites for WEEE/E-waste have been found to be highly cost effective because these facilities require minimal upgrading. Drop-off and permanent collection points at retail outlets have also been found to be very successful. The operation of the collection systems described above requires storage and transport infrastructure, which is discussed in greater detail below.

The primary means for collection include permanent drop-off facilities, special drop-off or collection events, regular curbside pickup, door-to-door pickup and, as needed, scheduled pickup. The mechanisms for implementing any given method depend on the stakeholder responsible for the collection, which could be a government, retail entity or organisation, original equipment manufacturer (OEM) or other commercial entity. Table 4.1 summarizes collection mechanisms implemented by four stakeholders.

Table 4.1: Collection mechanisms implemented by various stakeholders[13]

Mode	Stakeholder			
	Government	**Retail**	**Commercial**	**Original equipment manufacturer (OEM)**
Permanent drop-off location	Co-located with offices or other hazardous waste drop-off locations	Located at retail stores	Located at entity	Location created in partnership with one of other three stakeholders
Special drop-off/ collection event	A one or two-day event in which waste generators drop off WEEE/E-waste at a location affiliated with the stakeholder			
Door-to-door pickup	Curbside pickup	N/A	Direct pickup, particularly from other commercial entities	Pickup via post or logistics company

4.2 WEEE/E-waste Take-back Architecture and System Management

Every recycling system has some form of management structure coordinating both monetary and material flows through the system. The system manager must be responsible for coordinating the actions of various stakeholders and enforcing the system's rules and regulations. The jurisdiction of the system manager is shown in Figure 4.1. System management responsibilities can include establishing and collecting recycling fees, contracting transport logistics firms and processors, setting and enforcing processing standards, enforcing sales bans (against non-compliant producers), and awareness raising to increase public awareness of and participation in the system. Systems differ in the range of transport, processing, and other options provided to those with financial responsibility.

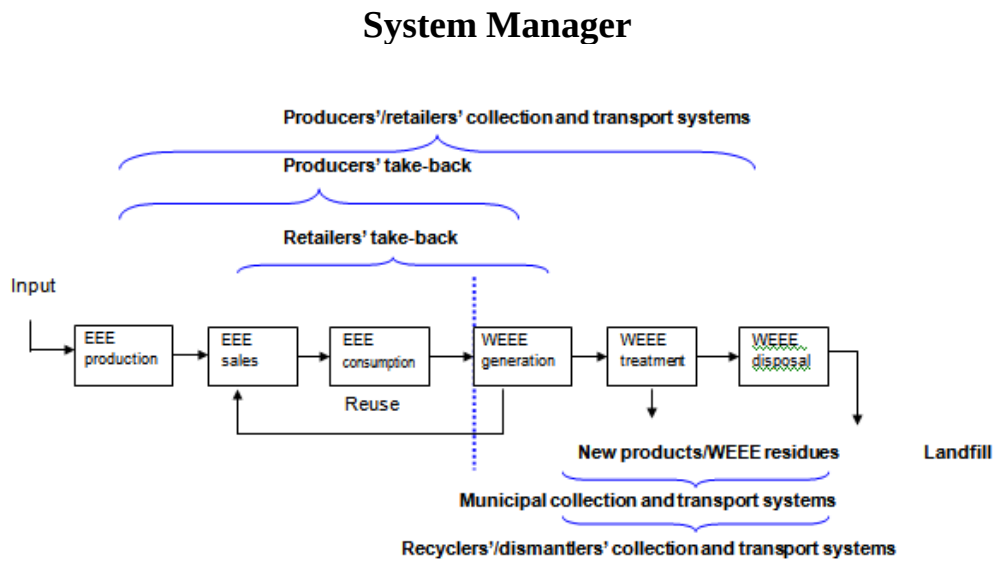


Figure 4.1 WEEE/E-waste collection systems[14]

[13] January 2009, *Solving the E-waste Problem (StEP) White Paper; E-waste Take-Back System Design and Policy Approaches*
[14] United Nations Environmental Programme (UNEP), Division of Technology, Industries and Economics, International Environmental Technology Centre, Osaka/Shiga, *WEEE/E-waste Inventory Assessment – Manual 2.*

The system can be managed by producers, recyclers, government entities, or third-party organizations. Each of these system managers is described below.

Government entities may be tasked with managing take-back systems. In particular, government agencies handling environmental affairs are typically given additional responsibilities associated with supervising system operations. These responsibilities might include collection fees, reimbursing collectors and processors, setting and enforcing treatment standards, enforcing sales bans on producers who do not comply with take-back system laws and approving processors and collectors to take part in the system. Government entities may be tasked with supervising a single take-back system for an entire region or multiple systems within a region.

A third-party organization (TPO) may also manage and administer a recycling programme on behalf of its members. The TPO's membership may be comprised entirely of producers of the items being recycled or it may also include government entities and other entities such as recyclers or collectors. Alternatively, it may be a single entity created by the government to manage the system. Activities carried out by TPOs and compliance schemes vary from country to country and depend on not only specific legislation requirements but also the services offered to members.

For example, Sweden requires all logistics and processors be hired through El-Kretsen, the Swedish E-waste system manager, whereas Germany has over 20 system managers each choosing its own logistics and processing providers. Thus, in Sweden, the electronics manufacturers, who are responsible for most of the E-waste system finances, must pay the charges determined by El-Kretsen if they wish to sell their products in Sweden, whereas in Germany, producers may choose to participate in any one of several E-waste recycling systems.

Some producers have established individual product stewardship programmes. Under such programmes, two different options exist. The first of these is a product recovery network that incorporates its own recycling infrastructure as well as refurbishment or recycling programmes to process its own appliances. The OEM has full control over operations and is directly involved in the entire process. The second option involves contracting service providers in order to collect and treat an OEM's proprietary discarded appliances. The level of engagement of the OEM is determined by the contractual agreement and can vary from full oversight of the process to insignificant engagement in how the contracted operations are performed.

Therefore, the overall WEEE/E-waste management system is comprised of three smaller systems:

1. A **collection system**, under which the mass of E-waste to be collected, the costs of operating collection sites and the costs and environmental impacts of transporting E-waste are a function of the geo-economic context and the chosen number of available collection and processing points;

2. A **processing system**, which calculates the amount of various materials recovered from the recycling process and the associated revenues and costs to the system;

3. A **management and financing system**, which accounts for the overhead costs of operating an E-waste system.

Within the system architecture, collection and transport systems can be optimized as shown in Figure 4.2. The processing model has already been described in *E-waste Manual 2*.

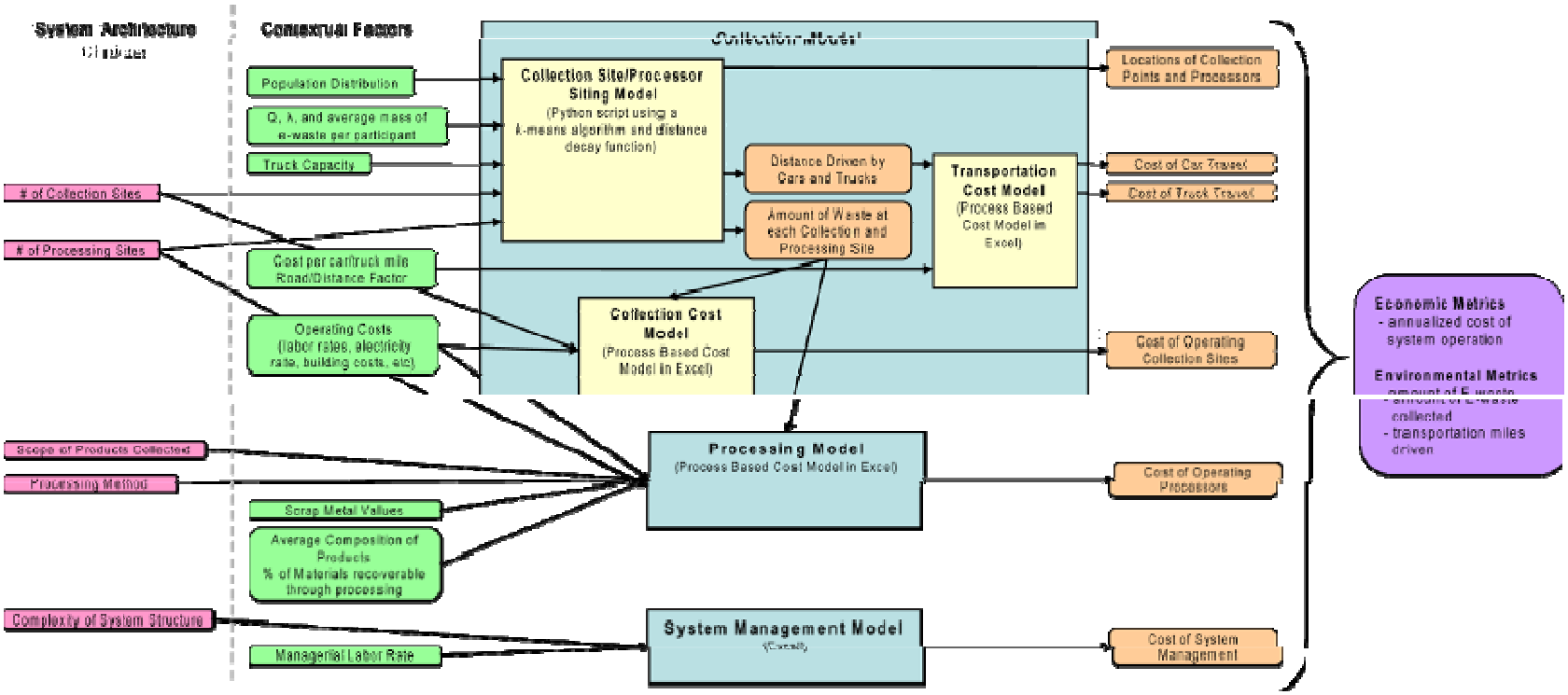


Figure 4.2: Collection and transport systems within an overall WEEE/E-waste management system[15]

[15] Fredholm, Susan, September 2008. *Evaluating Electronic Waste Recycling Systems: The Influence of Physical Architecture on System Performance*

4.3 Collection and Transport Infrastructure

The collection target and the transport required to achieve the target determine the most appropriate collection and transport infrastructure for a geographical region. Collection requires the establishment of WEEE/E-waste collection points and storage areas in a city or geographical region. Different criteria have been used in different countries to identify these locations. The steps involved in determining the location of collection points and storage facilities are given below.

Step 1: Study consumer behaviour to determine the most appropriate option(s) for collection points (e.g. retailer take-back collection centres, municipal collection centres or other options to be explored later through a pilot survey).

The literature cites that in Switzerland, transport distances of 35 to 50 km between WEEE/E-waste collection points (with the distance varying according to the type of collection point), weighted according to actual collection amounts at the various types of collection points, have been incorporated into the life cycle assessment calculation of WEEE/E-waste collection systems.[16]

Step 2: Calculate the WEEE/E-waste haulage capacity.

Step 3: Calculate the number of trucks or trailers of different capacities required to transport the WEEE/E-waste.

Step 4: Optimize the route and frequency of collection based on the degree of accessibility of the collection site(s).

The collection system is designed based on the collection targets, e.g. the amount and types of WEEE/E-waste collected and the distance travelled to bring it to the recycling centres. Because distance to the centres is a factor, a geographical boundary or catchment area for the system must be established. An assessment of the catchment area under “business as usual” (i.e. without any economic instruments) can be carried out by comparing the cost of collection and transport against the value of recoverable items from the targeted WEEE/E-waste.

Cost of collection and transport = Cost of collection centre + Cost of transport

The **cost of collection and transport** is the sum of the costs of establishing and operating the collection centre and of transporting the WEEE/E-waste. The **cost of collection centre** is calculated based on the costs of exogenous variables (capital costs and other cost factors), facility operations and packaging, using inputs from Annexure 4. The **cost of transport** can be calculated based on the ton per kilometer (or per mile) rate provided by transporters.

An example of assessing the **cost of collection** of WEEE/E-waste in the USA for cathode ray tube (CRT) TVs, CRT monitors and laptops is given below.

[16] Hishier, R. et al. Does WEEE recycling make sense from an environmental perspective? The environmental impacts of the Swiss take-back and recycling systems for waste electrical and electronic equipment (WEEE), *Environmental Impact Assessment Review* 25 (2005), 525-539

Cost of collection centre[17]

1. Exogenous variables

Average employee wage	$16	/hour	(LABORSTA 2008)
Benefits	82	%	(Cascadia 2003)
Working days	260	days/year	
Number of shifts	1	shifts/day	
Paid time	7	hours/shift	
Financial rate of return	15	%	
Equipment life	10	years	
Building life	20	years	
Price of electricity	$0.12	/kWh	(EIA 2006)
Price of building space	$1,000	/m^2	
Investment maintenance cost	5	%	
Overhead cost	25	%	

2. Facility operations

Capacity (actual amount processed)	100,000	kg
Equipment cost	$2,000	/station
Space requirement	100	m^2/station
Processing rate	300	kg/hr/station
Workers	1	workers/station
Power consumption	1	kW/station
Is equipment dedicated?	0	[1=yes, 0=no]
Forklift cost	$20,000	
Forklifts required per station	0.25	forklifts/station
Forklift power (electric)	2	kW/forklift
Is forklift dedicated?	0	[1=yes, 0=no]

3. Packaging

Gaylord cost	$10	/Gaylord	Take it Back
Gaylord capacity	200	kg	Network (2003)
Pallet cost	$8	/pallet	
Cardboard layer cost	$3	/each	
Pallet CRT capacity	27	/pallet	(FEC 2006)
Cardboard layers per CRT pallet	2	/pallet	
Pallet CPU capacity	45	/pallet	(FEC 2006)
Cardboard layers per CPU pallet	2	/pallet	
Shrink wrap cost	$0.03	/m	
Shrink wrap amount per pallet	17.48	m/pallet	

An example of an assessment of value of recoverable items from the targeted WEEE/E-waste can be found in Annexure 3.

[17] Fredholm, Susan, September 2008. *Evaluating Electronic Waste Recycling Systems: The Influence of Physical Architecture on System Performance.*

It has been observed that the greater the number of collection centres in a particular catchment, the greater the WEEE/E-waste collection efficiency will be. A cost-benefit analysis can be carried out by comparing the cost of collection and transport against the value of recoverable items from the targeted WEEE/E-waste.

Table 4.2 gives an example of the cost of collection and transport versus the value of recoverable items from the targeted WEEE/E-waste in India.

Table 4.2: Tentative recovery vs. total cost of procurement

No. of computers	Wt in kgs	Cost of transport			Processing cost of computer itself/ kg @ Rs.20 – 25	Total cost (Rs.) (cost of transport + Processing cost of computer itself)			Total recovery cost (Rs.)
		50 km	100 km	200 km		50 km	100 km	200 km	
2	54	400	800	1,600	1,080 – 1,350	1,480 – 1,750	1,880 – 2,150	2,680 – 2,950	2,797.20
10	270	400	800	1,600	5,400 – 6,750	5,800 – 7,150	6,200 – 7,550	7,000 – 8,350	13,986.00
50	1,350	600	1,200	2,400	27,000 – 33,750	27,600 – 34,350	28,200 – 34,950	29,400 – 36,150	69,930.00
100	2,700	750	1,500	3,000	54,000 – 67,500	54,750 – 68,250	55,500 – 69,000	57,000 – 70,500	139,860.00
Cost of transport, assuming a full load									
Small pickup truck @ Rs. 8				Mini truck @ Rs. 12		Canter truck @ Rs. 15			

Table 4.2 indicates that under a "business as usual" scenario in where there are no economic instruments applied, it is viable to have a catchment area with a radius of between 700 km and 1000 km. This assessment further indicates the price sensitivity for procuring WEEE/E-waste with respect to distance to be transported as well as quantity to be collected. Therefore, a pan-country WEEE/E-waste collection and transport system can be conceptualized based on the number of collection stations. In the case of B2B, it has been observed that the collection and transport system implemented by means of collection centres is very smooth. This is because business consumers try to minimize their transport costs when meeting the compliance requirement. However for B2C or household collection, a number of local factors need to be incorporated in locating the collection centres. The major factors affecting the location of the collection centres under B2C include the amounts and types of WEEE/E-waste generated, population density and distances to the collection centres.

Some models used to establish the number of WEEE/E-waste collection sites are grounded in the hypothesis that an individual's likelihood of participation decreases as distance to nearest collection site increases. The mathematical formula representing this phenomenon is given below.[18]

[18] Fredholm, Susan, September 2008. *Evaluating Electronic Waste Recycling Systems: The Influence of Physical Architecture on System Performance*

$$\textit{e-waste collected} = \underline{\textit{e-waste per participant}} \sum_{\textit{Population}} [\underline{\textit{max}}\ \textit{participation}\ e\text{-}e^{\lambda * \textit{distance}}]$$

or

$$\textit{e-waste collected} = \underline{\textit{e-waste per participant}} \sum_{\textit{town}} [\text{town population}\ \underline{\textit{max participation}\ e\text{-}e^{\lambda * \textit{distance}}}]$$

In this formula, "E-waste per participant" represents the average mass of E-waste each participant will bring to the collection site.

"Max_participation," or Q, represents the maximum likelihood, expressed as a percentage, that a member of the population will participate in the E-waste program. The long list of factors which can influence Q include among others the individual's age, education, likelihood of having E-waste, convenience of drop-off points and degree of public awareness of the system.

max _ participation = (% with E-waste) • (% participating if distance = 0)

λ (lambda) expresses the strength of the decay in participation as a function of distance

Distance is the length between an individual's home and his or her nearest collection site.

The **participation rate** of E-waste generators in an E-waste recycling system is the result of many factors governed by consumer behaviour. This behaviour can be determined through a pilot survey. The tentative locations to be used during the pilot survey can be fixed based on land use categories and on a mapping of the WEEE/E-waste trade value chain described in Annexure 5, prepared from *WEEE/E-waste Manual 2*. The results of the pilot survey can be extrapolated to arrive at the optimum locations for collection centres.

The cost benefit analysis should be carried out by comparing the total costs (based on system catchment, geographical area and system architecture) against the benefits to be accrued. A viability gap analysis is then undertaken for each item in order to assist in deciding the type of financial intervention.

4.4 Guidance Notes

Objective: The major objective of these guidance notes is to assist policy makers and other stakeholders in designing a collection and transport system within a take-back mechanism. This includes the design and selection of the collection channel, system architecture, system manager and system infrastructure within a geographical area.

Guidance procedure: The guidance procedure includes completing the following six steps.

Step 1: Fix the target of the WEEE/E-waste inventory to be collected and transported within each geographic area. This can be accomplished by using the outputs from steps 1 and 2 of the guidance procedures in chapter 2.

Step 2: Assess the WEEE/E-waste collection and transport infrastructure required to meet the target to be achieved.

Step 3: Assess the price sensitivity of procuring and collecting WEEE/E-waste with respect to the distance to the collection centre and the quantity to be collected under a “business a usual” scenario as given in Table 4.2. This can also be correlated to the capacity of the recycling facility in terms of the numbers of trucks required per day from the catchment area to feed the recycling facility.

Step 4: Carry out a pilot study in order to assess consumer behavior and address B2C collection and transport requirements.

Step 5: Assess WEEE/E-waste collection and transport infrastructure requirements based on the outputs of steps 3 and 4.

Step 6: Carry out a cost-benefit analysis of the infrastructure under a “business as usual” scenario and assess the viability gap for each WEEE/E-waste item. This will form the basis for developing econometric tools such as an end-of-life (EOL) tax or advanced recycling fee (ARF).

Chapter 5: Financing Schemes

5.0 Introduction

This chapter overviews the financing of existing WEEE/E-waste take-back activities as well as the allocation of economic responsibilities in countries having the potential to institute WEEE/E-waste take-back systems in the future. The means by which stakeholders financially contribute to different activities varies and there are a number of models that are applicable to the conditions in any given country. In addition to looking at these matters, this chapter will also provide guidance on assessing financial flows. It will furthermore provide guidance for assessing impacts on stakeholders, compliance with legislative requirements and economic and financial effectiveness. Major guidance on each model will be provided concerning the design of a financial or economic instrument, along with its application within the model. The economic or financial instrument may include various options. These options include the actual costs of recycling, the projected costs of recycling for each category and cross subsidization, considering WEEE/E-waste from information and communications technologies, and white goods and brown goods.

5.1 Financing Mechanism for WEEE/E-waste Take-back Systems

The financing mechanism for WEEE/E-waste take-back activities and for the allocation of economic responsibilities along the material chain is complex and challenging both in countries with existing take-back systems and countries still in the process of developing such systems. This mechanism includes designing and operating the financing of the system architecture of downstream WEEE/E-waste activities and the allocation of economic responsibilities to different stakeholders. The activities along the downstream chain include waste generation, collection, transport, treatment and disposal. Three main stakeholders—society, consumers and producers—share the economic responsibility for financing WEEE/E-waste management.

- Society: WEEE/E-waste management systems may be financed by the entire society (i.e. through taxes), especially when government organizations maintain control over operations.

- Consumers: This is based on the “polluter pays principle,” where the polluter is recognized as the person responsible for the proper treatment and disposal of an end-of-life appliance. It can also be argued that even though a producer may bear financial responsibility, consumers ultimately pay the end-of-life costs in the form of a higher purchase price, regardless of whether separate up-front external charges are paid at point of sale.

- Producers: This is the implementation of the “extended producer responsibility” principle to various degrees. It should be noted that although producers ensure the financing of systems, internalization of costs in the product price may take place either through reductions in producers’ sales margins, resulting in the financial impact being fully borne by producers, or through higher sales prices, resulting in the financial impact being borne indirectly by consumers.

Of the three approaches mentioned above, a combination of the “consumers” and “producers” approaches is currently in use in the majority of countries implementing WEEE/E-waste management. This combination integrates the “polluter pays principle” and “extended producer responsibility” to form the basis for designing the compliance scheme. Different financing models

currently using this approach are described below.

5.2 Financing Models and Funding for Supply Chains

Financing models of WEEE/E-waste take-back systems are grounded in basic principles for financially managing compliance schemes in general. As a basic principle, these compliance schemes are designed to minimize the costs of operation while meeting the compliance requirements stipulated in the regulations, thereby meeting environmental goals while also recovering items of economic value. Under this principle, these schemes define financial flows and linkages between stakeholders in the flow, assess the impact on stakeholders, comply with legislative requirements and assess the scheme's own economic and financial effectiveness.

Generally speaking there are said to be five generic financing models in operation around the world.[19] These models are (i) the compliance cost model; (ii) the compliance cost visible fee model; (iii) the reimbursed compliance cost model; (iv) the recycling fee model and (v) the end-of-life model. Each model funds its own supply chain using different instruments. The flow of funds generated through these instruments covers different parts of material flow chain involved in WEEE/E-waste management. Each of these models is described below.

5.2.1 Compliance Cost Model

In the compliance cost model, producers finance activities in the system. The model incorporates their direct involvement as stakeholders in the financing of the system. A producer bears the costs by joining a compliance scheme, financing their own take-back system or product stewardship program while also participating in means to address historical and orphan waste. The salient features of the compliance cost model are given below.

1. Producers join a compliance scheme and pay money to cover the costs of take-back and recycling programs and all other services included in the scheme.
2. Costs may be unit-based or weight-based. They are assessed by the scheme on the basis of actual recycling costs or estimations of future costs.
3. Compliance costs are assessed based on the fees charged by treatment plants and logistics partners.
4. The contractual agreements producers enter into under the compliance scheme generally contain provisions for cost revisions (quarterly, annually or over other timeframes) and specific provisions for treating historical and orphan waste.

Generally, the burden of financing historical and orphan waste treatment in any given year is shared collectively by the producers who are active in the market during that year. The financial flows in this type of WEEE/E-waste management system are mapped in Figure 5.1, with the orange line indicating the financial flow.

[19] United Nations University/StEP Initiative, January 2009. *E-waste Take-Back System Design and Policy Approaches* (Solving the E-waste Problem (StEP) White Paper)

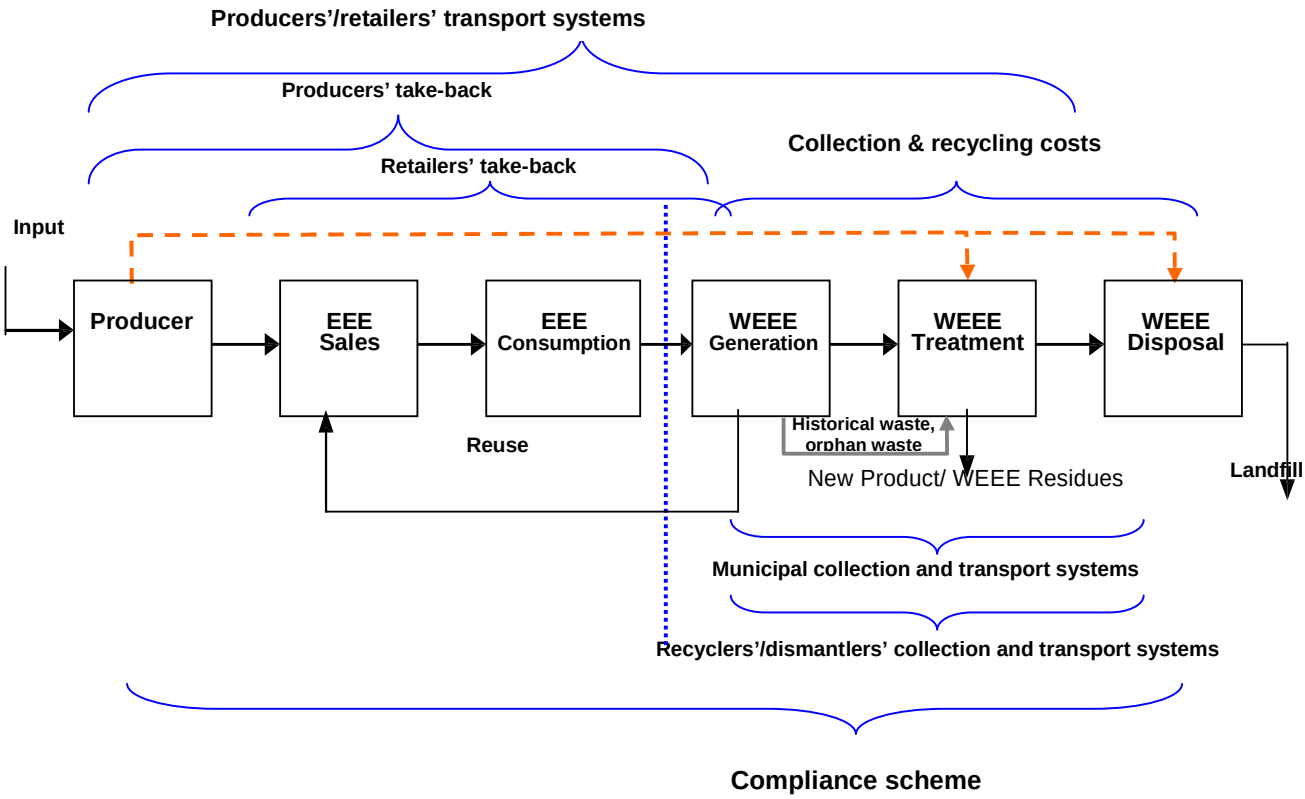


Figure 5.1: WEEE/E-waste compliance cost model

5.2.2 Compliance Cost and Visible Fee Model

The compliance cost and visible fee model uses key features of the compliance cost model described in section 5.2.1 while also utilizing an economic instrument. The model is characterized by involving consumers along with producers as stakeholders in the financing of the system. These stakeholders bear the costs by joining a compliance scheme and financing their own take-back system or product stewardship program while also participating in means to address the issue of historical and orphan waste. This model uses the economic instrument of a "visible fee" to generate revenues from final users. This fee is used to cover historical and orphan waste management costs. The salient features of the compliance cost and visible fee model are given below.

1. The model combines two different financial mechanisms for the two separate flows of appliances, namely new and historical waste.
2. The compliance cost and visible fee model includes direct involvement of producers as stakeholders in the financing of the system.
3. Producers are allowed to share financial responsibility with consumers to cover the costs of historical waste.

The mapping of these features depicting the financial flows in the WEEE/E-waste management system is shown in Figure 5.2. The orange line in Figure 5.2 indicates the financial flow from the producers, while the green lines show financial flows arising through the economic instrument.

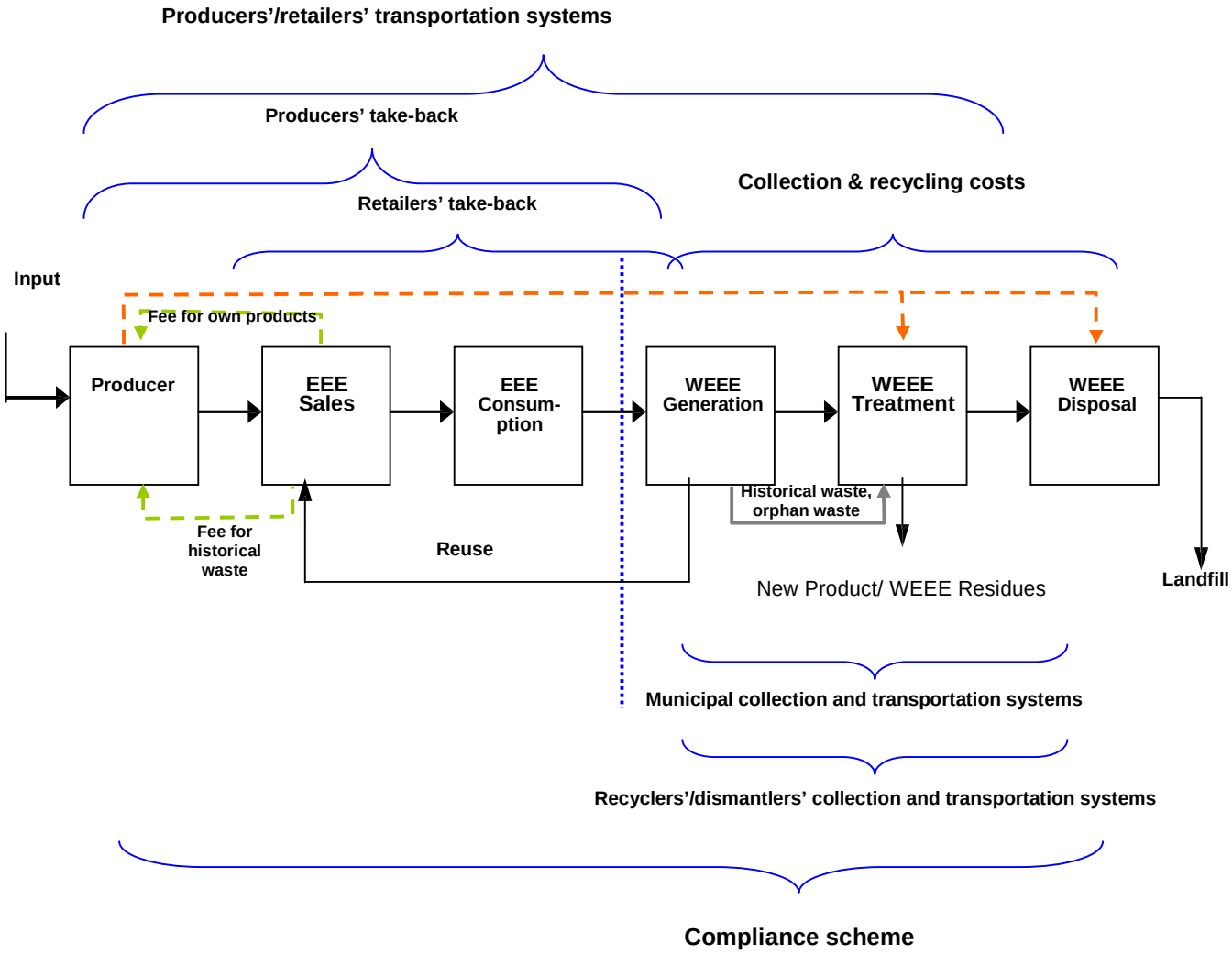


Figure 5.2: WEEE/E-waste compliance cost and visible fee model

5.2.3 Reimbursed Compliance Cost Model

The reimbursed compliance cost model uses salient features of the compliance cost model described in section 5.2.1 as well as usage of an economic instrument. The model is characterized by involving consumers along with producers as stakeholders in the financing of the system. These stakeholders bear the costs by joining a compliance scheme and financing their own take-back system or product stewardship program while also participating in means to address historical and orphan waste. This model uses the economic instrument of a "visible fee" to generate revenues from final users. This fee is used to cover historical and orphan waste management costs. The salient features of the reimbursed compliance cost model are given below.

1. Producers pay for compliance schemes upfront when placing appliances on the market.
2. Producers are reimbursed for the costs through a visible fee paid by consumers at the time of purchase.
3. Consumers finance the entire system by paying the visible fee.

The mapping of these features depicting the financial flows in the WEEE/E-waste management system is shown in Figure 5.3. The olive line in Figure 5.3 indicates the financial flow from the consumers, while the light green lines show financial flows arising through the usage of the visible fee.

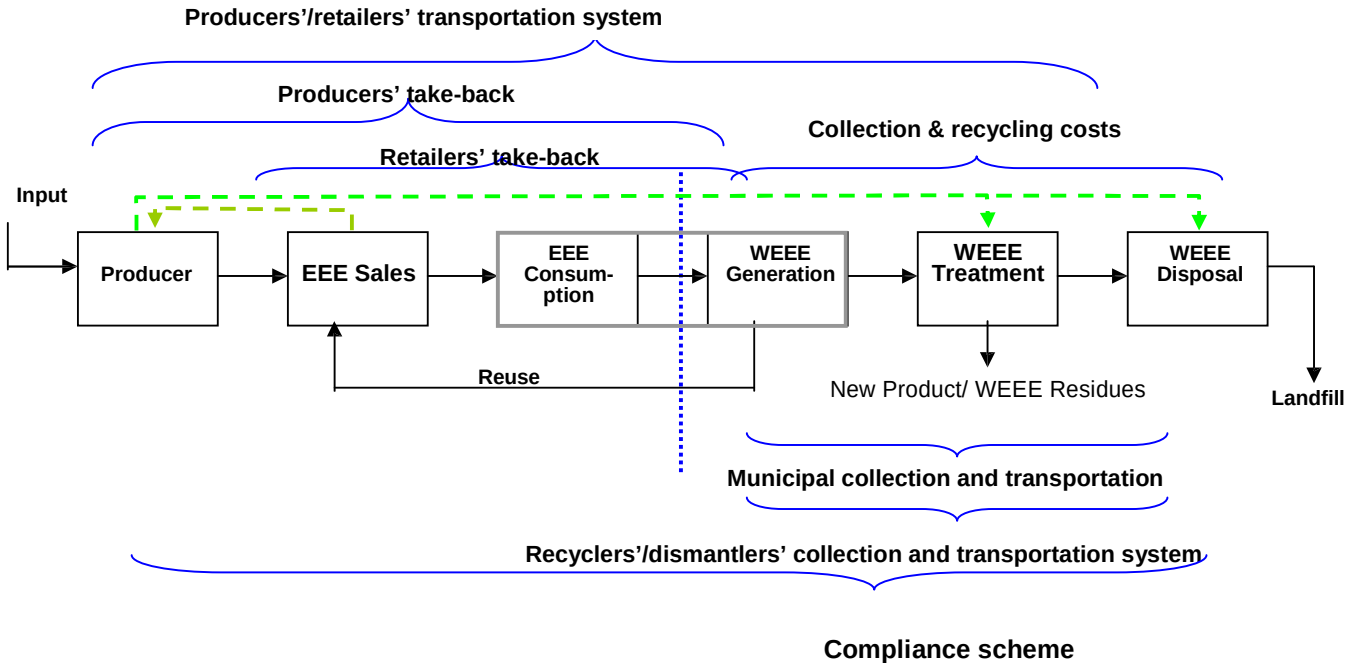


Figure 5.3: WEEE/E-waste reimbursed compliance cost model

5.2.4 Recycling Fee Model

The recycling fee model does not involve producers in the financing of WEEE/E-waste management. The recycling fee, which may also be called a recovery fee, is paid by consumers when they buy new equipment and is used to finance the cost of WEEE/E-waste management. Therefore, consumers bear the entirety of the costs for managing WEEE/E-waste. The salient features of the recycling fee model are given below.

1. The recycling fee may be used to collect funds for future treatment of the appliances currently being sold.
2. Each appliance's future recycling cost is estimated in advance and paid up-front by the consumer at the time of purchase.
3. Recycling costs currently arising are covered by the fees paid up-front for appliances currently being sold.
4. The main difference between the two options is that in the first case the amount paid by the consumer represents an upfront estimation of costs arising in the future, whereas in the second case, the fees associated with the appliances currently being sold contribute to the financing of current recycling costs.

The mapping of these features depicting the financial flows in the WEEE/E-waste management system is shown in Figure 5.4. The green line in Figure 5.4 indicates the financial flow from consumers arising through an economic instrument.

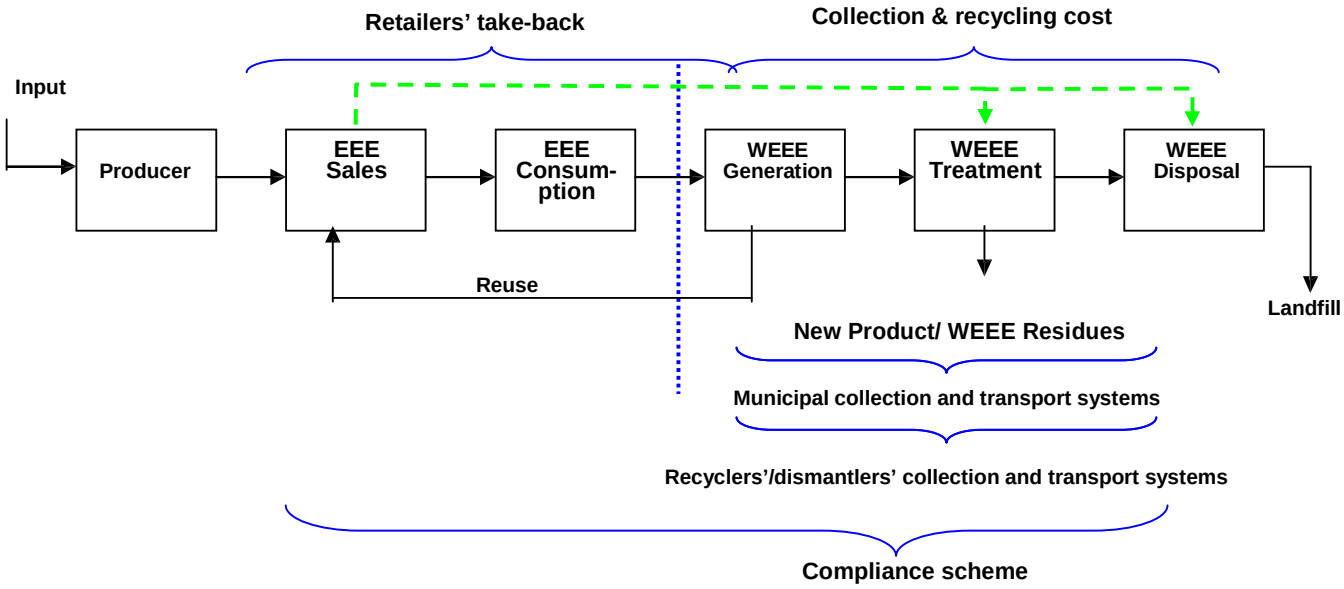


Figure 5.4: WEEE/E-waste recycling fee model

5.2.5 End-of-Life Fee Model

The end-of-life (EoL) fee model includes payment of an end-of-life fee by generators of WEEE/E-waste (i.e. the last owner of a product who decides to recycle it) to an entity who assumes responsibility for recycling the EoL product. The fee covers collection and recycling costs. The mapping of these features depicting the financial flows in the WEEE/E-waste management system is shown in Figure 5.5. The green line in Figure 5.5 indicates the financial flow from the WEEE/E-waste generators to entities responsible for recycling.

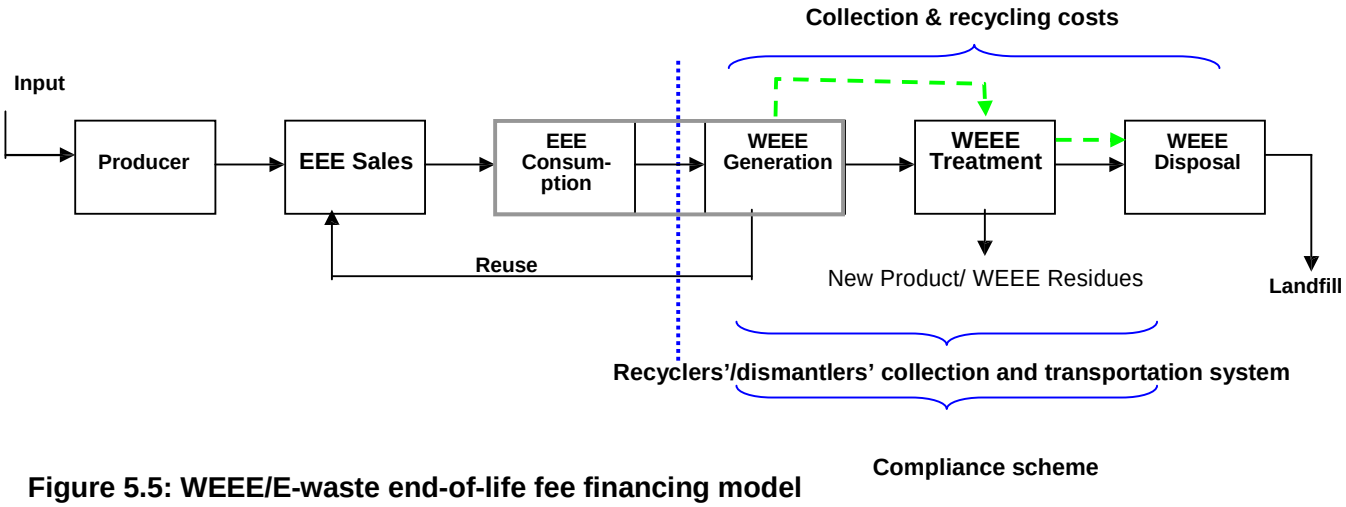


Figure 5.5: WEEE/E-waste end-of-life fee financing model

5.3 Fees and Other Economic Instruments

A number of policy instruments broadly classified under administrative, economic and informative instruments are being used under extended producer responsibility regimes in different countries. The economic instruments are derived from the stakeholders of the society, producers and consumers sharing the economic responsibility in some way. The major criteria are who is to pay what, at what point in the material flow chain and when. These instruments may utilize material/product taxes, subsidies, advance disposal fee systems, deposit-refund systems, and upstream combined taxes/subsidies.

An analysis of the above models indicates that the development of economic instruments and their internalisation are major issues in any WEEE/E-waste management system. The key features are the types of products—specifically, whether the products are identifiable or non-identifiable—and whether they were placed on the market before or after the date on which the EPR regulation came into force. Products A & B are new products, while C & D are historical products. Product D as shown in Table 5.1 is the unusual case of an item that is both historical and an orphan product.

Table 5.1: Types of products[20]

		The Producer of a product	
		Identifiable	Non-Identifiable
Put on the market	After	A	B
	Before	C	D

Table 5.2 summarizes the economic responsibility implemented through the economic instruments and their structure for each of the models overviewed above.

Table 5.2: Financing models and economic instruments

No.	Model	Economic instrument (new + historical + orphan)	Fee structure
1.	Compliance cost model	Fee (recyclers & logistics partner)	Compliance cost = fee (recycler) + fee (logistic partner)
2.	Compliance cost and visible fee model	Visible fee	Compliance cost = visible fee for new WEEE/E-waste + visible fee for historical & orphan product
3.	Reimbursed compliance cost model	Visible fee	Compliance cost (upfront) = reimbursed costs through visible fee from end users
4.	Recycling fee model	Recycling fee	Recycling cost (future/current) = collection fee + recycling fee (upfront)
5.	End-of-life fee model	End-of-life (EOL) fee	EOL fee = collection fee + recycling fee

The development of the fee structure and its point of application within the material flow chain are key to its internalization. If the producer is the key stakeholder, then the compliance cost could be paid upfront, with cost recovery either upfront or reimbursed depending upon the

[20] Manomaivibool, Panate et al., 2009. Table 1, Types of products, Extended Producer Responsibility in a Non-OECD Context, *The Management of Waste Electrical and Electronic Equipment in Thailand*

regulatory framework and the acceptance by other stakeholders. Over the years, some of the efficient WEEE/E-waste management systems in Europe have transitioned from models using end-of-life fees to those using visible fees. The management of funds generated from product fees is an important driver of a WEEE/E-waste management system. Some of the principles defining the fee structure and the fund management framework are given below.

1. Effectiveness: The fees collected and the funds generated should fund the management of the WEEE/E-waste while also meeting environmental goals.
2. Self-sufficiency: Revenues generated from product fees should cover the implementation costs.
3. Fairness: The fee structure should avoid free riders. It should not render the EEE sector uncompetitive compared to the international market.
4. Simple: The fee structure should be simple to implement.
5. Viable: The fee structure should be able to be implemented for products covered under the regulation.

The structure of the economic instrument, e.g. a product fee, is based on the above principles. It is a function of three types of costs:

- Buy-back cost
- Technical cost
- Administrative cost

All three types of costs are calculated independently and then added to arrive at the product fee.

Product fee = buy-back cost + technical cost (collection, transport, dismantling & recycling, disposal) + administrative cost

Mathematically, the relationship can be represented as:

F (product fee) = f (buy-back cost) + f (technical cost) + f (administrative cost)

Assessment of the 'buy-back' cost

Some of the salient features that assist in assessing buy-back costs are given below. This list has been developed based on existing WEEE/E-waste management systems in both developed and developing countries.

1. In the majority of developed countries, buy-back costs are nil and the old products are exchanged for new products free of charge. Buy-back costs are a function of consumer behavior.
2. In developing countries/countries in transition, the buy-back rate is a major issue under both B2B and B2C scenarios, because the consumer receives money from the WEEE/E-waste procurer. The procurer could be an entity in either the formal or the informal sector. Therefore, in order to make the take-back system work, there is a need for a paradigm shift in consumer behavior from "money receiver" to "money provider".
3. Under B2B, fulfilling regulatory compliance is a major driver for supplying WEEE/E-waste to the WEEE/E-waste compliance scheme.
4. For B2C involving households, the type of collection system implemented is one of the major drivers affecting the discarding of WEEE/E-waste.
5. The trade-off between buy-back rates and the location of the collection centre or the provision of door-to-door pick up can be established through consumer/household surveys.

Therefore, there is a need to carry out a consumer/household survey. The type of survey is very important because the paradigm shift in consumer behavior needs to be assessed. This means that the survey could be based on the fundamental principles of "willingness to accept" within the existing situation and "willingness to pay" under future conditions. Since the informal sector is competing with the formal sector in buy-back scenarios under existing conditions, there is a need to understand consumers' "willingness to accept" buy-back rate. This will give an idea of the extent to which the consumer is ready both in terms of convenience for returning WEEE/E-waste and the buy-back rate in the context of meeting the WEEE/E-waste collection target fixed under the EPR regime. This will help in designing the take-back scheme during the transition period for implementing EPR-based regulations. Once the take-back system stabilizes, a consumer survey based on "willingness to pay" can be carried out to institutionalize the take-back mechanism over the long term. The salient features of the design of the consumer survey based on the "willingness to accept" are given below.

1. The major factors to be considered when designing the consumer/household survey include income group analysis and the revised buy-back rate as compared to the current buy-back rates offered by informal sector with options of drop off, door-to-door pick up service, and return to retailers/distributors.
2. The survey methodology can be based on how extensively the survey is to be carried out, with the sample size based on the percentage of WEEE/E-waste in a geographical region, using a structured survey instrument. One example of this comes from Thailand, where the Contingent Valuation methodology was changed to the Choice Experiment method after conducting a survey in which respondents were given the following five options.
    Option 1: Drop-off without receiving any payment
    Option 2: Pick-up without receiving any payment
    Option 3: Drop-off and receive payment (x amount)
    Option 4: Pick-up and receive payment (y amount, lower than x)
    Option 5: Not willing to return via any option
3. The factors expected to influence households' willingness to accept the proposed buy-back payment include demographic variables (age, gender, education level, household income, residence, family size); specific knowledge, skills, habits and other factors such as the level of knowledge and exposure to hazardous substances from WEEE/E-waste; level of participation in waste sorting and collection activities; vehicle ownership and distance to potential drop-off points (workplaces, shopping centres, markets, etc.).
4. The survey instrument can be designed to elicit information such as the following:
    - Background information
    - Current EEE possessed, WEEE/E-waste stored and past behavior of WEEE/E-waste disposal (e.g. stored at home without use, thrown away with other waste, returned old item upon buying new one in exchange for a discounted price, gave to relatives/others, sold to junk shops)
    - Questions on socio-economic profile
    - Questions on participating in a buy-back program that would address options 1 to 5 above, e.g. at what price (or range of prices) drop-off and pick-up would be acceptable. An example of the response received in Thailand regarding this aspect of the survey instrument is given in Table 5.3.

Table 5.3: WEEE/E-waste items and proposed buy-back rates[21] (Thai baht/unit)

WEEE/E-waste item	Low bids		Medium bids		High bids	
	Drop-off	Pick-up	Drop-off	Pick-up	Drop-off	Pick-up
1. Television sets						
• CRT, small (≤21")	80	50	120	70	180	110
• CRT, large (>25")	100	60	150	90	230	140
• LCD/plasma, small (≤32")	120	70	180	110	270	160
• LCD/plasma, large (>33")	150	90	230	140	350	210
2. Digital cameras/camcorders	40	20	60	40	90	50
3. Portable media players	10	6	20	12	30	20
4. Printers & facsimiles	60	40	90	50	140	80

Assessment of technical costs (collection, transport, dismantling & recycling, disposal)

Technical costs include the cost of collection, transport, dismantling, recycling and disposal. Calculations of collection & transport costs have been described in chapter 4. Calculations of dismantling and recycling costs can be found in UNEP's *E-waste Manual 2*. Ideally, the revenue generated through material recovery from recycling should be deducted from the cost of recycling if the right to own the materials remains with recycler.

Assessment of administrative costs

Administrative costs are the costs incurred by the system manager to manage WEEE/E-waste, which include costs related to fee collection, fund administration and auditing. This figure varies from country to country and can be arrived at via consensus in a given country context. As examples of this, survey studies in Thailand indicate the range to be between 1% to 3% of the taxes/fees collected, whereas in India this could vary between 3% and 5%, without considering the salaries or wages of personnel at the administering agency.

The recovered product fee will go into a WEEE/E-waste management fund, which could be managed by a producer responsibility organisation (PRO), an association of producers/retailers, etc., a government agency or a combination of both public and private entities. Financial responsibility will be determined in accordance with the EPR regulation in the country as described in chapter 3. Some of the major features, factors and inferences related to the administration of fees and fund management are given below.

1. The flow of buy-back rates to the consumer is the key to collecting WEEE/E-waste successfully. Therefore, the agency interfacing between consumers and receivers responsible for transferring the buy-back rate has an important role. If this agency is not transferring the agreed buy-back rate to the consumer then there will be "leakage" of WEEE/E-waste into the informal sector. To prevent such leakage, buy-back rates and

[21] Household Surveys on WEEE Management and Buy-back Program, Seminar on the Progress of Study Project on Criteria and Fees of Thailand's WEEE Management, 18 November 2009, Bangkok.

accounting rules must be uniformly harmonized across the entire material flow chain and with partners for regulated products so that buy-back partners and other partners can be strictly monitored and audited.

2. It is important for auditors to verify that the amount of incoming WEEE/E-waste corresponds with the amount of WEEE/E-waste going to authorized partners, specifically from retail/buy-back centres to registered transfer stations/collection centres and from there to dismantlers/recyclers. Transport companies' adherence to licensing, inspections and the manifest system can be checked under existing laws.
3. The visibility of product fees is an important aspect of the take-back system. While fees with a high degree of visibility can raise consumer awareness, it can also lead to public resistance against environmental policies. Consumers might have little awareness of the relationship between the product fees and the buy-back rates. Since the buy-back rates will naturally be lower than the product fees being collected, this lack of understanding might give rise to discontent and mistrust among the public. Moreover, visible fees may also be perceived as price fixing that allows industries to shift the whole burden onto consumers, especially in the very early stages of the take-back system. Disclosure of the fees and their components, needs to be strategically agreed between system managers, producers and the regulatory agencies.
4. The major challenges perceived within the management of funds include the proper handling of negative balances in the short run and surpluses over the long run. An initial negative balance may result from limited success in WEEE/E-waste collection or hibernating WEEE/E-waste, or may be due to inventory collected by collectors seeking to get the maximum amount of subsidies from the fund. Surplus funds may arise because of inaccurate target setting within the WEEE/E-waste collection scheme and growing markets for EEE products. The fund balance in a particular year may be calculated based on input EEE products placed in the market and the WEEE/E-waste collected in that year, using the formula below.

$$FB_t = \sum [(F_i \times QP_{it}) - (S_i \times QC_{it})]$$

   Here, FB_t is the fund balance in the year t;
   F_i is the fee for product i;
   QP_{it} is the quantity of new shipments of product i in year t;
   S_i is the subsidy for WEEE/E-waste item i; and
   QC_{it} is the quantity of WEEE/E-waste item i collected in year t.
5. Negative balances can be addressed by phasing the take-back implementation as the present phase, the preparatory phase or the implementation phase. During the preparatory period, an end-of-life fee in accordance with the end-of-life model or a discounted product fee can be levied to replenish the fund to address the implementation phase. This was used in Switzerland during the initial years of its take-back system. Alternately, the government can levy a tax or use a combination of both taxes and fees during this period to replenish the fund.
6. Surplus money can be reinvested in awareness campaigns to increase collection rates, in capacity building or in other environment-related activities.

An example of the proposed WEEE/E-waste management system has been developed in Thailand as shown in Figure 5.6.

The development and use of an economic instrument require phasing, the timing of which should match the implementation of the EPR-based regulations. The phasing of the implementation period varies with the circumstances in each individual country and with the strategy to address WEEE/E-waste before it becomes "uncontrollable" waste.

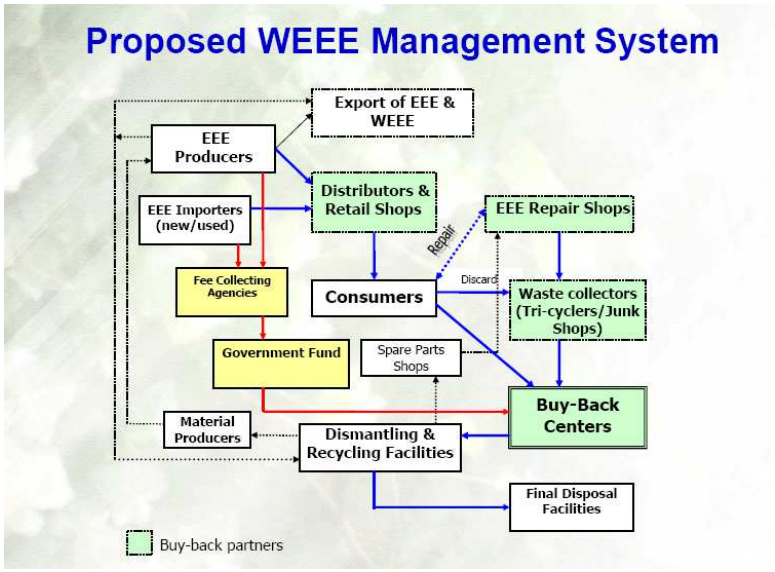


Figure 5.6: Proposed WEEE/e-waste management system in Thailand[22]

In Figure 5.6, the red line indicates financial flows while the blue lines represent product waste flow with the participation of distributors and retail shops, EEE repair shops, waste collectors and buy-back centres as buy-back partners. Figure 5.6 also shows the involvement of fee collecting agencies and the creation of government funds to manage the WEEE/E-waste management systems.

5.4 Guidance Notes

Objective: The major objective of these guidance notes is to assist policy makers and other stakeholders in designing the financing mechanism within a take-back system, identifying the model to be followed, designing the fee or other economic instrument and determining the phasing for implementation. The major guidance for each model will be provided for the design of the financial or economic instrument, along with its application within the model. The financial or economic instrument may incorporate multiple options to address the actual costs of recycling, the projected costs of recycling for each category and cross subsidization.

Guidance procedure: The guidance procedure includes completing the following nine steps.

Step 1: Identify the responsibilities and their allocation under regulatory requirements as an outcome of following steps 1 to 14 in chapter 3.

Step 2: Map the output of step 1 to the five models described in section 5.2 and identify the model(s) that may be applicable in a given country. Identify the economic instrument that could be used, such as a tax, a fee or a combination of both.

Step 3: Calculate the buy-back costs through the following activities.

- Review existing literature on household surveys that address the willingness to pay and the willingness to accept and examine the survey methodology. Fix the

[22] Surin Aree, July 2010. Presentation at "WEEE Management in Thailand, Regional Workshop on WEEE/E-waste Management," held by UNEP DTIE-IETC in collaboration with the Global Environment Centre Foundation (GEC)

sample size based on the amount of WEEE/E-waste generation and the population profile in the identified area.

- Set assumptions on factors influencing households' participation in WEEE/E-waste buy-back schemes, such as the effect of different buy-back rates on participation and the various effects of options 1 to 5 mentioned in section 5.3.
- Design a survey instrument or questionnaire for identifying consumer behavior based on socio-economic profile, current EEE possessed and WEEE/E-waste stored, past behavior regarding WEEE/E-waste stored, policy scenarios, bidding prices and elicitation formats.
- Pilot test the questionnaire and fine-tune it to elicit maximum response.
- Plan the survey and collect data.
- Analyze the data to estimate the buy-back rates by using the template given in Table 5.4.

Table 5.4: WEEE/e-waste items and proposed buy-back rates (currency/unit)

WEEE/E-waste item	Low bids		Medium bids		High bids	
	Drop-off	Pick-up	Drop-off	Pick-up	Drop-off	Pick-up

Step 4: Develop an economic instrument, such as a product fee based on the buy-back cost, technical cost and administrative cost.

- Arrive at a range of buy-back rates for each WEEE/E-waste item.

Step 5: Calculate the technical costs. Use the outputs of steps 1 to 6 in the guidance notes in chapter 4 to calculate collection and transport costs as part of the technical costs. Calculate dismantling/recycling and disposal costs following the guidance given in *WEEE/E-waste Manual 2*.

Step 6: Estimate the administrative costs based on similar activities already underway in a country with similar circumstances.

Step 7: Organize a workshop with different stakeholders, including producers, recyclers, collectors, logistics providers, government agencies, and municipalities in order to discuss the outputs of steps 3, 4 and 5 and arrive at consensus on the economic instrument to be introduced, such as a fee, a tax or a combination of the two. Identify the fund flow and arrive at consensus in identifying the fund manager.

Step 8: Develop an action plan for institutionalising the WEEE/E-waste take-back system starting from the base year, including both a preparation period and an implementation period. Determine how the selected economic instrument is to be used during the preparation and the implementation phases.

Step 9: Develop monitoring and auditing requirements for each category of stakeholder along the material flow chain. Auditing may include product audits, financial and accounting audits and collection and transport audits.

Chapter 6: Case Studies

6.0 Introduction

Knowledge of WEEE/E-waste management, especially the take-back mechanism in both developed and developing country contexts, is important for practitioners as they design a WEEE/E-waste management project. This chapter presents two case studies, one from Europe and the other from a developing country, describing each aspect of the WEEE/E-waste take-back mechanism. These case studies can be read in parallel to chapters 1 to 5 in order to understand the specific elements described in each chapter.

6.1 Case Study 1: Existing Financing Mechanism of WEEE/E-waste Management in Europe

The financing mechanism of the WEEE/E-waste management system in Europe evolved to reflect experience gained over years of operation. It covers each aspect of the WEEE/E-waste management, including collection, transport and the treatment costs of WEEE/E-waste. Typically, this system follows the compliance cost and visible fee model and the reimbursed compliance cost model for financial management. The variations of these models used in different EU countries that demonstrate the elements defined in sections 5.2, 5.3 and 5.4 of chapter 5 are described in the following sections.

6.1.1 Financing Models

The entire financial model in Europe is based on extended producer responsibility integrated with the polluter pays principle, whereby the producing organizations are responsible for WEEE/E-waste take-back and treatment. The financial model is an integrated model consisting of WEEE/E-waste collection, transport and treatment and the end user pays a product fee. The conceptual guidance for financing each of the schemes in the EU has been provided by EU Directive. These guidance features as per EU Directive are given below. The basic features of schemes underway in non-EU European countries are similar to those found under the EU Directive.

1. Producers are responsible for the costs of picking up WEEE/E-waste from collection facilities and for refurbishing waste products for reuse or for recycling and recovery.
2. For historical products—products C&D in Table 5.1, chapter 5 (i.e. those placed on the market before August 13, 2005)—the costs of waste management are to be shared by all producers in existence at the time those costs are incurred. These producers may impose a separate visible fee (one that is explicitly designated, perhaps on new items' price tags) to cover these costs for eight years (ten years for large household appliances).
3. End users other than households may be made partly or totally responsible for financing the management of historical products.
4. For new products whose producer is known—product A in Table 5.1, chapter 5 (i.e. those placed on the market after August 13, 2005)—producers have individual responsibility and must pay the cost of managing their own products. They can do this through programs set up by individual companies or through participation in collective schemes.
5. No visible fees are permitted to fund the management of waste from new electrical and electronic products.
6. When producers place a new product on the market, they must provide a financial guarantee that waste management of the product will be paid for. Producers can get

waivers on this guarantee by participating in a producer responsibility organization (PRO), enrolling in recycling insurance, or setting up a special bank account for this purpose.

The information and communications technology (ICT) sector and the brown and white goods sectors have different financial models for WEEE/E-waste management, namely the compliance cost and visible fee model and the reimbursed compliance cost model. Each product category prefers the model suitable to its own consumption and discard pattern. The salient features are given below.

1. Brown and white goods producers are comfortable with the schemes set up to address brown and white goods product categories, while the IT producers are comfortable with the schemes set up to address IT goods.

2. White goods firms, and to a lesser extent, consumer electronic firms, generally support visible fee schemes such as Recupel and NVMP, and are less supportive of arrears-based market share schemes such as ICT Milieu.

3. ICT firms prefer arrears-based schemes to visible fee schemes.

4. ICT firms also tend to favor competitive compliance systems, rather than national schemes, as they perceive that costs provided by different compliance systems will be competitive and will be better managed.

This indicates that the differences in charging fees under two models reflect differing preferences for dealing with historical (products C&D) and orphan (products B&D) WEEE/E-waste. ICT firms have fewer historical liabilities due to the higher obsolescence rate of ICT products in comparison to brown and white goods.

6.1.2 Fee Structure

The fee structure includes a number of options. These options could be applied separately to individual product categories or a single option could be applied to all product categories. Table 6.1 lists examples of fee structures in some European countries where collection efficiency is high.

Table 6.1: Established European WEEE schemes (EU/EEA): Flexibility of cost models[23]

Scheme	Number of Cost Models	Type of Cost Allocation
Recupel (Belgium)	1	Fixed Fee Model – All categories
NVMP (The Netherlands)	1	Fixed Fee Model – Certain categories excluded
ICT Milieu (The Netherlands)	1	Debiting Model – ICT Products: Real costs are calculated on a month-by-month basis and divided amongst members on a market share basis, calculated monthly.
EI-retur (Norway)	3	Fixed Fee Model (EE Bransjen): According to type and volume of products placed on market (brown goods). ICT Model (IKT Retur/IT Retur): Actual costs are calculated month by month and divided amongst members on a current market share basis.

[23] United Nations Environmental Programme (UNEP), Division of Technology, Industry and Economics, International Environmental Technology Centre, Osaka/Shiga. *WEEE/E-waste Management Manual, Volume 2*

Scheme	Number of Cost Models	Type of Cost Allocation
		Fixed Fee Customer Model: White goods (Hvitevareretur). A fee is levied by customs on imports and passed to PROs.
EI-Kretsen (Sweden)	3	Debiting Model – Preliminary Cost: A preliminary cost (per unit, per kg or as a percent of sales values) is fixed for the year. These fees are compared against actual costs at year end and the difference is settled. Debiting Model – ICT Products: Real costs are calculated on a month-by-month basis and divided amongst members on a market share basis, calculated using the preceding year's figures. Costs per unit will therefore vary on a month-by-month basis. Other Debiting Model: Special fixed-fee debiting models have been developed for specific product groups such as light bulbs (2500 SEK per year).
SWICO (Switzerland)	2	Fixed Fee Model – ICT Products: Fixed fee tariff banded according to sales price. There are 12 fee bands, with no fee for products priced under 50 CHF. Fixed Fee Model – Consumer Electronics/Photographic: Fixed tariff according to product category. There are five fee levels, with no fee for products priced under 50 CHF.

An analysis of Table 6.1 indicates:

1. Fees are levied based on product category and volume;

2. If the fee is the same for all categories, then a level of cross-subsidization across product categories can be anticipated, since different product categories will have different buy-back, technical and administrative cost components. It also indicates usage of some other economic instrument for managing the WEEE/E-waste system if cross subsidization does not occur.

3. Fixed fee models may consist of different fixed fee bands that correlate to sales price bands of EEE products placed in the market, with cap and ceiling rates, e.g. SWICO;

4. Fixed fees may be levied by customs on imports and passed on to PROs;

5. The debiting model is based on upfront payments followed by debiting on a monthly or yearly basis, based on actual costs and market share.

The above analysis also indicates the existence of variants of models for different product categories within a country. This indicates that the fee and fund management system has stabilized to at least some extent in that country.

6.2.3 Financial Guarantee

A financial guarantee is provided by the producer to fulfill their take-back obligation for electrical and electronic products placed on the national market after the effective date of the local legislation. The form of financial guarantee in EU member states is summarized in Table 6.2.

Table 6.2: Summary of financial guarantees in EU member states[24]

	Austria	**Belgium**	**Cyprus**
New B2C WEEE & financial guarantee	Membership in collective scheme eliminates need for guarantee; collective scheme not required to provide guarantee	Only required from individual compliers; visible fee allowed for estimated costs of collection, treatment and recycling until 2011 (until 2013 for large appliances)	As in the Directive
	Czech Republic	**Denmark**	**Estonia**
New B2C WEEE & financial guarantee	Collective system members may comply for new WEEE in the same way as for historical WEEE; guarantee only required from producers that comply individually	Individual compliers must provide guarantee; collective schemes may be exempted if members have >30% market share	By market share; guarantee only required from producers that comply individually
	Finland	**France**	**Germany**
New B2C WEEE & financial guarantee	Guarantee required only from individual compliers	Pro rata principle to be applied based on 'whichever date the EEE is placed on the market'; guarantee required only from individual compliers	By market share or sorting own WEEE at each collection point; all B2C producers to provide guarantee; three insurance-based systems: GSA, ZVEI, Philips
	Greece	**Hungary**	**Ireland**
New B2C WEEE & financial guarantee	Financial guarantee only required from individual compliers	No distinction between the financing of historical and new WEEE; guarantee only required from individual compliers	Producer pays for own products; guarantee only required from individual compliers
	Italy	**Latvia**	**Lithuania**

[24] United Nations Environmental Programme (UNEP), Division of Technology, Industry and Economics, International Environmental Technology Centre, Osaka/Shiga. *WEEE/E-waste Management Manual, Volume 2*
http://www.gulfenvironmentforum.com/

Financing of new B2C WEEE & financial guarantee	Until EU-wide system for producer identification is in place, but no later than 13 August 2007, new WEEE is to be financed as historical WEEE; guarantees: no explicit exemption for collective system members; obligation from 13/8/06, unclear if required before producer identification in place	Producers have three options for complying: (i) pay a Natural Resource Tax; (ii) join a collective system; or (iii) comply individually	Options for producers: (i) manage WEEE individually or through a WEEE management company; (ii) join a collective system; (iii) found or participate in a system which extends the municipal WEEE management programme; guarantee required for individual or joint compliance
	Luxembourg	**Malta**	**Netherlands**
Financing of new B2C WEEE & financial guarantee	Producer responsible for own products, may transfer obligation; guarantee only required from individual compliers	Collective or individual compliance will be possible; guarantee only required from individual compliers	Producer to finance WEEE from own products from retail and local gov't. collection points; guarantee only required from individual compliers – membership of collective system guarantee
	Poland	**Portugal**	**Slovakia**
Financing of new B2C WEEE & financial guarantee	Producer to finance own brand and any brand in same category, proportional to market share; guarantee only required from individual compliers	Producer responsible for WEEE from own EEE placed on market; guarantee only required from individual compliers	Producer to finance WEEE from own products; guarantee only required from individual compliers
	Slovenia	**Spain**	**Sweden**
Financing of new B2C WEEE & financial guarantee	Guarantee required from all producers (bank guarantee or insurance), further details to be defined	Producer responsible for own WEEE; only required from individual compliers	Producer responsible for own WEEE; only required from individual compliers

The following inferences can be drawn from Table 6.2.

1. Guarantees are required for joint and individual compliance.
2. Membership in collective scheme eliminates the need for providing a financial guarantee. The collective scheme may be organized by product category or otherwise.
3. In collective schemes, the value of the guarantee may be in accordance with actual market share.
4. Guarantees may take the form of set-off bank accounts, insurance or otherwise.

In most European countries, an additional financial guarantee is not needed if the producer is a member of a collective scheme. In the majority of countries, the producers join a collective scheme to minimize the need to submit a bank guarantee, thereby minimizing the cost of WEEE/E-waste management.

6.2.4 Funding for the Supply Chain

The fee that is charged catalyses financial flows along the WEEE/E-waste supply chain. Examples of funding of WEEE/E-waste stakeholders along the supply chain in the Netherlands and Switzerland are described below and shown in Figures 6.1 and 6.2. These examples demonstrate usage of single and dual types of economic instruments.

<u>NVMP Model</u>

The salient features of the Netherlands' NVMP model are as follows.

1. Usage of two economic instruments: a visible fee and a municipal waste tax. The municipal waste tax funds the municipal infrastructure used in WEEE/E-waste management.
2. Producers/importers pay the NVMP Association to manage their WEEE/E-waste responsibilities as established under Dutch legislation. A fixed fee is paid to the NVMP for each product placed on the market. This fee is passed on to the consumer with no mark up. The scheme covers household WEEE/E-waste.
3. Households pay a visible fee on the purchase of new EEE products. Households pay a local municipal waste tax to fund general waste collection and the operation of municipal sites. Households may return WEEE/E-waste free of charge to municipal collection sites. Municipalities provide some kerbside collection. Households may also return WEEE/E-waste to retailer/distributors free of charge on the basis of a 1:1 new for old purchase. Retailers may charge for collecting the old product from a household.
4. Retailers are obliged to take back WEEE/E-waste on a new for old basis from consumers. They may then transfer the WEEE/E-waste to a municipal waste site, directly to regional sorting stations (RTSs) or pay for collection by the NVMP.
5. Municipal collection sites receive WEEE/E-waste and take responsibility for delivery to regional sorting stations operated by the municipalities and the NVMP. Municipalities are not reimbursed.
6. Regional sorting stations receive WEEE/E-waste free of charge and sort for collection and treatment. The NVMP makes a financial contribution to the operation of RTSs.
7. Transport contractors are responsible for the collection of WEEE/E-waste from the RTSs and for its delivery to treatment plants and recycling firms. Contractors create invoices on the basis of weight. Logistics are organized in-house by the NVMP.
8. Treatment and recycling contractors take receipt of WEEE and process it. Contractors invoice NVMP on the basis of actual treatment costs.

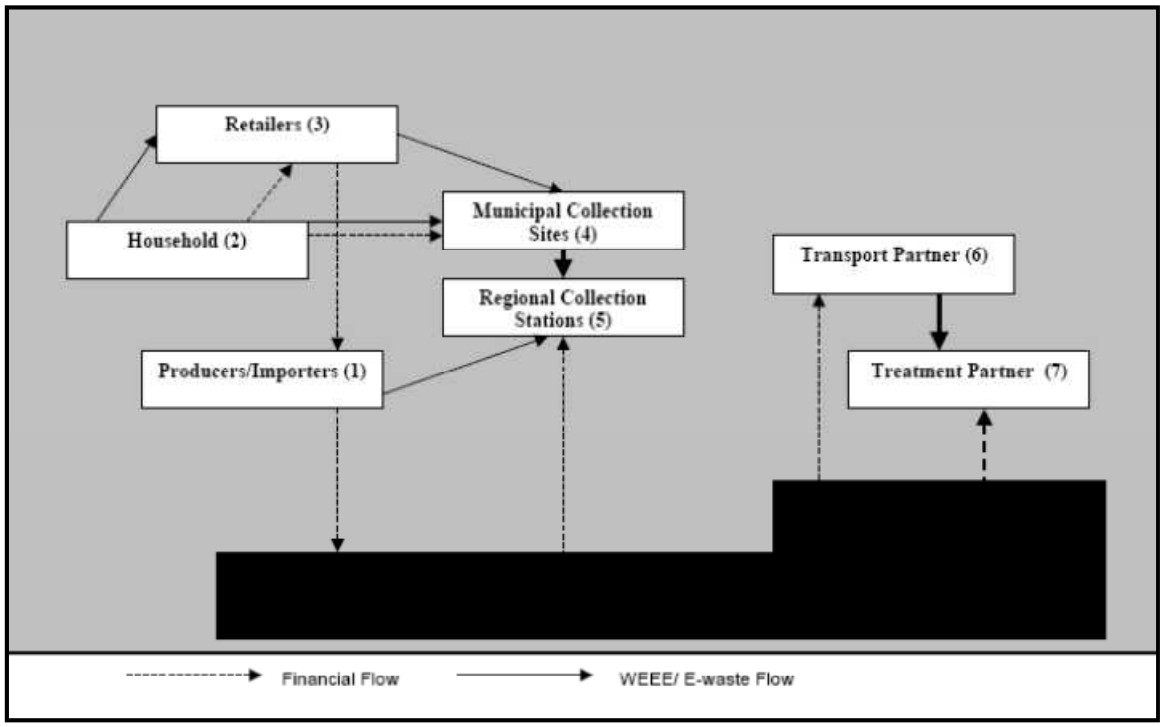


Figure 6.1: Financial model of the Netherlands' NVMP – An EU collective compliance system[25]

SWICO/SENS Model

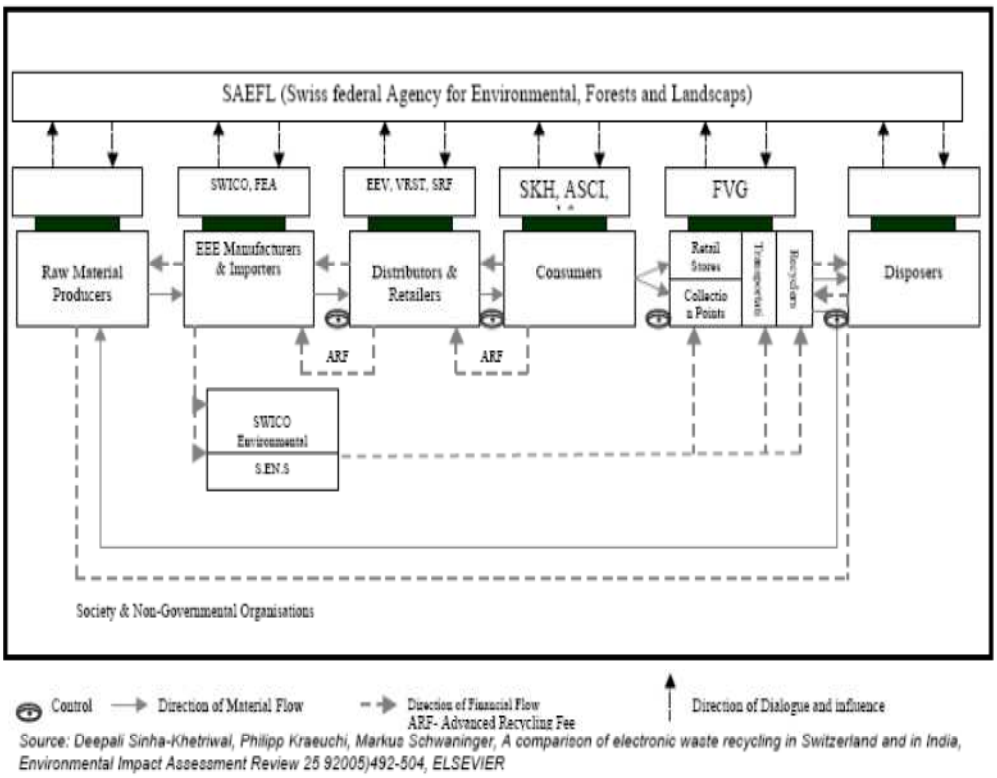
The Swiss system is based on EPR both legally and operationally, meaning that both producers and importers are physically as well as financially responsible for the environmentally sound disposal of WEEE/E-waste. It also shows application of one economic instrument, namely an advance recycling fee, which differs with respect to product categories, banded by selling price with "cap" and "ceiling" boundaries. The salient features of the Swiss WEEE/E-waste supply chain model are as follows.

1. The entire operative responsibility is shared by the two PROs, SWICO and SENS, who manage and operate the system on behalf of their member producers.
2. Secured financing of the collection and recycling is ensured by way of an advance recycling fee (ARF) charged on all new appliances. The ARF is used to pay for the collection, transport and recycling of disposed appliances. The ARF can range from a minimum of 1 CHF (1 Swiss franc) on small items, such as hair dryers and electric shavers, to 20 CHF for TVs and 40 CHF for refrigerators. Both SWICO and SENS have established distinct categories of products according to the approximate cost of recycling them. The largest portion of the ARF goes to the recyclers.
3. The Swiss ARF is an intergenerational contract between appliances purchased in the past and those that will be purchased in the future, similar to a pension system. Therefore, it requires accurate estimates of how much waste will be generated and how many new products will be sold.
4. SWICO and SENS have official collection points around Switzerland in addition to the thousands of retail locations which are obligated to take back old equipment free of

[25] United Nations Environmental Programme (UNEP), Division of Technology, Industry and Economics, International Environmental Technology Centre, Osaka/Shiga. *WEEE/E-waste Management Manual, Volume 2*

charge, irrespective of the brand or year of manufacture. This facilitates consumers' disposal of WEEE/E-waste at appropriate locations.

5. By having common collection points, the PROs are better able to manage logistics, benefit from economies of scale and provide a consumer-friendly, all-inclusive solution instead of prohibitively expensive brand-specific ones.
6. Both material and financial flows are controlled at every stage, as depicted in Figure 6.2.



Source: Deepali Sinha-Khetriwal, Philipp Kraeuchi, Markus Schwaninger, A comparison of electronic waste recycling in Switzerland and in India, Environmental Impact Assessment Review 25 92005)492-504, ELSEVIER

Figure 6.2: Financial flow model of Swiss WEEE/E-waste

Independent controls not only deter free riders but also give credibility to the entire system. They also ensure the participation of retailers and consumers.

6.2 Case Study 2: Developing WEEE/E-waste Management in a Developing Country

The financing mechanism for WEEE/E-waste management systems in developing countries evolve through customising the experiences gained over years of operation in developed countries to the specific context found in the developing country. The mechanism covers each aspect of WEEE/E-waste management including collection, transport and treatment costs of WEEE/E-waste. An attempt has been made to describe this customization in the following sections. This case study has been adapted from a study carried out in Thailand. It is based on presentations and documents presented in the national workshop organized for consultative purposes and the article "Extended Producer Responsibility in Thailand: Prospects for Policies on Waste Electrical and Electronic Equipment," which appeared in Volume 15, No. 2 of the Journal of Industrial Ecology (2011).

6.2.1 WEEE/E-waste Scenario

The penetration of electrical & electronic devices has shown a high rate of growth in Thai households. The penetration rate increased from 17% to 92% between 1979 and 2003. Similarly, mobile phone penetration increased from 5.6% to 47.2% while household computer penetration increased from 0.8 to 4.5 million units. The ICT & household appliance market in Thailand is expected to reach saturation after 2035. Thailand already has an EEE repair and reuse market. WEEE/E-waste generation is expected to reach 25 million units, equivalent to 180,000 tonnes, by 2020. Industrial WEEE/E-waste is estimated to reach around 11,000 tonnes/year. The main driver for this generation is the increased consumption of EEE, with the life cycle of EEE also expected to become shorter.

Currently, WEEE/E-waste in Thailand is regulated by two pieces of legislation. The first of these is the Public Health Act, B.E. 2535 ("Buddhist Era"; 1992 A.D.), which regulates the collection and disposal of municipal solid waste (MSW). The second is the Factory Act of the year B.E. 2535 (A.D. 1992), which classifies and regulates industrial activities, including the recovery, treatment, and disposal of wastes. Under the regulations, sorting plants, landfill operators and reprocessing plants have to be licensed by the industrial authorities. Most of the postconsumer WEEE/E-waste collected through donations and waste dealers does not reach recycling, even though Thailand had 41 recycling facilities as of 2006. These facilities instead survive on high-grade industrial WEEE/E-waste, which is available to them because of strict regulatory compliance. However, postconsumer WEEE/E-waste is rarely channelized into the existing value chain. Though commercial take-back schemes exist, no environmentally driven take-back scheme exists in Thailand. A simplified version of the WEEE/E-waste chain in Thailand is shown in Figure 6.3.

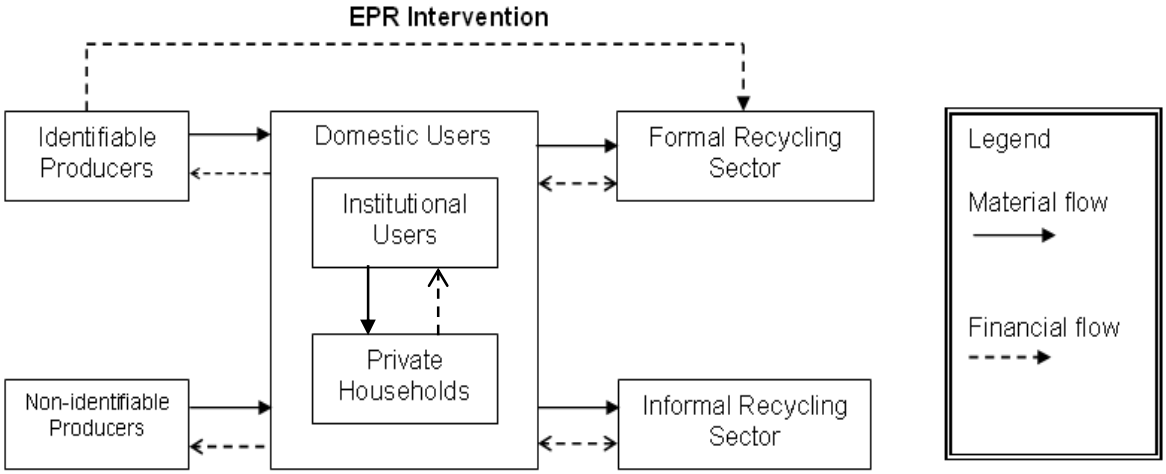


Figure 6.3: Simplified value chain framework for EPR intervention[26]

6.2.2 Proposed Policy and Regulatory Intervention

Thailand's National Integrated Strategy for the Management of Waste Electrical and Electronic Equipment came into existence in 2007 and gives a 10-year road map for WEEE/E-waste management until 2017. The major objectives of this strategy are:

[26] Manomaivibool, Panate et al., 2011. "Extended Producer Responsibility, Prospect of Extended Producer Responsibility: Waste Electrical and Electronic Equipment, Thai Context and Policy," *Journal of Industrial Ecology*, Volume 15, No. 2

1. To manage domestic post-consumer WEEE in a scientific and systematic manner;
2. To establish an efficient and sustainable WEEE management system with cooperation from every sector of society;
3. To reduce hazardous wastes from EEE at the point of origin and to encourage environmentally friendly design and production;
4. To enhance the competitiveness and negotiation power of Thailand in international trade; and,
5. To have nationwide efficient and effective integrated WEEE management by 2017.

A list of ten priority products have been identified to be covered under the new regulatory regime. These are specifically (1) CRTs (TVs and monitors), (2) digital cameras and camcorders, (3) portable media players, (4) mobile and cordless phones, (5) FPDs (TVs and monitors), (6) fluorescent lamps, (7) desktop and notebook computers, (8) printers and facsimiles, (9) unit-type air conditioners, and (10) refrigerators and freezers. Two regulations, the first one on economic instruments and the second one a subordinate law for implementation, are expected to be formulated and implemented. The regulation on economic instruments is being drafted by the Ministry of Finance, while the subordinate law is being drafted by the Ministry of Natural Resources and Environment. An attempt is being made to implement these by making use of the EPR intervention shown in Figure 6.3. The framework expected under the two forthcoming regulations is shown in Figure 6.4.

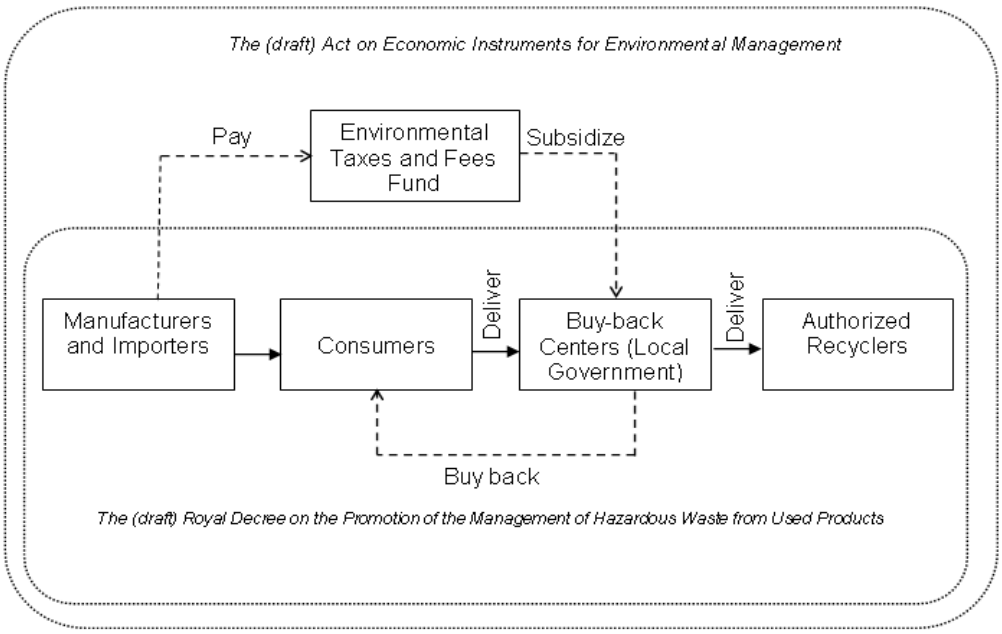


Figure 6.4: Expected future management of WEEE/E -waste in Thailand[27]

6.2.3 Proposed Financing Model

The salient features of the financing model are as follows.

- The government is to create a market for used products containing hazardous waste by offering to buy them back.
- The buy-back activities are to be financed through fees levied on new products.

[27] Manomaivibool, Panate et al., 2011. "Extended Producer Responsibility, Prospect of Extended Producer Responsibility: Waste Electrical and Electronic Equipment, Thai Context and Policy," *Journal of Industrial Ecology*, Volume 15, No. 2

- A fund will be established to administer the revenue from product fees and pay out subsidies.
- The subsidies will not only cover the money given back to consumers but also cover the costs of storage, transport, treatment, and disposal borne by the buy-back centres, to provide for cases in which the recycling of collected WEEE is not profitable.
- In exchange for the subsidies, the buy-back centres have to comply with stricter standards than ordinary waste dealers, including a condition to forward intact WEEE to authorised treatment facilities (ATFs).
- Treatment and disposal will continue to be under the existing regime of individual factories.

It is proposed that part of the fees representing the buy-back cost be made visible to consumers at the point of sale in order to encourage greater participation, while keeping the remainder invisible. Therefore, a compliance cost and partial visible fee model is expected in the short term, which will transform into the compliance cost model and visible fee model over the long term.

6.2.4 Fees, Economic Instruments, and Fee Structures

Two types of economic instruments, namely a combination of product fees and recycling subsidies, have been proposed to finance the WEEE/E-waste management system.

A comprehensive product fee-setting methodology has been used through quantitative surveys and qualitative consultation with key stakeholders based on consumer behavior. The proposed fee covers three main cost components. The first component is the buy-back cost reflecting the level of consumers' willingness to accept the buy-back rate based on the collection target set by the authority. This willingness to accept has been determined by an economic valuation study carried out through household surveys based on sample size and WEEE/E-waste inventory in particular geographic regions. The second component is the technical cost, which includes the cost of buy-back and collection centres, the transport cost, and the net recycling cost. The third component is the administrative cost of the system. The product fee has been set as a standard value for each product group reflecting the unit recycling cost of that product group on average. The proposed product fees and subsidy rates for different items are given in Table 6.3.

Table 6.3: Product fees and subsidy rates for different items[28]

		Subsidy (THB/unit)		
Product/waste type	**Product fees (THB/unit)**	**Buy-back**	**Operating[a]**	**Administrative[b]**
Televisions	389-730	150-250	156-423	33-62
Desktop computers	306-453	250-300	0-164	3-26
Notebook PCs	306	300	0	26
Air conditioners	900-1,200º	600-750	740-970	124-160
Refrigerators	325-1,000º	300-450	1,656-2,410	182-266
Printer/facsimile machines	253	50	182	22
Digital cameras	69-71	60	3-5	6
Portable media players	33	30	0	3
Mobile phones	66-72	60	0-6	6
Fluorescent lamps	3-4º	1-2	3-5	0-1
Compact fluorescent lamps	2	1	1	0
Dry-cell batteries	1-3º	1	1-2	0

[28] Manomaivibool, Panate et. al., 2011. "Extended Producer Responsibility, Prospect of Extended Producer Responsibility: Waste Electrical and Electronic Equipment, Thai Context and Policy," *Journal of Industrial Ecology*, Volume 15, No. 2

Note: One THB (1 Thai Baht) ≈ US$0.03; [a] "Operating" denotes operating costs of storage, transport, recycling, and final disposal. An entry of "0" in the subsidies column implies that the recycling is profitable, and there is no need to subsidize the operating cost. [b] "Administrative" denotes administrative costs covering the expenses of fee-collecting agencies, the fund office, the local coordinators of buy-back networks, and third-party auditors. [c] This figure is the fee rate after adjustment to 5% of product price.

6.2.5 Funding for the Supply Chain

The producers of regulated products are expected to pay the fees levied on new products they place on the market. The fees are to be collected into a government fund. The fund is to be used principally to subsidize the buy-back program, WEEE/E-waste recycling, and related activities. The proposed "take back" program is expected to utilise the material and financial flows depicted in Figure 6.5.

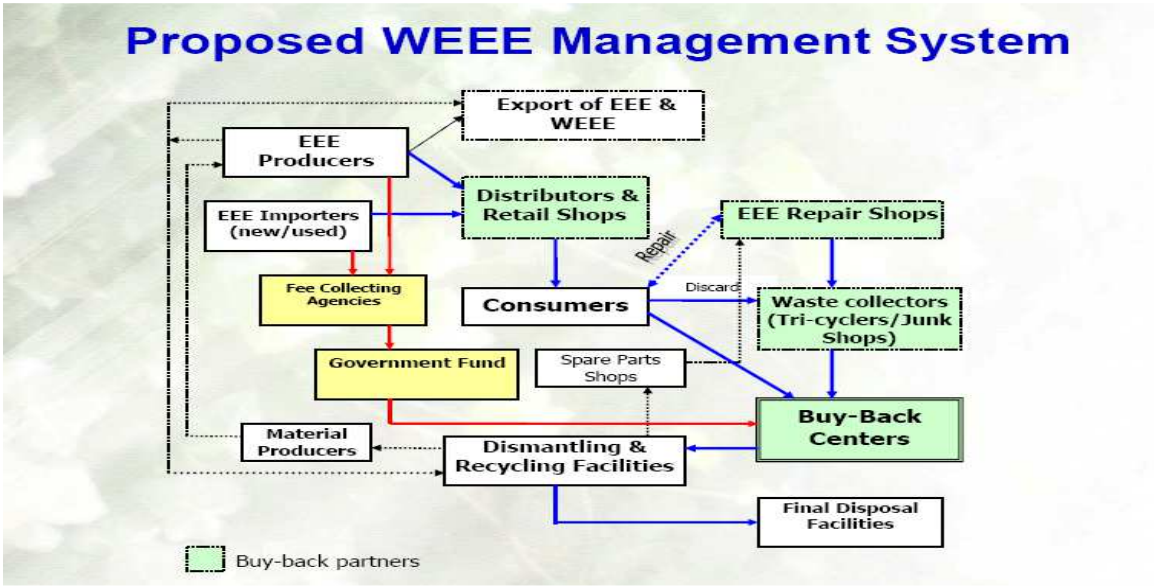


Figure 6.5: Proposed financial flow within Thailand's WEEE/E-waste management system[29]

In the first year of the program, the fund is expected to have a negative balance since the number of obsolete products bought back in the program may exceed the number of new products placed in the market. Over the long term the fund is expected to generate surplus funds due to the difference in the new EEE products placed in the market and WEEE/E-waste collected. Strategies include building reserve funds and government financing in the short term through discounted product prices or usage of economic instruments such as taxes or subsidies while surpluses are invested in other environmental activities in the long term.

The fund is expected to pay subsidies only to authorized buy-back centres for the quantity of bought-back items verified by third-party auditing groups contracted by the fund manager.

The subsidies cover buy-back costs and will also cover technical costs in cases in which recycling is not profitable. The buy-back centres transact with authorized transport companies and recycling enterprises which meet recycling standards and requirements. The fund will directly reimburse responsible agencies for their incurred expenditures as part of administrative costs. All authorized buy-back centres are entitled to receive recycling subsidies from the fund.

[29] Surin Aree, July 2010. Presentation at "WEEE Management in Thailand, Regional Workshop on WEEE/E-waste Management," held by UNEP DTIE-IETC in collaboration with the Global Environment Centre Foundation (GEC)

6.2.6 Other Aspects

Sales data, stocks of EEE in households and non-household establishments and WEEE/E-waste inventory are crucial to the success of the program. Sales data and WEEE/E-waste data will be generated during the processes of fee collection and auditing buy-back centres. A second set of data on the stocks will be based on the penetration rate of targeted products in the country and can be incorporated into a survey of consumer goods undertaken regularly by the National Statistical Office. The enhanced quality and quantity of data is expected to facilitate greater monitoring and regulatory controls not only to ensure compliance but also to reinforce the funding for WEEE/E-waste management.

6.2.7 Conclusions

The design and implementation of EPR for WEEE/E-waste management in a developing country poses a number of challenges. Thailand, which is in the process of designing an EPR-based WEEE/E-waste management system, is expected to encounter these challenges. The design of the system indicates that conceptually, the elements of EPR are being internalized in the proposed management system. However, a government-run buy-back system represents a type of policy innovation rather than complete transfer to an independently run management system. This step may be regarded as a precursor leading to future amendments to the system based on lessons that will be learned during implementation.

Annexure 1

Definitions, Policies, Laws, Regulations and Institutional Roles Related to WEEE/E-waste in the European Union and Other European Countries[30]

Country/ Features	Definitions identical to EU WEEE Directives	Variation	Policies/ Laws/ Regulations	B2C WEEE Collection	B2B WEEE Responsibility	National Register	Clearing House	Collection Systems
Austria	√		Verordnung des Bundesministers für Landund Forstwirtschaft, Umwelt undWasserwirtschaft über die Abfallvermeidung, Sammlung und Behandlung von elektrischen und elektronischen Altgeräten (Elektroaltgeräteverordnung (EAG-VO), April 2005	Local govt. to organize collection free of- charge for consumers. Producers ompensate Municipalities with Infrastructure lump sum 1:1 take-back at retailers Producer systems to set up at least one collection point per political district for free take-back from retailers and consumers	Dual use defined in scope guidelines available Producers to pay for historical non-household WEEE if supplying replacement; otherwise end user is responsible	Environment Agency (Umweltbundesamt)	Elektroaltgeräte-Koordinierungsstelle Austria GmbH, industry owned and managed	UFH Altlampen UFH Elektroaltgeraet ERA EVA ERP
Belgium	√		Decree of the Flemish Government of 14 July 2004, modifying the Decree of the Flemish Government of 5 Dec 2003. Decision of the Brussels Capital Government of 3 June 2004 modifying the decision of the Brussels Capital Government of 18 July 2002. Decree of the Walloon Government of 10 March 2005, modifying the Decree of the Walloon Government of 25 April 2002. Royal Decree on the prevention of hazardous substances in electrical and electronic equipment of 12Oct 2004; federal Level.	Local govt. to organize free of-charge collection in container parks 1:1 take-back by retailers Recupel compensates retail and local governments for collection	Producers to pay for historical non-household WEEE if supplying replacement; otherwise end user is responsible	Producers complying collectively to register with Recupel; only individually complying companies to register with 3 regional environmental agencies	Not required, one system	Recupel (6 divisions); currently no collection system for categories 7, 8, 9, 10; individual compliance requires approval of 3 regional environmental agencies

[30] Prepared by modifying and updating table given in the "Executive Summary" section of *Transposition of the WEEE and RoHS Directives in Other EU Member States,"* Perchards Report, United Kingdom, November 2005.

Country/ Features	Definitions identical to EU WEEE Directives	Variation	Policies/ Laws/ Regulations	B2C WEEE Collection	B2B WEEE Responsibility	National Register	Clearing House	Collection Systems
Cyprus	√		Administrative Act No 668 of 2004, published in Official Gazette No 3888, Annex III (I), on 30 July 2004.	Local govt. not obliged to collect WEEE Producers to finance entire WEEE management	As Directive	Producers must register with the Environment Service of the Ministry of Agriculture, Natural Resources and Environment	Not required, one system	EDHHA, founded by Chamber of Commerce in Aug 2005, to be financed and owned by around 16 importers
Czech Republic	√		Act No. 7/2005 Coll., amending Act 185/2001 Coll. (the general waste management law of the Czech Republic) published on 6 Jan 2005. Decree 352/2005 published on 15 Sept 2005.	Producers to finance separate collection Municipalities may collect in which case producers must provide containers 1:1 take-back by retailers free of charge to consumers	Producer to register, but no guarantee New WEEE: Producer responsible, unless otherwise agreed with purchaser Historic WEEE only on a 1:1 basis	Environment Ministry responsible Producers to apply for registration by 12 Sept 2005.	Not yet required, only one system per category	Elektrowin, Ekolamp, Retela, REMA, Asekol Government to choose in December 2005 which system will handle which category
Denmark	√		Statutory order No. 591 of 9June 2006 and Statutory order no. 873 of 11th August 2006	Local govt. to ensure sufficient free of charge collection points. May organise pickup collection themselves or in collaboration with producers. Retailers accept WEEE on 1:1 basis	Producers responsible for new WEEE, unless alternative arrangements agreed Producers responsible for historic WEEE on 1:1 basis; otherwise, endusers pay	The WEEE System	The WEEE System	EPA Elretur Denmark to begin April 2006.
Estonia	√		Amendments to the Waste Act of 1May 2004. Regulation No. 376 of the Government of the Republic of 24 Dec 2004 on Requirements and Procedure for Marking Electrical and Electronic Equipment, Requirements, Procedure and Targets for Collection, Return to Producers and Recovery or Disposal of Waste Electrical and Electronic Equipment, and	Producers to finance WEEE management. Entirely 1:1 take-back by retailers; they must take back WEEE from any category they sell if no industry collection point within 10 km.	Producers responsible for WEEE on 1:1 basis	Environment Information Centre (EIC), to be under government control	Not provided for	EES-Ringlus; further system in preparation

Country/ Features	Definitions identical to EU WEEE Directives	Variation	Policies/ Laws/ Regulations	B2C WEEE Collection	B2B WEEE Responsibility	National Register	Clearing House	Collection Systems
			Time Limits for Reaching Targets, which entered into force on 1 Jan 2005. Minister of Environment Regulation No. 9 of 9 Feb 2005 on Requirements for Treatment of Waste Electrical and Electronic Equipment, which entered into force on 20 Feb 2005. Regulation on the Central Register of Producers, which was adopted on 19 Jan 2006 and will enter into force after its publication in the Estonian State Gazette					
Finland	√	The scope of products includes luminaries in households, which have been excluded from the scope of products in the WEEE Directive	Act 452/2004 amending the Waste Act (1072/1993) adopted on 4 June 2004 and Government Decree on Electrical and Electronic Waste 852/2004 adopted on 9 September 2004.	1:1 take-back by retailers (or retailers must inform consumers about alternative collection) Producers responsible for organising & funding collection, may contract local authorities or waste management companies All collectable WEEE to be collected – not only 4 kg.	Producers responsible for B2B WEEE placed on the market after 13 August 2005, unless alternative arrangements agreed Producers to bear the cost of pre 13 August 2005 WEEE if a replacement is purchased; otherwise, end users pay	Only individual compliers must register with the Pirkanmaa Regional Environmental Centre	Not required, only one system per category	SERTY Oy (household WEEE); FLIP Py (lamps and lighting); ICT Producer Cooperative (ICT); SELT Ry (lighting, heaters, surveillance and control equipment)
France	√		TEXTES GÉNÉRAUX MINISTÈRE DE L'ÉCOLOGIE ET DU DÉVELOPPEMENT DURABLE Décret no 2005- 829 du 20 juillet 2005 relatif à la composition des équipements	Producer must either establish an individual system for separate collection or pay a clearing house which reimburses municipalities for extra costs for	New EEE: producer responsible unless otherwise agreed. Historic B2B EEE: end-user Responsible even if replacement	To be prepared and operated by ADEME (Environment Agency)	Not yet established	4-8 collective producer systems expected competing in several categories, e.g. Recylum ECO-Systèmes Eco-Logic ERP

Country/ Features	Definitions identical to EU WEEE Directives	Variation	Policies/ Laws/ Regulations	B2C WEEE Collection	B2B WEEE Responsibility	National Register	Clearing House	Collection Systems
			électriques et électroniques et à des déchets issus de ces équipements	separate collection (extra cost not defined) 1:1 take-back at retailers, may delegate this to a compliance system	purchased, unless otherwise agreed Mandatory visible fee to be set for some large appliances			
Germany	√		Electrical and Electronic Equipment Act, "Gesetz über das Inverkehrbringen, die Rücknahme und die umweltverträgliche Entsorgung von Elektround Elektronikgeräten (Elektro- und Elektronikgerätegesetz (ElektroG))vom 16. März 2005	Local gov't. to finance collection; may manage WEEE itself. Local govt. sends take-back request to clearinghouse, which notifies producer with highest unfulfilled obligation to pick up container. Retailer or producer may take back from consumers.	Treatment costs of historic B2B EEE to be borne by the final user, but users and producers may negotiate their own agreements for different arrangements. Producers responsible for B2B WEEE placed on the market after 13 Aug 2005, unless alternative arrangements agreed.	EAR Foundation, industry-managed; responsibilities designated by UBA 6 July 2005	EAR Foundation	Producers cannot transfer responsibility (Purchasing) consortia restricted by competition authority, e.g. ERP, ProReturn, ENE, LARS, Olav, BSH-Miele-Philips, Quelle; Waste mgmt. systems/services: ALBA, DSD, DHL, e-back, EGR, Entec, AVR, Fliege Cleanaway, Hellmann, Interseroh, Landbell, Pape, Remondis, TechProtect/RENE, Take-EWay, Vfw, Zentek
Greece	√		Decree No 117/2004, Gazette No A82 on 5 March 2004	Local govt. to organize free of-charge collection 1:1 take-back by retailers Collection to be coordinated by compliance scheme, in collaboration with local govt.	Producers responsible for new B2B WEEE, unless alternative arrangements agreed Producers responsible for historic B2B WEEE if a replacement is purchased. otherwise, endusers	Environment Ministry responsible for registration and data collection	Not required	All producers are expected to join the approved collective compliance scheme (Recycling of Appliances S.A.), but the law provides an individual compliance option

Country/ Features	Definitions identical to EU WEEE Directives	Variation	Policies/ Laws/ Regulations	B2C WEEE Collection	B2B WEEE Responsibility	National Register	Clearing House	Collection Systems
					pay			
Hungary	√		Government Decree 264/2004 on the take-back of WEEE of 23 September 2004, Ministerial Decree 15/2004 of 8 October 2004 Amendment 103/2004 to the Product Fee Act LVI.	Producers to bear costs of collection, must reimburse local govt. for collection & sorting Producers may establish and operate collection centres 1:1 take-back by retailers above a minimum selling area; mobile phone take-back by retailer Product Fee (tax) payable on the difference between the recovery targets and recovery achieved (members of collective system exempt)	New WEEE: producer responsible; no provision for other agreement Historic WEEE: producer only responsible on 1:1 replacement basis, otherwise last user responsible	National General Directorate of Environment and Water Management	None, obligated parties to prove achievement of collection targets as % of amount placed on market	Four competing systems, open to all producers on same terms: Elektro-Coord (all categories B2C, B2B) Ökomat Kht (all categories B2C, B2B, except mobile phones and refrigerators) Elektro-Waste Kht (IT) Re-Elektro Kht
Ireland	√		Statutory Instrument No. 340 of 2005 on Waste Management (Waste Electrical And Electronic Equipment) Regulations 2005 defines E-waste/ WEEE as electrical and electronic equipment, which is waste within the meaning of article 1(a) of Council Directive 75/442/EEC of 15 July 1975	Local govt. to finance collection through delivery to civic amenity sites Distributors must either take back WEEE on a 1:1 basis or display a notice informing retailers about the available collection systems. Producers to finance take-back from local govt. and other collection points.	Producers responsible for B2B WEEE placed on the market after 13 Aug 2005, Unless alternative arrangements agreed Producers responsible for historic WEEE on 1:1 replacement basis; otherwise, endusers pay	National WEEE Registration Body, WEEE Register Ltd	'Black Box' system provides confidential clearing house service	ERP WEEE Ireland Ltd
Italy	√		Decree 25 July 2005 n.151	Municipal govt. to organize separate collection on their territory except for category 5. 4 kg target postponed by 2 years. Producers to finance take-back from municipal collection points on, may set up own collection 1:1 take-back by retailers.	Producers responsible for new B2B WEEE, unless alternative arrangements agreed. Must provide financial guarantee. Producers	Activity code as EEE producers at Chamber of Commerce which will feed Register to be set up by 'Supervision and Control of WEEE Mgmt Committee's consisting of govt. representatives sub-decree	Under 'Supervision and Control of WEEE Mgmt Committee'	8-10 systems competing in one or several categories expected, e.g. Ecolamp, Ecolight, Ecodom, Remedia, EcoR'It, ERP

Country/ Features	Definitions identical to EU WEEE Directives	Variation	Policies/ Laws/ Regulations	B2C WEEE Collection	B2B WEEE Responsibility	National Register	Clearing House	Collection Systems
					responsible for historic WEEE on 1:1 basis if old EEE less than double weight of new			
Latvia	√		Law on Waste Management, as amended 19 February 2004, 2 December 2004 and 22 June 2005; Regulations of the Cabinet of Ministers No. 624 on Categories of EEE (adopted on 27July 2004); Regulations of the Cabinet of Ministers No. 736 on Requirements for the Labelling of EEE and on Providing Information (adopted on 24 August 2004); Regulations of the Cabinet of Ministers No. 923 on the Management of WEEE (adopted on 9 Nov 2004)	Producers responsible for separate collection	Producers responsible for new B2B WEEE, unless alternative arrangements agreed	Environment Ministry may delegate responsibility to organisation of producers that has been active for at least 5 years	Not planned	LZE (by LETERA, LDTA will cover IT, perhaps other categories) CECED Latvia may set up an organisation to cover household appliances
Lithuania	√		Amendment No. X-279 to the Law on Waste Management, adopted on 28 June 2005; Order of Minister of Environment No. D1-481 on Rules on Management of WEEE, adopted on 10 September 2004 Government Resolution No. 1252 on National Strategic Waste Management Plan, adopted on 5 Oct 2004.	Legislation leaves several options, form coll. system to state run WEEE Management programme 1:1 mandatory take-back at retailers of all sizes Producers responsible for meeting collection targets through own and municipal systems	Producers are responsible for new WEEE and historic WEEE on 1:1 basis only – otherwise final holder responsible	Environment Ministry and Agency to operate register, regional environmental departments to register producers and importers	Not planned	System by INFOBALT (category 3, 4, excl TVs), system by CECED, Zaliasis Taskas (packaging compliance organisation) considering WEEE management
Luxem-bourg	√		Grand Duke's Decree 18 January 2005; Environmental Agreement between the Ministry of the Environment,	Existing public Infrastructure to be used; producers to finance take-back at least from there on; they may set up separate	Producers responsible for new B2B WEEE through	Administration of the Environment; Ecotrel (for producers complying	None	ECOTREL set up February 2004 by industry and retail federations:

Country/ Features	Definitions identical to EU WEEE Directives	Variation	Policies/ Laws/ Regulations	B2C WEEE Collection	B2B WEEE Responsibility	National Register	Clearing House	Collection Systems
			Ecotrel and professional associations (including the Luxembourg Chamber of Commerce, the Chamber of Trade and the Skilled Tradesmen's Federation) on 16 March 2006, which entered into force on 1 April 2006	collection 1:1 take-back by retailers who may inform of alternatives if they have insufficient space	individual or collective system Producers responsible for historic B2B WEEE on 1:1 replacement basis	through Ecotrel;		approved 28 October 2005 – fees payable from 1 Sept 2005, all Categories
Malta	√		RoHS regulations adopted August 2004; eco-tax imposed on EEE from September 2004; draft WEEE regulations of October 2004 still not adopted	Eco-tax on EEE: Environment Ministry empowered to grant full or partial exemptions according to recovery rate achieved and/or for members of a compliance system free of charge; take-back at existing sites & new ones to be set up	Producers responsible for new B2B WEEE unless agreed differently Producers responsible for historic B2B WEEE on 1:1 replacement basis	Malta Environment and Planning Authority to be responsible	None	None (some WEEE currently collected by WasteServ, a governmentowned company)
Netherlands	√		BEA Decree and REA Regulation adopted in July 2004	1:1 take-back by retailers Local govt. collection points take back household WEEE from households and distributors; producers may arrange their own take-back from households	Producers responsible for new B2B WEEE unless agreed differently Final user responsible for historic B2B WEEE	Ministry of Housing, Spatial Planning and the Environment	None	ICT-Milieu (IT, office equipment,telecoms) and 6 non-competing systems under NVMP umbrella: VLEHAN – white goods FIAR – brown goods' VLA - ventilation equipment SVEG – electrical tools SMR - metal and electrical products Stichting Lightrec
Poland	√		WEEE ACT 9/05 adopted in July 2005 with 3 orders and certain articles coming into force in July 2006	Producers to finance WEEE from collection point operators (municipalities, retailers) Start date for take- back from municipal collection not defined	Producer responsible for historic B2B WEEE on 1:1 replacement	Chief Inspector of Environmental Protection, may delegate to producer organisation	References to Clearing House removed from Act	Elektro-Eko, single system by major associations CECED, KigEIT

Country/ Features	Definitions identical to EU WEEE Directives	Variation	Policies/ Laws/ Regulations	B2C WEEE Collection	B2B WEEE Responsibility	National Register	Clearing House	Collection Systems
				1:1 take-back at retailers from 1July 2006. No collection targets set yet	basis Producers always esponsible for new B2B WEEE	with > 75% market share	as adopted	(competition authority approval pending) ERP
Portugal	√		Decree Law 230/04 adopted in Sept 2004, published in December 2004, plus amendment approved in Septe,mber 2005 and 25 Oct 2005 by Law Decree 174/2005	Producers to set up collection system which combines local authority WEEE collection centres and WEEE collected by retailers 1:1 take-back by retailers also on delivery of new products to private households	Producer responsible for historic B2B WEEE on 1:1 Replacement basis Producers responsible for new B2B WEEE unless agreed otherwise	Register to be run by producer associations and the compliance system (ANREE), under licence from the National Waste Institute	None	Amb3E ERP
Slovakia	√		Act 733/2004, amending the Waste Act 223/2001, adopted on 2 December 2004. Ministerial Decree 208/2005 regarding the management of WEEE, adopted on 29 April 2005	Producers to finance containers (7 types) and take back from municipal sites 1:1 take back at retailer only mandatory if retailer is producer Producer to reach annually increasing collection targets as % of EEE placed on market Product fee (tax) charged on Underachieved quantities	There is a tax on EEE, linked to the recovery rate achieved	Environment Ministry	Provisions in place, but no operations yet	No approval required for collective systems. Ekolamp (Category. 5) Envidom (Category. 1, 2) SEWA (Category 3, 4) Etalux (Category 5) Individual Compliance through waste management companies (Envi-Geos Nitra, Logos, Enzo, Brantner).
Slovenia	√		Decree 4871, 4 November 2004 with amendment published on 10 June 2005. A new "Decree on treatment of waste electrical and electronic equipment" (Official Journal of RS, No. 107/06) entered into force on 1 November 2006.This new decree in addition to transposition of EU directive	Tender to one system to be called in 2009 if recovery targets not met Local authorities currently operate Collection centres for WEEE – producers to provide containers There is a tax on EEE, linked to the recovery rate achieved	There will be a tax on EEE, linked to the recovery rate achieved	Ministry of Environment and Spatial Planning	Environment Ministry	Ekolamp, ZEOS (all other categories); Individual compliance: Slopak, Interseroh

Country/ Features	Definitions identical to EU WEEE Directives	Variation	Policies/ Laws/ Regulations	B2C WEEE Collection	B2B WEEE Responsibility	National Register	Clearing House	Collection Systems
			also specified registration of producers and importers of WEEE					
Spain	√		Royal Decree 208/2005	1:1 take-back by retailers free-of-charge to consumers Local govt. collection points take back household WEEE from households and distributors Producers may arrange their own takeback from households	Producer responsible for historic B2B WEEE on 1:1 Replacement basis Producers responsible for new B2B WEEE unless agreed otherwise; local govt. may take back B2B if there is a voluntary agreement	The National Register of Industrial Establishments, but producer must also register with the competent body of the Autonomous Region where their head office is located	National Register of Industrial Establishments	ECOLEC (categories 1, 2) TRAGAMOVIL (mobile phones) ECOFIMATICA (office IT and reprographic) ECOASIMELEC ECOTIC (category. 4, air conditioners, medical equipment, toys) Ambilamp (category 5)
Sweden	√		Swedish Code of Statutes 2005:209, "Ordinance on producer responsibility for electrical and electronic products" Published: 26 April 2005	Local govt. responsible for collecting WEEE that has not been returned to a producers' collection system Producers to organize collection from municipal sites No new obligations for retailers – unchanged from previous (2000) legislation – i.e take-back optional	Producers to finance takeback of products placed on market after 12 August 2005, and of historical waste if a replacement is bought; otherwise, end- users to fund historical waste	The Environmental Protection Agency is to run the National Register Registration expected to start early 2006	None	El-Kretsen runs the El-retur system jointly with local govt., and also operates a recovery system for ICT products El-Kretsen is revising its statutes to bring them into line with the requirements of the new Statutory Order
Norway	√	WEEE/ E-waste is defined as EE waste, where EE waste means scrap EE equipment. EE equipment is defined as EE equipment means products and	relating to the recycling of Waste, 1 June 2004, Chapter 1	Retailers and Municipalities to take back free of charge. Producers to collect and take back from Municipalities and retail collection centers. Collection system to recover fee from producers and importers.	Business can deliver to dealer on 1:1 take back. Producers are responsible for both historic and new.	Norwegian Pollution Control Authority	None	El-retur AS RENAS AS Ragn-sells AS Veolia AS Eurovironment

Country/ Features	Definitions identical to EU WEEE Directives	Variation	Policies/ Laws/ Regulations	B2C WEEE Collection	B2B WEEE Responsibility	National Register	Clearing House	Collection Systems
		components that depend on an electrical current or electromagnetic field in order to function correctly, as well as equipment for the generation, transfer, distribution and measurement of these currents and fields, including the components necessary for the cooling, heating, protection, etc., of the electrical or electronic components.						
Switzerland	√	The definition of WEEE/E-waste is identical to EU directives. However, equipment covered by this ordinance are electrically powered and fall under one of the following categories: -Entertainment	VREG: Ordinance on the return, the taking back and the disposal of electrical and electronic equipment (ORDEE)	Distributors, retailers and manufacturers must take back free of charge (even if no equipment is purchased). Consumers fund collection and recycling through ARF.	Distributors, retailers and manufacturers must take back free of charge (even if no equipment is purchased). Consumers fund collection and recycling through ARF	Responsibility of Environment Ministry, but no registry implementation, which is instead done by Swiss Cantons.	None	SWICO – ICT SENS – White goods SENS with SLG (Luminaries and Illuminants)

Country/ Features	Definitions identical to EU WEEE Directives	Variation	Policies/ Laws/ Regulations	B2C WEEE Collection	B2B WEEE Responsibility	National Register	Clearing House	Collection Systems
		electronics - Office, information, & communication appliances - Household appliances - Fluorescents with lightbulbs - Fluorescents without lightbulbs - PCB-containing fluorescents - Tools (larger industrial tools excluded) - Sport/ entertainment appliances and toys - Components of the aforementioned						
United Kingdom	√		The Waste Electrical and Electronic Equipment Regulations 2006, to be enforced in 2007	Direct 1:1 take back by distributors from consumers free of charge If member of DTS, direct consumers to nearest DCF to dispose of their WEEE producers to finance in both cases	Not a collective obligation. Individual producer responsibility. For non hazardous luminaries, producers take back where collective system will charge flat monthly fee per item of equipment.	UK environmental agencies to issue preliminary 2007 market share percentage to based on 2006 sales data submitted with producer's registration.Environment agency to approve and give registration number to agency.	Environment al Agency	REPIC – White goods Valpak – IT and Office Equipment Lumicon – Non-Household Luminaries

Annexure 2

Policies/ Laws/ Regulations/ Institutional Roles for WEEE/E-waste in Other Developed Countries

Country/ Features	Policies/ Laws/ Regulations	B2C WEEE Collection	B2B WEEE Responsibility	National Register	Clearing House	Collective Systems
Australia	No specific WEEE/E-waste regulation. Only Australian Capital Territory has regulation, placing a levy on the disposal of TVs & PCs at landfill sites. Product stewardship initiative under development	Municipal collection system exists for major household items. Voluntary mobile phone industry recycling program exists (take-back at retailers)	No industry-wide take-back exists	Does not exist	Does not exist	Does not exist
Canada	Canada's WEEE/E-waste regulations are being enforced at the provincial level based on EPR and stewardship. Alberta, Ontario, Saskatchewan, British Columbia, and Nova Scotia have WEEE/E-waste regulations in place.	Under development based on the principles of extended producer's responsibility/ stewardship	Under development	Does not exist	Does not exist	Under development
Japan	Reduce, recycle, recover; "The Law for Recycling of Specified Kinds of Home Appliances (Home Appliances Recycling Law)" (1998) and "The Law for Promotion of the Effective Utilization of Resources" (2000)	1:1 take back for home appliances by retailers for free. When not purchasing a new item, consumers to pay for disposal/recycling charges and transport. Collection points are located at retailers, collection centers or post offices (for direct delivery to OEM). OEM responsible for collection and transport of WEEE/E-waste but generator to pay for collection and management costs.	Exists	Ministry monitors recycling rates	Does not exist	Joint recycling services offered by companies, e.g. Hitachi, IBM Japan

Country/ Features	Policies/ Laws/ Regulations	B2C WEEE Collection	B2B WEEE Responsibility	National Register	Clearing House	Collective Systems
Korea	Producer Responsibility/ Product Stewardship. Article 2 of Act for resource recycling of Electrical and Electronic Equipment and Vehicles adopted on 2nd April 2007	Municipality collect for old discarded and charge for collection and disposal of WEEE/E-waste (in case of no new purchase) 1:1 take back of household by retailers for limited items (new purchase)	1:1 limited mandatory free take back for WEEE (purchase of new product) by producers	Ministry of Environment, which announces the quantity of recycling based on amount market, previous records and given capacity of recyclers.	Does not exist	Mutual Aid Association on Recyclers
New Zealand	No specific legislation, which defines WEEE/ Ewaste in New Zealand. However, Imports and Exports (Restrictions) Order (No 2) 2004 covers WEEE/E-waste.	Drop off at retail stores, recycling/ refurbished centers; curbside collection centers; local authorities collection centers	Voluntary schemes developed by industry, e.g. HP, IBM, Dell, Fisher and Paykel, Vodafone, Telecom, Exide	Does not exist	Does not exist	Does not exist
USA	No specific legislation at federal level, but 20 states have E-waste laws.	Ongoing drop-off at non-profit institutions; ongoing drop-off at retailers; 1:1 take-back by retailers in some states Sporadic collection events	Not clearly defined. States have different systems.	Does not exist	Does not exist	Does not exist

Annexure 3

	Material recovered through processing (%)																Selling prices of materials recovered				
	PCs				TVs				Refrigerators				Mobile telephones								
Element	Content (% of total weight)	Content (kg)	75% Recoverable weight of element (kg)	Recoverable quantity per ton (kg)	Content (% of total weight)	Content (kg)	75% Recoverable weight of element (kg)	Recoverable quantity per ton (kg)	Content (% of total weight)	Content (kg)	75% Recoverable weight of element (kg)	Recoverable quantity per ton (kg)	Content (% of total weight)	Content (kg)	75% Recoverable weight of element (kg)	Recoverable quantity per ton (kg)	Selling price (Rs. per kg.)	Value of PCs (Rs.)	Value of TVs (Rs.)	Value of refrigerators (Rs.)	Value of mobile telephones (Rs.)
Plastics	23.00	6.21	4.66	**174.38**	12.00	3.60	2.70	**93.62**	25.39	9.67	7.25	**190.45**	50.00	0.06	0.04	375.00	15.00	2,615.73	1,404.30	2,856.81	5,625.00
Lead	6.00	1.62	1.22	**45.49**	0.20	0.06	0.05	**1.56**					0.50	0.00	0.00	3.75	70.00				
Aluminium	14.00	3.78	2.84	**106.15**	1.20	0.36	0.27	**9.36**	3.20	1.23	0.92	**24.13**					98.00	10,402.28	917.48	2364.43	
Germanium	0.00	0.00	0.00	**0.01**																	
Gallium	0.00	0.00	0.00	**0.01**																	
Iron	20.00	5.40	4.05	**151.64**	26.00	7.80	5.85	**202.84**	66.30	25.26	18.95	**497.56**	3.00	0.00	0.00	22.50	17.00	2,577.83	3,448.34	8,458.59	382.50
Tin	1.00	0.27	0.20	**7.58**									1.00	0.00	0.00	7.50	720.00				
Copper	7.00	1.89	1.42	**53.07**	3.40	1.02	0.77	**26.53**	2.50	0.96	0.72	**18.87**	15.00	0.02	0.01	112.50	360.00	19,106.23	9,549.24	6,792.54	40,500.00
Barium	0.03	0.01	0.01	**0.24**																	
Nickel	0.85	0.23	0.17	**6.45**	0.04	0.01	0.01	**0.30**					2.00	0.00	0.00	15.00	810.00				
Zinc	2.00	0.54	0.41	**15.16**	0.30	0.09	0.07	**2.34**					0.50	0.00	0.00	3.75	70.00				
Tantalum	0.02	0.00	0.00	**0.12**									0.50	0.00	0.00	3.75					
Indium	0.00	0.00	0.00	**0.01**																	
Vanadium	0.00	0.00	0.00	**0.00**																	
Terbium	0.00	0.00	0.00	**0.00**																	
Beryllium	0.02	0.00	0.00	**0.12**									0.10	0.00	0.00	0.75					
Gold	0.00	0.00	0.00	**0.01**	0.00	0.00	0.00	**0.01**					0.04	0.00	0.00	0.30	1,200,000.00	14,557.13	9,362.00		360,000.00
Europian	0.00	0.00	0.00	**0.00**																	
Tritium	0.02	0.00	0.00	**0.12**																	
Ruthenium	0.00	0.00	0.00	**0.01**																	
Cobalt	0.02	0.00	0.00	**0.12**									4.00	0.00	0.00	30.00	890.00				
Palladium	0.00	0.00	0.00	**0.00**									0.02	0.00	0.00	0.11	60,000.00				
Manganese	0.03	0.01	0.01	**0.24**													50.00				
Silver	0.02	0.01	0.00	**0.14**	0.00	0.00	0.00	**0.02**					0.40	0.00	0.00	3.00	15,000.00	2,149.45	234.05		45,000.00
Antinomy	0.01	0.00	0.00	**0.07**																	

	Material recovered through processing (%)																Selling prices of materials recovered				
	PCs				TVs				Refrigerators				Mobile telephones								
Element	Content (% of total weight)	Content (kg)	75% Recoverable weight of element (kg)	Recoverable quantity per ton (kg)	Content (% of total weight)	Content (kg)	75% Recoverable weight of element (kg)	Recoverable quantity per ton (kg)	Content (% of total weight)	Content (kg)	75% Recoverable weight of element (kg)	Recoverable quantity per ton (kg)	Content (% of total weight)	Content (kg)	75% Recoverable weight of element (kg)	Recoverable quantity per ton (kg)	Selling price (Rs. per kg.)	Value of PCs (Rs.)	Value of TVs (Rs.)	Value of refrigerators (Rs.)	Value of mobile telephones (Rs.)
Bismuth	0.01	0.00	0.00	**0.05**																	
Chromium	0.01	0.00	0.00	**0.05**									0.50	0.00	0.00	3.75					
Cadmium	0.01	0.00	0.00	**0.07**									0.50	0.00	0.00	3.75					
Selenium	0.00	0.00	0.00	**0.01**																	
Niobium	0.00	0.00	0.00	**0.00**																	
Yttrium	0.00	0.00	0.00	**0.00**																	
Rhodium	0.00	0.00	0.00	**0.00**																	
Mercury	0.00	0.00	0.00	**0.02**																	
Arsenic	0.00	0.00	0.00	**0.01**																	
Silica	24.88	6.72	5.04	**188.64**	53.00	15.90	11.93	**413.49**	0.74	0.29	0.21	**5.61**	15.00	0.02	0.01	112.50	2.00	377.28	826.98	11.23	
		26.71				**28.84**															
Oil									0.53	0.21	0.15	**4.04**									
CFCs + hydrocarbons									1.12	0.43	0.32	**8.41**									
										38.03											
Total elements recovered																					
Material lost																					
Total weight of the scrap	1.00								1.00				1.00					**51,785.93**	**25,742.37**	**20,483.61**	**451,507.50**

Annexure 4

Guiding principles for design and formulation of technical specifications of WEEE/E-waste collection points

The following features mentioned in WEEE EU directive provide guidance on a conceptual approach for establishing collection points and storage areas:

1. Appropriate measures should be adopted to minimize the disposal of WEEE/E-waste as unsorted municipal waste and to achieve a high level of separate collection of WEEE/E-waste.
2. Availability and accessibility of the necessary collection facilities should be ensured taking into account in particular the population density.
3. The collection and transport of separately collected WEEE/E-waste shall be carried out in a way, which optimizes reuse and recycling of those components or whole appliances capable of being reused or recycled.
4. Ensure that a rate of separate collection of at least four kilograms on average per inhabitant per year of WEEE/E-waste from private household is achieved.
5. Private households not to dispose of WEEE/E-waste as unsorted municipal waste and to collect such WEEE/E-waste separately.
6. Sites for storage (including temporary storage) of WEEE/E-waste prior to their treatment should have impermeable surface for appropriate areas with the provision of spillage collection facilities and where appropriate, decanters and cleanser-degreasers.

Sites for storage (including temporary storage) of WEEE/E-waste prior to their treatment should have weatherproof covering for appropriate areas. An effort has been made to define principles for designing and formulation of technical specifications of collection points/ storage area by taking recourse to “Code of Practice for Collection of WEEE from Designated Collection Facilities (DCF)”, dti, Government of UK, February 2007, “Guidance on Best Available Treatment, Recovery and Recycling Techniques (BATRRT) and Treatment of Waste Electrical and Electronic Equipment (WEEE),” Department of Environment, Government of UK and other sources.

As per Annex 1 - Designated Collection Facilities of “Code of Practice for Collection of WEEE from Designated Collection Facilities (DCF)”, a DCF should:

1. Enable household WEEE to be collected from the DCF by the following five streams

A – Large household appliances (category 1) other than cooling appliances
B – Cooling appliances in category 1
C – Display Equipment containing Cathode Ray Tubes
D – Gas discharge lamps
E – All other WEEE

This means being able to **accommodate** if required containers, of a size and type appropriate to the site, for C-E, and hard standing or containers for A and B. Where this is not possible because of the size, policy requirements, layout or accessibility of the site, EITHER fewer streams may be collected, provided that:

- Those streams which are collected should be segregated from each other on site
- Sites able to receive the other streams from the public are within a reasonable distance in the Local Authority area and accessible to all on an equal basis

OR streams may be mixed, so long as C and D remain separate from other streams and each other, and B can be readily identified for uplifting separately.

2. If intended to take household WEEE direct from members of the public:

- be **accessible** to members of the public with household WEEE
- have **signs** to direct members of the public depositing household WEEE to the relevant container or area
- **Accommodate** a minimum volume capacity of 3m^3 for D and 1 m^3 for E.

3. Be run using reasonable endeavors to **prevent the mixing** of WEEE with other waste or its contamination by other hazardous material, so as to make it unsafe or disproportionately difficult to treat or to exceed the levels in Annex 2 or otherwise agreed with the producer collecting from that site;

4. Under its operating and collection contracts allow producers to arrange collection of household WEEE from the site and treatment.

As per Annex 2 - contamination with non-WEEE hazardous and non-hazardous material, "Code of Practice for Collection of WEEE from Designated Collection Facilities (DCF)", a DCF should include:

Part I: Unacceptable levels of contamination

1. The following should be considered as unacceptable levels of contamination of WEEE:

(a) The presence in a container provided to take WEEE of:

(i) 15% or more by weight of material other than that for which the container is designated, whether or not WEEE

(ii) Any of the following prohibited items regardless of weight:

a. Food waste

b. Hazardous waste of a type other than that for which the container is designated

c. Liquid wastes other than water

(b) The presence in, on or with any items of WEEE not containerized, such that they are either not evident when the item is collected or cannot readily be separated from the item for collection, of the material listed in (a)(i) and (ii).

Some recommendations as per "Guidance on Best Available Treatment, Recovery and Recycling Techniques (BATRRT) and Treatment of Waste Electrical and Electronic Equipment (WEEE)", Department of Environment, Government of UK, are given below.

<u>Impermeable surfaces</u>

The type of impermeable surface required depends on a number of factors. Major factors are given below:

- The type and quantity of WEEE/E-waste being stored including whether the WEEE/E-waste contain hazardous substances and fluids
- The type and volume of other materials dealt with
- The type and level of activity undertaken on the surface
- The length of time the surface is meant to be in service
- The level of maintenance.

The impermeability of the surface will depend on how it is constructed and its usage. A surface will not be considered impermeable, if for example,

- It has slabs or paving not properly joined or sealed

- It is composed solely of hard standing made up of crushed or broken bricks or other types of aggregate even if the WEEE is also stored in containers
- Spillages or surface water will not be contained within the system.

The impermeable surface should be associated with a sealed drainage system and may be needed even where weatherproof covering is used. This means a drainage system with impermeable components which does not leak and which will ensure that:

- No liquid will run off the pavement other than via the system
- All liquids entering the system are collected in a sealed sump except where they may lawfully be discharged.

Spillage collection facilities

Spillage collection facilities include the impermeable pavement and sealed drainage system as the primary means of containment. However, spill kits to deal with spillages of oils, fuel and acids should be provided and used as appropriate.

Weatherproof covering

The purpose of the weatherproof covering for storage is

- To minimize the contamination of clean surface and rain waters, to facilitate the reuse of those whole appliances and components intended for reuse
- To assist in the containment of hazardous materials and fluids

The areas that are likely to require weatherproof covering will therefore include those storing hazardous or fluid containing WEEE/E-waste or whole appliances or components intended for reuse.

The type of weatherproof covering required will depend of the types and quantities of waste and the storage activities undertaken. Weatherproof covering may in some circumstances simply involve a lid or cover over a container but in others it may involve the construction of a roofed building. An example of impermeable surfaces and weatherproof covering is given in Figure 1.

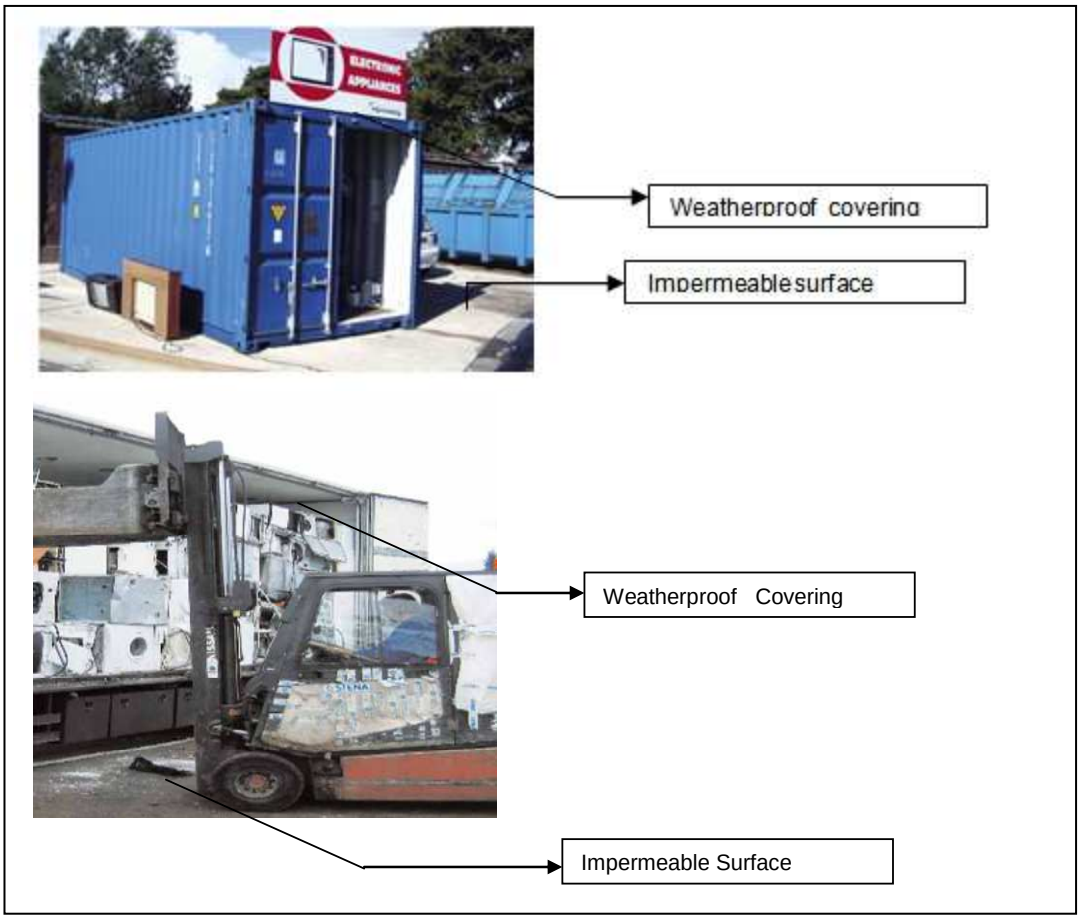


Figure 1: Examples of WEEE/E-waste collection systems (impermeable surfaces & weatherproof coverings) at a collection facility[31][32]

The following insights have been drawn with respect to specifications from the analysis of code of practice, BATRRT and other sources of literature.

Layout of Collection Point/ Storage Area

1. Collection point/ storage area should be easily accessible i.e the identification of their location is very important
2. Area of the collection point/ storage should be able to accommodate separated/ sorted WEEE/ E-waste with respect to size
3. Collection point/ storage area should have impermeable surface with sealed drainage system
4. Weatherproofing of collection point/ storage area.

[31] Source: Waste Electrical and Electronic Equipment (WEEE) Pilot Scheme Report, www.ehsni.gov.uk
[32] Source: El-retur, www.elretur.no

Area of Collection Point/ Storage Facility

Area of collection point and storage facility is an important feature for fixing up layout of storage area. For instance in Austria, only retailers with sales area greater than 150 m^2 are obliged to take back WEEE/E-waste, while in Canada, feasibility study for WEEE/E-waste collection system has been carried out considering 1000 ft^2 of collection facility. Different steps to fix up area of collection point/ storage facility are given below:

1. Calculate the WEEE/E-waste capture rate for the geographical area served
2. Calculate volume of each of the separated WEEE/E-waste item based on tonnage captured, e.g. in Canada, the assumptions taken for for different WEEE/E-waste items are given below.
    - Cellphone – 0.613 m^3/ tonne
    - Telephone – 2.08 m^3/ tonne
    - Stereos – 6.502 m^3/ tonne
    - Computers – 3.851 m^3/ tonne
    - Monitors – 4.952 m^3/ tonne
    - Peripherals – 4.049 m^3/ tonne
    - TV – 6.146 m^3/ tonne
3. Based on captured WEEE/E-waste items calculate the bin/ container/ cage/ Gaylord container size and their numbers. Examples of containers are shown in Figure 1.

The types of bins/ cages used for WEEE/E-waste collection are shown in Figure 2.

Number of Collection Points/Storage Facilities

Collection target defines the number of collection points. The number of WEEE/E-waste collection points will vary from country to country. An example of local collection facilities per population some European countries are given in Table 1.

Table 1: Local authority collection facilities per population in 2003[35]

Country	Population (millions)	Local authority collection facilities	Ratio (facilities/person)
The Netherlands	16.0	600	1 : 27,000
Sweden	8.8	600	1 : 15,000
Norway	4.5	400	1 : 11,000

[33] Source : Waste Electrical and Electronic Equipment (WEEE) Pilot Scheme Report, www.ehsni.gov.uk
[34] Source: www.sens
[35] Wilkinson, S. and N. Duffy, EPA Ireland, 2003. *Waste electrical and electronic equipment (WEEE) collection trials in Ireland*

In Canada, the feasibility of WEEE/E-waste collection has been carried out by using the following assumptions.[36]

Urban areas: One collection point per city of 50,000 people and one additional collection point for cities with a metro population of 200,000 or more.

Rural areas: One collection point per 10,000 people or 50 km radius.

Different steps to determine number of collection points/ storage facilities are given below:

1. Calculate the population served
2. Calculate each of the WEEE/E-waste capture rate per inhabitant per year
3. Calculate the number of collection points required to achieve the target rate
4. Fix up the final number of collection points after studying the study area/ land use/ geography after deciding the location.

[36] Prepared for Resource Recovery Fund Board, Nova Scotia, by PHA Consulting Associates, 31st March 2006. *Electronics Waste Recovery Study*, Annex J, Table J1

Annexure 5

Electronic and Electrical Waste (E-waste) Treatment in Japan

1 The E-waste Treatment System in Japan

Figure A1 shows Japan's legal system for promoting the establishment of a sound material-cycle society. Its basic framework was laid out in the Basic Act on Establishing a Sound Material-Cycle Society and entered into force in January 2001. Under this framework, a series of laws has been formulated and put into force, including the Act on the Promotion of Effective Utilization of Resources (the "Resource Utilization Act," enforced in April 2001) and other acts for specific recyclable items in accordance with their characteristics. These add to the provisions of the Waste Disposal and Public Cleansing Act (the "Waste Disposal Act") of 1970 that aims to "preserve the living environment and public health" through the appropriate treatment of both municipal and industrial waste.

Acts for specific recyclable items include provisions that are in accordance with the characteristics, life cycles and other aspects of the items targeted under the legislation. The Act on Recycling of Specified Kinds of Home Appliances (the "Home Appliance Recycling Act") enacted in April 2001 is a prominent example of an act targeting specific recyclable items.

Figure A2 shows Japan's system of E-waste treatment. When E-waste is collected together with general waste, it is not recycled. It is instead incinerated or disposed of in landfills.

In the case of four kinds of home appliances — air-conditioners, televisions (cathode-ray tube, liquid-crystal and plasma display panel televisions), refrigerators and freezers, and washing and drying machines — the Home Appliance Recycling Act requires retailers to collect and transport used products from consumers and requires manufacturers and importers to recycle them. As for personal computers and small secondary batteries, the Resource Utilization Act requires manufacturers to curb waste emissions and effectively utilize recyclable resources and reusable parts. This Act also lays out provisions for voluntary take-back by manufacturers, processors, and repair and sales entities.

While no legal system has yet been stipulated for treating other small electronic and electrical items, municipalities and the private sector have made voluntary commitments to collect and recycle such products. In March 2012, the Cabinet approved a bill seeking to promote the recycling of used small devices (the "Bill for Recycling of Small Devices"). The legislative bill recommends the institutional establishment of appropriate and secure ways to recycle small devices.

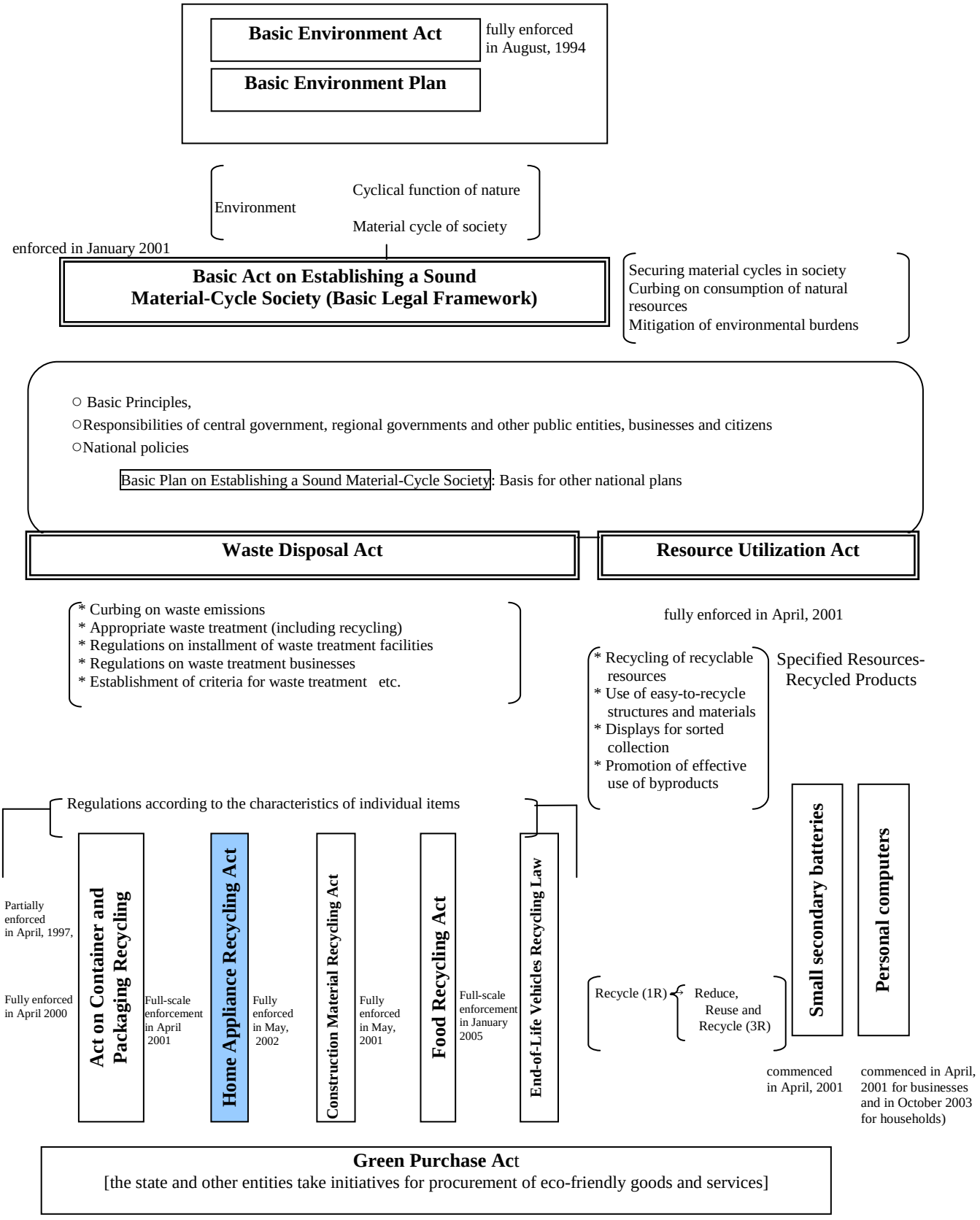


Figure A1: Legal system for the promotion of a Sound Material-Cycle Society[37]

[37] Created based on materials from the Ministry of the Environment of Japan

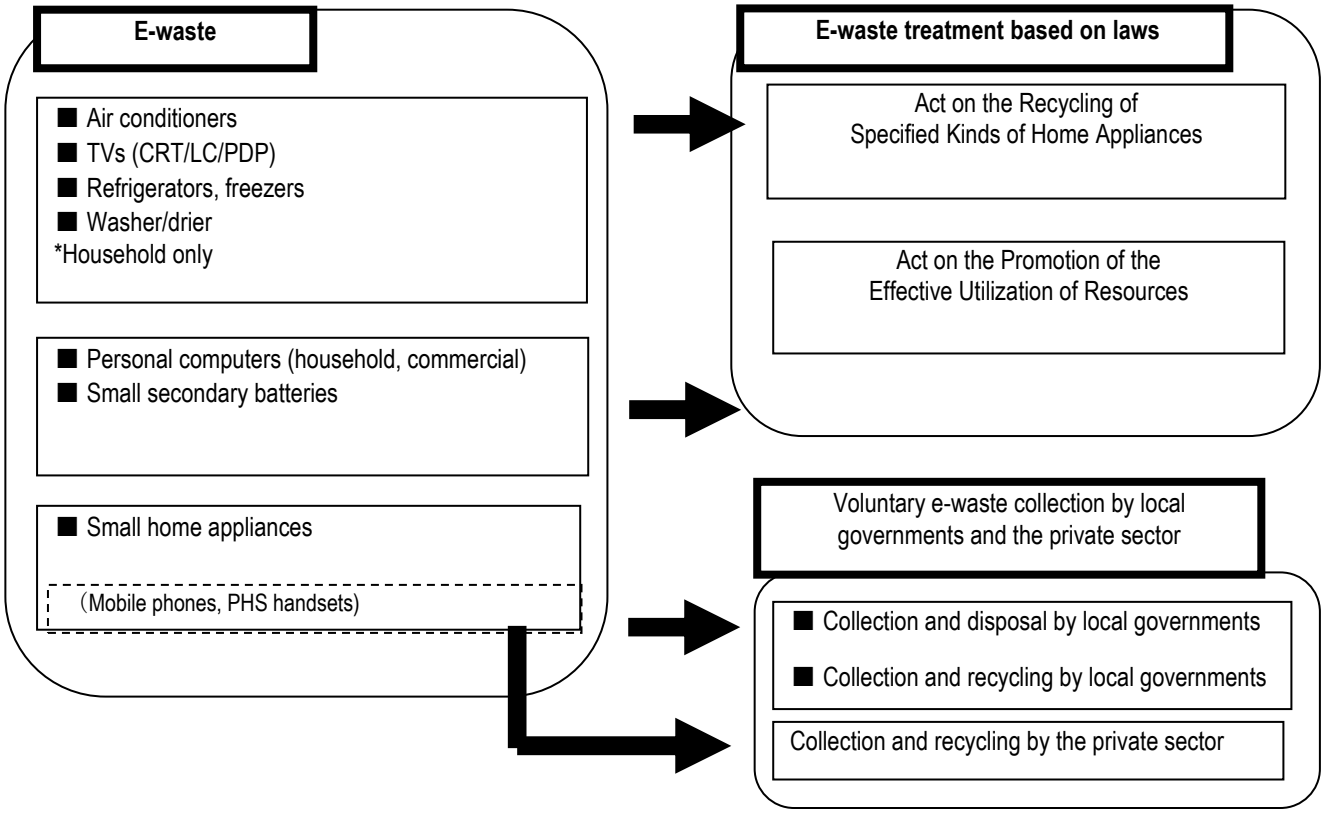


Figure A2: E-waste collection system in Japan

2 E-waste Treatment as Stipulated in Law

2-1 Act on the Recycling of Specified Kinds of Home Appliances

(1) Items subject to the Act

The Home Appliance Recycling Act is aimed at four kinds of home appliances, namely air conditioners, televisions (cathode ray tube, liquid crystal and plasma display panel televisions), refrigerators and freezers, and washing and drying machines. Table A2-1 shows the different types of these appliances subject to the law and the criteria for recycling. Liquid crystal and plasma display panel televisions and drying machines became subject to the law only upon its revision in December 2008.

Table A2-1: Items subject to the Act on the Recycling of Specified Kinds of Home Appliances

Item*	Coverage	Recycling target
Air conditioners	Wall type (split-type, gas heater, hybrid-type [combination of oil, gas and electricity-fueled air-conditioners, etc.]), multi-purpose air conditioners, floor model (split-type, hybrid-type [combination of oil, gas and electricity fueled air-conditioners, etc.]), window and through-wall, and exterior units.	70% or more
Televisions	CRT (TV/VCR combos, display monitor with tuner), liquid-crystal and plasma display panel TVs (TV/HDD or DVD combos, and display monitors with tuners)	CRT: 55% or more LC/PDP: 50% or more
Refrigerators	Refrigerators, refrigerator/freezers, wine coolers (wine	60% or more

and freezers	cellars), freezers (chest freezers, upright-type and drawer-type)	
Washing and drying machines	Washing/drying machines, automatic washing machines, two-part washing machines and drying machines (gas and electric)	65% or more

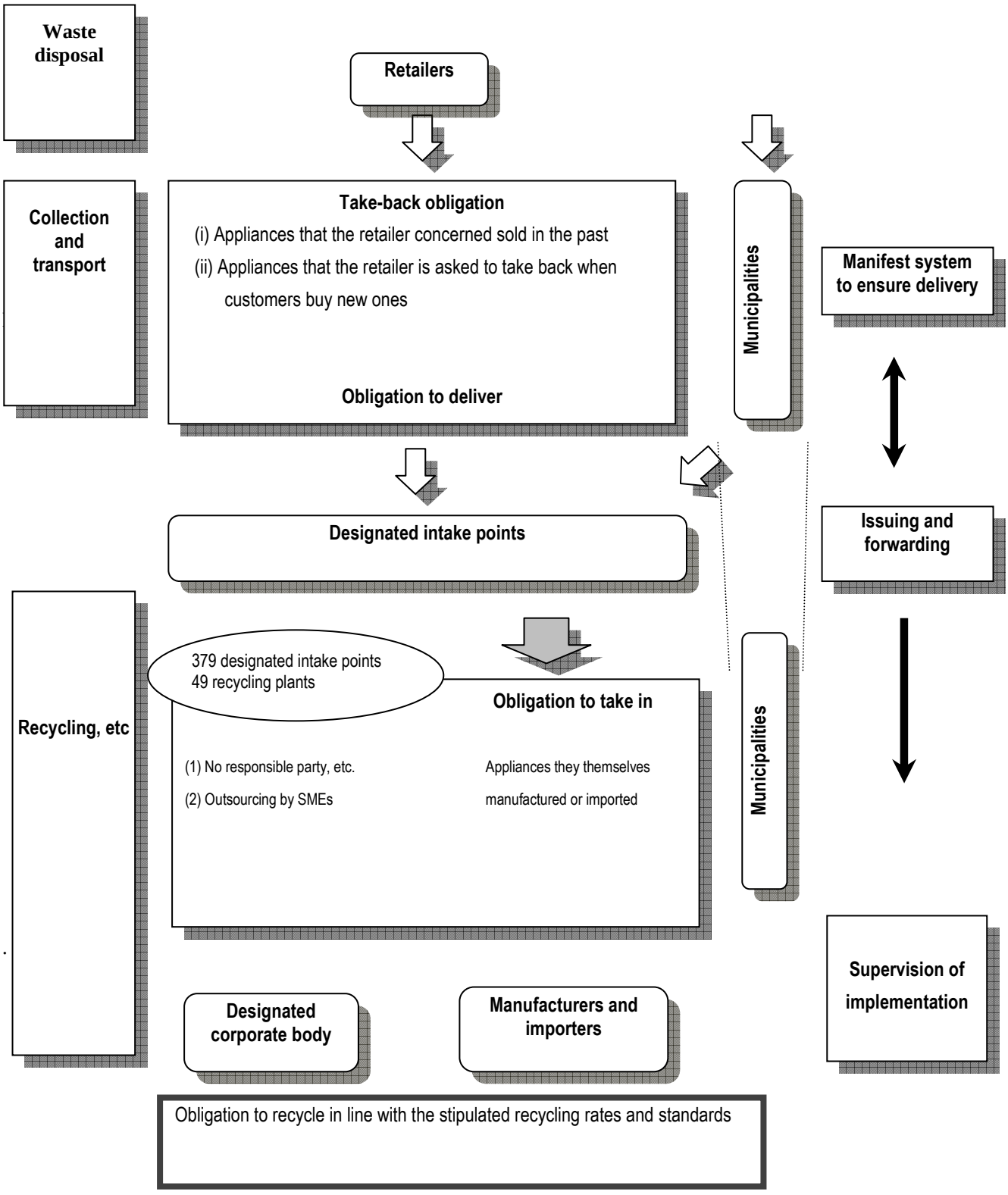
*Electric appliances for commercial use are not included.

(2) Collection and Recycling Methods

A schematic rendition of the recycling flow under the Home Appliance Recycling Act is shown in Figure 3-2-1. The roles of consumers, retailers, manufacturers and importers, and municipalities are also indicated. The Act stipulates the operation of an “electronic manifest management system,” whereby retailers are required to produce a manifest when they take back used home appliances from consumers, and manufacturers and importers are required to do so when they take back such appliances from retailers. Retailers, manufacturers and importers are required to keep these manifests for three years.

Consumers (households and businesses): Deliver used appliances to retailers and pay handling charges
Retailers: Take back used appliances from consumers and deliver them to manufacturers, etc.
Manufacturers* (manufacturers and importers): Take back used appliances from retailers and recycle them
*Designated corporate bodies will act in cases in which the responsible parties do not have a presence in Japan (for example, for items whose manufacturer or importer is no longer in business) or when the responsible parties are small- or medium-sized businesses that outsource the tasks to such designated corporate bodies.
Municipalities: Deliver taken-back appliances to manufacturers, etc. (or designated corporate bodies) and recycle them

In April 2000, the Association for Electric Home Appliances, a general incorporated foundation, became a designated corporate body. Table A3-2-2 shows the collection and recycling structure that the association has established.



*CFCs contained in cooling media and insulating materials are collected and recycled or destroyed when appliances are recycled.

Figure A-2-1: Schematic recycling flow according to the Home Appliance Recycling Act[38]

[38]Created based on materials from the Ministry of the Environment of Japan

Table A2-2: Collection and recycling system established by the Association for Electric Home Appliances[39]

Item	Overview
Collection and recycling system for manufacturers, etc.	The Association operates a nationwide recycling system by dividing manufacturers, etc. into two groups (Groups A and B).
Designated intake points	379 points across the country
Recycling plants	49 plants across the country *Group A*: 31 plants (existing plants owned by recycling businesses and those newly constructed exclusively for recycling used home appliances that serve as core facilities) *Group B*: 16 plants (plants newly built exclusively for recycling of used home appliances in collaboration with material-related businesses) Plants used by both groups: 2 plants

(3) Actual collection and recycling
The number of used home appliances subject to the Home Appliance Recycling Act that were appropriately taken back and the trend in the rate of products that are recycled are shown in Tables A-2-4 and A-2-5, respectively.

The number of used appliances taken back has been increasing every year. While the overall recycling rate has remained at the same level over the years, the rates for flat televisions, refrigerators/freezers, and washing/drying machines have been steadily increasing every year. All the recycling rates are above the minimum rates established under law, which were revised in December 2008 when the Act was revised. The minimum recycling rates established under the 2001~~2000~~ Act and its 2009~~2008~~ revision are as follows:

Table A-2-3: Minimum recycling rates under the Home Appliance Recycling Act and its 2008 revision

Item	Minimum recycling rate set forth under the Home Appliance Recycling Act	
	2001 Act	2009 revision
Air conditioners	60%	70%
Flat screen televisions (LC/PDP)	*None established*	50%
Refrigerators/freezers	50%	60%
Washing/drying machines	50%	65%

[39]Association for Electric Home Appliances, July 2011. *Annual Report on Recycling of Home Appliances for FY2010 (The 10th Term)*

Table A-2-4: Number of units of the four specified kinds of home appliances taken back, FY2011 to FY2010[4]

Unit: thousands

Appliance type	Fiscal year										Total
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
Air conditioners	1,334	1,635	1,585	1,814	1,990	1,828	1,890	1,968	2,154	3,142	19,340
CRT televisions	3,083	3,517	3,551	3,787	3,857	4,127	4,613	5,365	10,320	17,368	59,588
Flat-screen televisions	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	218	654	872
Refrigerators/ freezers*	1,929	2,425	2,662	2,813	2,953	2,943	2,884	2,821	3,087	3,136	27,653
Washing/drying machines**	8,549	10,150	10,462	11,216	11,620	11,614	12,112	12,899	18,786	27,700	135,108

*The figures for refrigerators/freezers for FY2001-03 are for refrigerators only.
**The figures for washing/drying machines for FY2001-08 are for washing machines only.

Table A-2-5: Recycling rates of the four specified kinds of home appliances, FY2011 to FY2010[40]

Appliance type	Fiscal year										Statutory recycling rate
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
Air conditioners	78%	78%	81%	82%	84%	86%	87%	89%	88%	88%	70%
CRT televisions	73%	75%	78%	81%	77%	77%	86%	89%	86%	85%	55%
Flat-screen televisions	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	74%	79%	50%
Refrigerators/ freezers*	59%	61%	63%	64%	66%	71%	73%	74%	75%	76%	60%
Washing/drying machines**	56%	60%	65%	68%	75%	79%	82%	84%	85%	86%	65%

*The figures for refrigerators/freezers for FY2001-03 are for refrigerators only.
**The figures for washing/drying machines for FY2001-08 are for washing machines only.

3-2-2 Act on the Promotion of Effective Utilization of Resources

The Act on the Promotion of Effective Utilization of Resources (the Resource Utilization Act) states that manufacturers, etc. of personal computers and small secondary batteries are required to curb waste emissions, promote the reuse of parts and the recycling of valuable materials that are able to be reused or recycled, and voluntarily take back and recycle such parts and materials. Unlike the case with the Home Appliance Recycling Act, under the Resource Utilization Act, retailers are not required to assume direct responsibility to take back used products.

[40] Association for Electric Home Appliances, July 2011. *Annual Report on Recycling of Home Appliances for FY2010 (The 10th Term)*

3-2-2-1Personal computers

(1) Items subject to the Act
Manufacturers and distributors of imported products have been responsible for collecting and recycling personal computers for business use since April 2001 as well as personal computers for individual use since October 2003. The items subject to the Act are desktop PCs, notebook PCs, CRT displays, LC displays, PC/CRT combos, and PC/LC display combos

(2) Collection methods
Figures A3-2-2 and A3-2-3 show the schematic flow of collection and recycling of personal computers for home and business use being implemented by the PC3R Promotion Association, an independent association established by the Japan Electronics and Information Technology Industries Association (JEITA), Japan's electronics related industry group. The roles of consumers, the post office, logistics companies and manufacturers are also indicated.

1) Personal computers for home use
- Consumers: Apply for disposal to manufacturers or the PC3R Promotion Association and deliver used items to a post office
- Post offices: Accept used items brought in by consumers or carriers and deliver them to manufacturers
- Manufacturers*: Accept applications and parcel slips from consumers, take back items from post offices and recycle them

*In cases in which manufacturers do not have a presence in Japan (for example for homemade computers or computers whose manufacturer or importer is no longer in business), the PC3R Promotion Association assumes those manufacturers' role.

2) Personal computers for business use
- Consumers: Apply for disposal to manufacturers or the PC3R Promotion Association and deliver used items to a logistics company
- Logistics companies: Pick up items from consumers and deliver them to manufacturers
- Manufacturers: Accept applications and parcel slips from consumers, take back items from logistics companies and recycle them

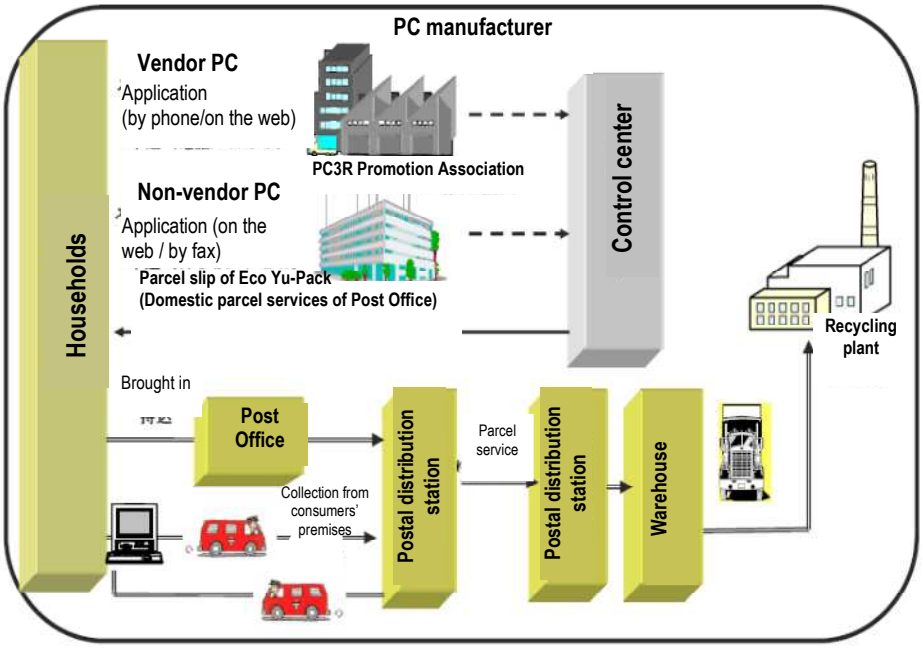


Figure A3-2-2: Schematic flow of collection and recycling of PCs for home use[41]

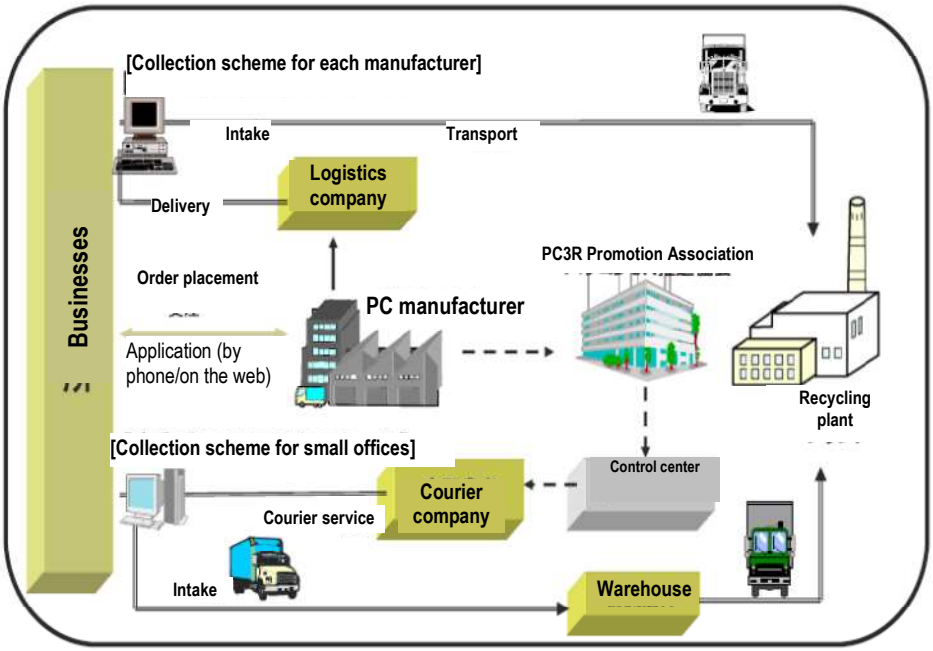


Figure A3-2-3: Schematic flow of collection and recycling of PCs for business use[42]

Now that the recycling scheme of personal computers is well established, most municipalities have stopped collecting vendor computers under independently established initiatives. However, some municipalities still continue implementing such initiatives. Table A3-2-7 shows the independent commitments of selected municipalities.

[41] Central Environment Council Sub-committee for the Recycling System of Small Electrical and Electronic Equipment and the Recycling of Useful Metals in Used Products, Group for Waste Materials and Recycling, documents for the 4th meeting 25 July 2011 http://www.env.go.jp/council/03haiki/y0324-04b.html

[42] Same as above.

Table A3-2-6: Independent commitments by municipalities[43]

Municipality	Summary of commitments
Sapporo (Hokkaido)	Sapporo offers, via the Sapporo City Environment Enterprise Public Corporation, pay services to collect used personal computers and peripherals that are not legally subject to the Resource Utilization Act (such as non-vendor PCs, and PCs, word processors, printers and other devices that weigh less than 1kg).
Ishikari (Hokkaido)	The city independently engages in activities for the recycling of "small electrical and electronic equipment" and collects used items that can be deposited in collection boxes (items smaller than 30x30cm, except for CRT displays) free of charge.
Sendai (Miyagi Prefecture)	For a fee, the city offers independent services to take in used PC models without a PC Recycling Mark*. Consumers are required to apply for disposal at an authorized business and bring the used computer to a recycling facility.
Adachi Ward (Tokyo)	As part of its recycling activities for household personal computers, the ward offers consumers the option to pay a fee and bring in their used personal computers to designated venues.

*A PC Recycling Mark has been attached to household computers made by participating manufacturers since October 2003. Computers with the mark require no additional charges for recycling.

(3) Actual collection and recycling

The number of used personal computers subject to the Resource Utilization Act that were appropriately collected and the trend in the rate of recycled products are shown in Tables A3-2-8 to A3-2-10.

Table A3-2-7: Actual collection and recycling of computers for home and business use in FY2011

Item	Volume collected (t)	No. of items collected	Disposal volume (t)	No. of items disposed	Recycled volume (t)	Recycling rate	Statutory recycling rate
Desktop PCs	2,179 (2,499)	194,825 (235,321)	1,935 (2,189)	171,793 (206,077)	1,488 (1,692)	76.9% (77.3%)	50%
Notebook PCs	498 (538)	148,354 (160,402)	420 (432)	127,283 (133,062)	238 (234)	56.8% (54.1%)	20%
CRT monitors	1,746 (2,503)	108,617 (149,856)	1,730 (2,481)	107,474 (148,345)	1,286 (1,870)	74.3% (75.4%)	55%
LC monitors	872 (921)	134,666 (132,697)	719 (718)	112,878 (104,977)	498 (509)	69.4% (70.8%)	55%
Total	5,295 (6,460)	586,462 (678,276)	4,803 (5,820)	519,128 (592,461)	3,511 (4,305)		

[43] Central Environment Council Sub-committee for the Recycling System of Small Electrical and Electronic Equipment and the Recycling of Useful Metals in Used Products, Group for Waste Materials and Recycling, documents for the 4th meeting

Table A3-2-8: Actual collection and recycling of computers for home use in FY2009 and FY2008[8]

Item	Volume voluntarily collected (t)	No. of items voluntarily collected	Disposal volume (t)	No. of items disposed	Recycled volume (t)
Desktop PCs	1,283 (1,338)	111,579 (119,864)	1,175 (1,193)	102,079 (107,300)	854 (863)
Notebook PCs	281 (269)	80,018 (74,715)	237 (211)	70,518 (62,205)	122 (102)
CRT monitors	1,241 (1,587)	73,316 (91,929)	1,241 (1,587)	73,316 (91,915)	895 (1,148)
LC monitors	562 (484)	72,322 (62,025)	464 (364)	62,202 (48,660)	312 (254)
Total	3,367 (3,679)	337,235 (348,533)	3,117 (3,355)	308,115 (310,080)	2,183 (2,367)

Table A3-2-9: Actual collection and recycling of computers for business use in FY2009 and FY2008[44]

Item	Volume voluntarily collected (t)	No. of items voluntarily collected	Disposal volume (t)	No. of items disposed	Recycled volume (t)
Desktop PCs	896 (1,161)	83,246 (115,457)	760 (995)	69,414 (98,777)	634 (829)
Notebook PCs	217 (268)	68,336 (85,687)	183 (222)	56,765 (70,857)	116 (131)
CRT monitors	505 (915)	35,301 (57,927)	489 (894)	34,158 (56,430)	391 (722)
LC monitors	310 (437)	62,344 (70,627)	254 (354)	50,676 (56,317)	187 (255)
Total	1,928 (2,781)	249,227 (329,743)	1,686 (2,465)	211,013 (282,381)	1,328 (1,937)

Notes:
(i) The figures are actual values for FY2009; the figures in parentheses are for FY2008.
(ii) The figures are aggregates of officially published values from individual businesses. (These include businesses legally required to engage in voluntary collection/recycling only; businesses that disposed of non-vendor items are not included.)
(iii)The figures for voluntary collection include the volume of items collected for reuse.
(iv) In these tables, the term “recycling” means utilizing parts of used and collected items as both reusable parts and recyclable resources.

[44] Ministry of the Environment of Japan

3-2-2-2 Small Secondary Batteries

(1) Items subject to the Act
In April 2001, the Resource Utilization Act was revised to require small secondary battery makers, manufacturers using batteries and businesses importing and selling them to collect and recycle such batteries. In April 2004, a limited liability intermediary corporation, the Japan Portable Rechargeable Battery Recycling Center, was established (and converted to a general incorporated association later) to promote the recycling of energy recourses. More specifically, the Recycling Center provides free of charge the service of collecting used small secondary batteries from collection points at the premises of partner shops (approximately 20,000) that have registered to support the recycling initiative, municipalities (approximately 190) and partner businesses (approximately 10,000). Table A3-2-11 shows the types of batteries subject to the Resource Utilization Act.

Table A3-2-10: Small secondary batteries subject to the Resource Utilization Act

Targeted items	Nickel-cadmium, nickel hydride, lithium-ion, small sealed lead acid, and other batteries

(2) Collection methods
Figure 3-2-4 shows the schematic flow of JBRC's collection and recycling methods for small secondary batteries. The roles of consumers, distributors, manufacturers and other parties involved are also indicated.

1) Batteries for home use
- Consumers: Bring used batteries to retail shops and put them in collection boxes
- Distributors: Take back used batteries from consumers and deliver them to manufacturers
- Manufacturers, etc.: Take back used batteries from distributors and recycle them

2) Batteries for business use
- Consumers: Request collection and deliver used batteries to manufacturers, etc.
- Manufacturers, etc.: Take back used batteries from consumers and recycle them

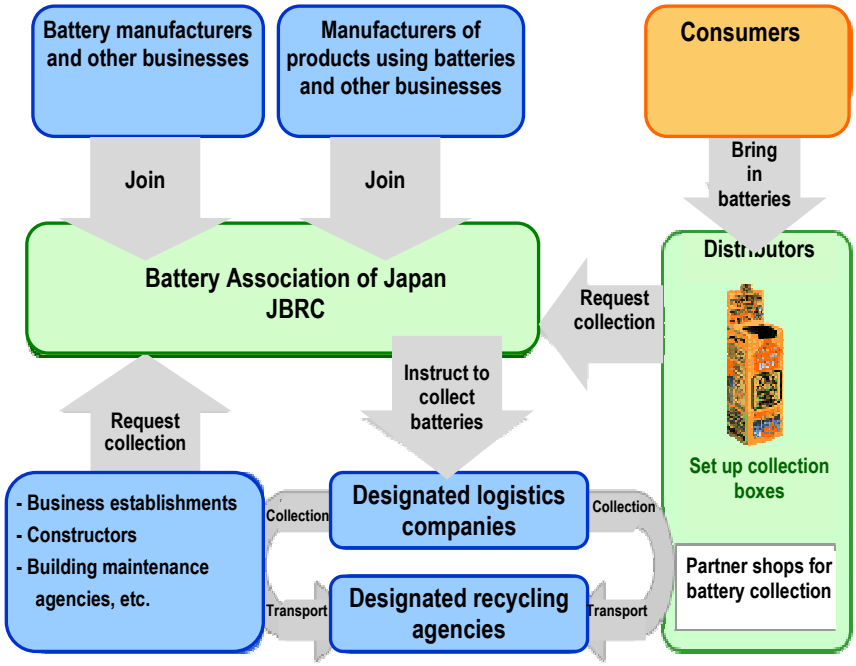


Figure A3-2-4: Schematic flow of collection and recycling of small secondary batteries[45]

[45] Ministry of Economy, Trade and Industry of Japan http://www.meti.go.jp/policy/main/admin_info/law/02/index05.html

(3) Actual collection and recycling

The actual trends in the collection and recycling of small secondary batteries subject to the Resource Utilization Act are presented in Table 3-2-12. The volume of batteries collected and the recycling rates have remained more or less unchanged over the years. The recycling rates have continuously exceeded the minimum recycling rates stipulated under the law.

Table A3-2-11: Actual collection and recycling of small secondary batteries in FY2009 and FY2008[46]

Item	Volume of voluntary collection (t)	Disposal volume (t)	Recycled volume (t)	Recycling rate	Statutory recycling rate
Nickel-cadmium batteries	984 (984)	885 (886)	652 (649)	73.6% (73.3%)	60%
Nickel hydride batteries	205 (224)	184 (202)	141 (154)	76.6% (76.6%)	55%
Lithium secondary batteries	371 (320)	346 (297)	251 (188)	72.5% (63.3%)	30%
Small valve regulated lead-acid batteries	1,886 (1,729)	1,886 (1,729)	943 (865)	50.0% (50.0%)	50%
Total	3,445 (3,258)	3,301 (3,114)	1,987 (1,857)		

Notes:

(i) The figures are actual values for FY 2009; the figures in parentheses are for FY 2008.

(ii) The figures are aggregates of officially published values of JBRC, the incorporated association Battery Association of Japan, the incorporated association Telecommunications Carriers Association and the general incorporated association Communications and Information Network Association of Japan (Mobile Recycle Network).

3-3 Voluntary E-waste Collection by Local Governments and the Private Sector

Municipalities and the private sector voluntarily commit themselves to collecting and recycling small electric home appliances whose methods of treatment have not yet been regulated. Telecommunication businesses and manufacturers have long engaged in voluntary activities for collecting and recycling mobile telephones and personal handy-phone system (PHS) handsets. On March 9, 2012, the Cabinet approved a bill for recycling small electric devices. Should this be enacted as law, it would legislate commitments to collection and recycling nationwide while taking advantage of efforts made so far.

3-3-1 Small Home Appliances

(1) Model projects for E-waste collection

Currently, municipalities collect a large proportion of used small home appliances as incombustible or recyclable waste but extract recyclable resources from only a small proportion of them.

In December 2008, the Ministry of the Environment and the Ministry of Economy, Trade and Industry jointly established a study group for the collection and appropriate handling of rare metals in used small home appliances. The group has been carrying out model projects for the collection of used small home appliances and examining effective and efficient collection methods. Table 3-3-1 outlines model projects launched around the country. Those in Akita Prefecture and the cities of Tsushima and Nagoya are overviewed below.

[46] Ministry of the Environment of Japan

Table A3-3-1: Summary of model projects for collection of used small home appliances[47]

Project area	FY	No. of types of targeted items	Collection method				Collection rate*
			Recycling box	Pickup collection	Waste station	Group collection/ participatory collection	
Akita Prefecture (prefecture-wide project)	2008-2010	40	√	√	—	—	3.8%
Ibaraki Prefecture (Cities of Hitachi, Takahagi and Kita-Ibaraki)	2008-2010	12	√	√	—	—	6.2%
Fukuoka Prefecture (Cities of Omuta and Chikugo; town of Oki)	2008-2010	14	√	√	√	—	17.9%
Tokyo (Koto Ward; city of Hachioji)	2009-2010	13	√	—	—	√	3.2%
Cities of Nagoya and Tsushima	2009-2010	27	√	—	√	√	6.3%
City of Kyoto	2009-2010	16	√	—	—	—	0.5%
City of Minamata	2009-2010	18	√	—	√	—	9.7%

*Collection rate = (the number of items collected) / (the number of items that could potentially be collected)
- The number of items collected is calculated by multiplying the basic unit for the number of items collected for each fiscal year by the population subject to collection.
- The number of items that could potentially be collected is calculated based on the proportion of the population subject to collection in the region concerned and the nationwide number of items that could potentially be collected.
- The nationwide number of items that could potentially be collected is the number of items for disposal estimated in accordance with the shipping volume obtained from existing statistics (shipping volume of products made in Japan + shipping volume of products shipped to Japan that were made abroad by Japanese makers + shipping volume of products shipped to Japan that were made abroad by overseas makers) and the average length of service.
*Recycling box:
- Recycling boxes are situated at various places. Consumers leave their used home appliances in them.
Pickup collection:
- Used home appliances are collected first through usual general waste collection services, after which used small home appliances are carefully picked out.
Waste station:
- Containers for collecting used small home appliances, together with containers for other recyclable wastes, are installed at waste stations.
Group collection/participatory collection:
- Citizens' groups already undertaking group collection of recyclable waste also collect used small home appliances.
Event collection:
- Recycling boxes are situated at venues during local festive and other events. Visitors leave their used appliances in the boxes.

1) Akita Prefecture[48]

Project area	Akita Prefecture (prefecture-wide)
Project year	FY2008-10
The usual collection method for small home appliances	As incombustible, household, recyclable or oversized waste
Types of items targeted	40 items: * Mobile telephones, digital cameras, camcorders, portable music

[47] Ministry of the Environment of Japan and the Ministry of Economy, Trade and Industry of Japan, April 2011. "A Summary of Studies by the Study Group on Collection and Appropriate Handling of Rare Metals in Used Small Home Appliances"
[48] Ministry of the Environment of Japan and the Ministry of Economy, Trade and Industry of Japan, April 2011. "A Summary of Studies by the Study Group on Collection and Appropriate Handling of Rare Metals in Used Small Home Appliances"

	players, portable MD players, portable CD players, electronic organizers, electronic dictionaries, calculators, portable liquid crystal televisions, portable radios, portable image players, DVD players/recorders (except for portable ones), audio equipment, VCRs, portable game devices, keychain game players, home-use game machines, game software (except for CD-ROMs), game controllers, automobile navigation systems/DVDs, automobile audio equipment, telephone sets, hard disk drives (external and internal), word processors, microwaves, IC recorders, induction heat (IH) cookers, other electric cookers, toys, electric toothbrushes, electric shavers, hair driers, AC adapters/cables/extension cords, remote controllers, telephone handsets, computer memories, modems, PC accessories and others
Collection methods in the model project	Recycling box and pickup collection
Details of collection methods	■ Recycling box 145 boxes in the project area (approx. 7,500 persons/box) Frequency of collection: once or twice per month ■ Pickup collection ・ Collection of incombustible waste – once a month; collection of oversized waste – once every second month (odd months). Consumers could also bring in items at any time (city of Odate only). ・ Collection of incombustible waste – once a week (city of Katagami only)
Actual collection	■ Recycling box 44,217 items (23,194kg) collected over a period of 548 days at 145 collection points ■ Pickup collection 28,601 items (27,494kg) picked up over a period of 523 days ■ Total 73,889 items (50,833kg)
Trends in the volume collected	■ Recycling box: The volume of disposed items decreased during the period of FY 2008-10 (2.66 items/1,000 persons/month in FY2010) ■ Pickup collection: The volume decreased at one time but started to increase in FY2010 (to 23.74 items/1,000 persons/month in FY2010)
Main items collected	■ Recycling box: Small items ■ Pickup collection: Relatively large items
Effects on the usual separate collection system	Before the project, residents normally put used small home appliances together with incombustible or oversized waste in designated prepaid collection bags. When the project started, however, they took them out for pickup collection, so the separate collection system was accepted to some extent.

2) Cities of Nagoya and Tsushima[49]

Project area	Cities of Nagoya and Tsushima
Project year	FY2009-10
The usual collection method for small home appliances	As incombustible waste
Types of items targeted	27 items * Mobile telephones, digital cameras, camcorders, portable music players, electronic organizers, electronic dictionaries, calculators, portable radios, portable image players, DVD players/recorders (except for portable ones), audio equipment, VCRs, home-use game machines, automobile navigation systems/DVDs, hard disk drives (external and internal), word processors, microwaves, induction heat cookers, other electric cookers, toys, electric toothbrushes, electric shavers, hair driers, AC adopters/cables/extension cords, remote controllers, PC accessories and others

[49] Ministry of the Environment of Japan and the Ministry of Economy, Trade and Industry of Japan, April 2011. “A Summary of Studies by the Study Group on Collection and Appropriate Handling of Rare Metals in Used Small Home Appliances”

Collection methods in the model project	Recycling box, waste station, and group collection/ participatory collection
Details of collection methods	■ Recycling box 10 boxes (approx. 226,000 persons/box) (Nagoya) 4 boxes (approx. 16,300 persons/box) (Tsushima) Frequency of collection: once a month ■ Waste station Items put in designated bags for collection (in Tsushima, conducted over 20 townsgeographical blocks) ■ Group collection/participatory collection Staff members accept used items directly from consumers at recycling stations.
Actual collection	■ Recycling box 9,676 items (4,138kg, over 348 days at 10 collection points in Nagoya, and over a period of 336 days at 4 collection points in Tsushima) ■ Waste station 1,718 items (1,743kg, over a period of 336 days in Tsushima) ■ Group collection/participatory collection 13,383 items (11,943kg) (over 348 days in Nagoya, and over 336 days in Tsushima) ■ Total 25,821 items (17,854kg)
Trends in the volume collected (Unit: items/1,000 persons/month)	■ Recycling box: The small number of boxes per area resulted in slightly low collection rates. ■ Waste station: Highly efficient ■ Overall collection: The number of items collected decreased slightly from FY2009 into FY2010 (Recycling box: 0.22, group collection/participatory collection: 0.44 in Nagoya. Recycling box: 4.67, waste station: 19.99, group collection/participatory collection: 0.22 in Tsushima; all figures are for FY2010)
Main items collected	The numbers of used AC adapters/cables/extension cords and of PC accessories are consistently the highest among the items collected under any method.
Effects on the usual separate collection system	No conspicuous effect was seen in the case of Nagoya, while residents in Tsushima were highly conscious of recycling and tended to bring recyclable items to waste stations.

Table 3-3-2 reviews each collection method adopted in the model projects. The reviews indicate that the most effective and efficient combinations of waste collection methods vary according to circumstances, specifically as follows:
- Large cities: recycling box + event collection
- Small and medium-sized cities: recycling box + pickup collection
- Regions where the practice of separate collection is well established: waste station

Table A3-3-2: Reviews of collection methods[50]

Collection method	Ease of accessibility	Degree of physical and psychological ease in getting rid of unwanted items	Possibility of theft or other trouble
Recycling box	・ Easy access to shops and public facilities increases the collection volume. ・ Greater difficulty in accessing train stations, schools and firms results in smaller collection volumes there.	・ People can dispose of unwanted items at any time. ・ Care must be taken for security.	If boxes are out of public view, they may be vandalized or items in the boxes may be stolen.
Pickup collection/	Easy access (since the	・ People can get rid of	・ Problems are less likely

[50] Ministry of the Environment of Japan and the Ministry of Economy, Trade and Industry of Japan, April 2011. “A Summary of Studies by the Study Group on Collection and Appropriate Handling of Rare Metals in Used Small Home Appliances”

waste station	pickup points/stations are those already used for usual waste collection)	unwanted items only on certain days. ・ No need to worry about vandalism or theft if pickup points/stations are manned.	to occur if pickup points/stations are manned. ・ Items collected may be stolen if venues are not manned.
Event collection	Easy access (it is possible to come by car or train.)	・ People can get rid of unwanted items only when events are held. ・ No need to worry about vandalism or theft if pickup points/stations are manned.	・ Problems are less likely to occur if pickup points/stations are manned. ・ Items collected may be stolen if the venue is not manned.

(2) Advanced approaches to recycling

In order to encourage municipalities to collect and recycle gold, silver and other precious metals, rare metals and other reusable substances in used small home appliances and other products for disposal, the Ministry of Economy, Trade and Industry researched sophisticated approaches taken by municipalities, compiled such approaches, and published a report in July 2011. Table 3-3-3 shows the advanced approaches referred to in the report.

Table A3-3-3: Advanced approaches of municipalities to recycling of small home appliances[51]

Municipality	Partner business	Overview	
		Municipality	Business
Adachi Ward (Tokyo)	Kaname Kogyo Co., Ltd.	■ Collection methods ・ Recyclable items are collected in new small/compact dump cars at collection points and transferred to the partner business. ・ Oversized waste is collected at each door, sorted out at intermediate stations, and transferred to the partner business. ・ Items collected are manually sorted out by the contract partner business into small home appliances, metal, glass, fluorescent lighting, plastic, ceramics, etc., and crushed into small pieces. ■ Collection volume The volume of waste that is not incinerated: approx. 5,000t/year, of which metal totals 1,672t/y and small home appliances total 399t/year (in FY2010). ■ Recycling method Sold	■ Treatment ・ Metal (sauce pans, kettles, etc.) and small home appliances are separated manually from items and collected and stored in clean metal containers. ・ Temporarily stored metal and small home appliances are shredded finely with heavy machines at a factory, processed with biaxial crushers, and beaten and rolled up with hummer crushers. The processed waste is classified into iron, glass, plastic and other fine waste (residues) with magnetic ore separators, screening and various other devices. Then, aluminium, stainless steel, copper and other non-ferrous metal, and large residues are separated with separators. ■ Use of treated waste ・ Iron and other metal, aluminium, stainless steel, copper and other non-ferrous metal, scrapped substrates and other residues are sold to intermediate metal treatment businesses. ・ Waste is screened into smaller groups at plants run by the intermediate metal treatment businesses. The focus is on recycling ferrous and non-ferrous metals in smelters. Though their amounts are small, gold, silver, palladium and other rare metals are extracted at the same time.
Anjo (Aichi Prefecture)	Arbiz Corporation	■ Collection methods Personnel of the city office pick up recyclable items from incombustible waste collected at the city's recycling centre. (This process was launched full-scale in April 2011.) ■ Collection volume The volume of home appliances: approx. 5.5t (in Oct. 2010) and approx. 5t (in April 2011) ■ Recycling method Sold (1 yen/kg when the project was carried out in an experimental manner, and 10 yen/kg to successful bidders when the project entered full-scale operation)	■ Treatment ・ Used small home appliances brought in are divided into those including a large amount of precious metals and those with only a small amount in their electronic substrates. ・ The former – high-quality materials – is manually dismantled to substrates, non-ferrous metal, iron and other parts, shredded and sold to manufacturers. ・ The latter – low-quality materials – is shredded to coarse pieces to remove iron and screened to various sizes first. Then, aluminium, plastic and metal-bearing pieces are separated with separators and metal detectors. Metal-bearing pieces are finely shredded and sold to mining companies. ■ Use of treated waste ・ Iron is sold to steel makers
Ichinomiya (Aichi Prefecture)	Arbiz Corporation	■ Collection methods Staff members of the Environment Centre separate small home appliances from oversized waste and incombustible waste that citizens have brought in to the Centre. (The process was launched full-scale in FY2012.) ■ Collection volume	

[51] Ministry of Economy, Trade and Industry of Japan, July 2011. "Advanced Approaches of Municipalities to Recycling of Small Home Appliances"

		The volume of home appliances: approx. 15t (during the experimental period in Jan.-Mar. 2011) ■ Recycling method Recyclables are sold to waste treatment businesses once a week or so (1 yen/kg in the experimental period; bidding will be carried out when the project is launched full-scale.).	・ Aluminium is sold to secondary alloy steel makers ・ Non-ferrous metal is sold to non-ferrous refining companies ・ Substrates and residues containing precious metal are sold to the relevant mining companies ・ Plastic (polypropylene) is sold to recycling companies. ・ Plastic (for fuel) is sold to steel makers as steel reducer.
Tajimi (Gifu Prefecture)	Arbiz Corporation	■ Collection methods Personnel manually classify shredded solid waste brought to the waste treatment centre in Sannokura into high-quality home appliances, low-quality home appliances and other home appliances before storing them. (The process was launched experimentally in July 2011.) ■ Collection volume The volume of shredded solid waste: approx. 350t/year, of which the volume of home appliances is 130t/year (estimate) (FY2010). ■ Recycling method Sold to waste dealers (3 yen/kg for waste including both high-quality and low-quality home appliances; and 1 yen/kg for other mixed waste)	
Tokotake Clean Center (Aichi Prefecture)	Arbiz Corporation	■ Collection methods Contract workers at the Center manually separate recyclable waste from incombustible waste brought in by local citizens and put the separated waste in containers for disposers (the process was carried out experimentally in Apr.-Sept. and launched full-scale in October 2011.) ■ Collection volume The volume of small home appliances: approx. 2.8t (for two weeks or so in April 2011). ■ Recycling method Sold to waste treatment businesses approximately once a week (at 1 yen/kg and approximately 1.5t each time)	
Ishikari (Hokkaido)	Matec Inc.	■ Collection methods Recycling boxes of the partner business are situated at seven places, including the city office. Waste brought in is collected by the partner business. ■ Collection volume The volume of small home appliances: 484kg/month (FY2010) ■ Recycling method Processed by the partner business	■ Treatment ・ Used small home appliances are processed appropriately in accordance with their characteristics. They are manually dismantled and classified, then shredded and sorted. Electronic substrates are processed to extract precious and rare metals. Insulated wires are processed to take out copper. Plastic is processed chiefly to produce RPF. ■ Use of treated waste ・ Iron is sold to electric furnace steel makers, etc. in Hokkaido. ・ Copper is sold to non-ferrous refining companies, etc. ・ Scrapped substrates are dismantled to gold, silver, copper, palladium and other precious metals by the partner business and sold to precious

			metal makers. ・ Plastic is chiefly used as refuse plastic fuel (RPF), and some portion is sold as plastic resource materials. ■ Other activities A recycling outlet was established in Shiroishi, Sapporo to take in small home appliances and other disused items from general households, who receive points under the program. The program was carried out on an experimental basis for one year from August 2010. The number of recycling outlets is scheduled to be increased.
Imizu (Toyama Prefecture)	Harita Metal Co., Ltd.	■ Collection methods Citizens are asked to directly bring in used small home appliances to Cleanpia Imizu, a waste treatment centre. ■ Collection volume The volume of small home appliances: approx. 10t (approx. 1.8t/month) (during Oct.~~Apr.~~ 2010 – Mar. 2011) ■ Recycling method Sold to successful bidders (11 yen/kg in FY2010)	■ Treatment ・ Used small home appliances are shredded and classified into iron, non-ferrous metal, various kinds of metal, plastic and other materials at facilities of the company (sorting/pre-processing, shredding, magnetic ore separation, eddy-current separation, heavy liquid separation, and colour separation). ・ For metal waste, not only iron and aluminium but also precious metals such as gold, silver and copper, as well as rare metals, are extracted. ■ Use of treated waste ・ Iron is sold to steel makers in Japan. ・ Aluminium is dissolved and remanufactured for recycling by the partner business. ・ Non-ferrous metal is separated and sold to non-ferrous refining companies in Japan. ・ Precious and rare metals are extracted from scraps and sold to refining companies in Japan.
Kurobe (Toyama Prefecture)	Harita Metal Co., Ltd.	■ Collection methods Users directly bring in their used home appliances to permanently established stations. (The process was launched full-scale in Nov. 2010.) ■ Collection volume The volume of small home appliances: approx. 8.4t (during Nov. 2010- Mar. 2011) ■ Recycling method Sold (10 yen/kg in FY2010)	
Takaoka (Toyama Prefecture)	Harita Metal Co., Ltd.	■ Collection methods Recycling stations have been established in two places to take in 15 types of recyclable items free of charge on Sundays. People place items in appropriate containers at the stations. (The stations started to take in used small home appliances in October 2010.) ■ Collection volume The volume of small home appliances: 3.6t/year (in FY2010) ■ Recycling method Sold to successful bidders (12 yen/kg in FY2011)	
Tonami (Toyama Prefecture)	Harita Metal Co., Ltd.	■ Collection methods Local citizens bring in and sort their used items at recycling stations in individual regions. (The process was launched full-scale in May 2010.) ■ Collection volume The volume of home appliances: approx. 16t (during May 2010 – Mar. 2011) ■ Recycling method	

		Sold to successful bidders (10 yen/kg)	
Toyama, #1 (Toyama Prefecture)	Harita Metal Co., Ltd.	■ Collection methods ・ Recycling stations (Environment Centers) are open from 9 a.m. to 3 p.m. on Saturdays, Sundays and national holidays. ・ Recycling services were expanded to all eight recycling stations in the city in October 2011. ■ Collection volume The volume of small home appliances: approx. 5t (Oct. 2010 – Mar. 2011); approx. 1.7t (Apr.-Jun. 2011) ■ Recycling method Sold to successful bidders (11.6 yen/kg in FY2011) (Bidders are required to recycle 90% or more of used home appliances, analyse the composition and report the results of the analysis.)	
Nan'etsu Sanitary Union (Fukui Prefecture)	Harita Metal Co., Ltd.	■ Collection methods The Union encourages local citizens to take oversized incombustible waste to a collection point in each town once a year, where they place used small home appliances into containers. ■ Collection volume Oversized incombustible waste: 634t/year, of which the volume of small home appliances: 32t/year (estimate for FY2010). *Small house appliances: approx. 12t (Apr.–Jun. 2011) ■ Recycling method Sold to intermediate waste treatment businesses (FY2011)	
Hakui Larger Area for Municipal Cooperation (Ishikawa Prefecture)	Harita Metal Co., Ltd.	■ Collection methods ・ Used small home appliances and other recyclable and incombustible waste are collected by waste collection vehicles, and brought to recycling centres, where contract workers manually separate small home appliances from other waste. ・ Recycling boxes are installed on the premises of the recycling centres for collection free of charge. ■ Collection volume Volume of waste containing recyclable items: 166.4t (Sept. 2010 – Mar. 2011) ■ Recycling method Sold to intermediate waste disposers via bidding. Successful bidders take out recyclable waste on Hiab vehicles (9 yen/kg in FY2011; 10 yen/kg in FY2010)	
The city of Hakusan and Ishikawa County for Municipal Cooperation	Harita Metal Co., Ltd.	■ Collection methods Incombustible waste is collected in waste collection vehicles and brought to clean centres, where contract workers manually separate small home appliances from other waste. ■ Collection volume	

(Ishikawa Prefecture)		Volume of small home appliances: 78t/year (FY2011); approx. 9.5t (June 2011) ■ Recycling method Sold to waste disposers via bidding (8 yen/kg in June 2011)	
Himi (Toyama Prefecture)	Harita Metal Co., Ltd.	■ Collection methods Contract waste collection and transport businesses collect “recyclable small home appliances” brought in by local citizens at recycling stations established in various regions and transfer them to storage. ■ Collection volume Volume of small home appliances: 8,480kg (Apr. – June 7, 2011) ■ Recycling method Sold (8 yen/kg)	
Wajima (Ishikawa Prefecture)	Harita Metal Co., Ltd.	■ Collection methods Metal waste including used small home appliances is collected in waste collection vehicles. ■ Collection volume Volume of metal waste: approx. 18t, of which the volume of small home appliances: 13t (Apr. 2011) ■ Recycling method Metal waste is sold to carriers via bidding (approx. once a month at a volume equivalent to two 10t-trucks at approx. 3.6 yen/t). The carriers manually sort small home appliances out of the metal waste and sell and transfer it to intermediate waste disposers.	
City of Wajima and the town of Anamizu Environmental and Sanitary Facility Union (Ishikawa Prefecture)	Harita Metal Co., Ltd.	■ Collection methods In June 2011, the waste collection system was revised to separate “metal waste (small home appliances, etc.)” from other incombustible waste. The former is kept in yards. ■ Collection volume Approx. 13.8t (during the experimental period between Apr. – May 16, 2011) ■ Recycling method Sold to waste disposers which take out the metal waste on Hiab vehicles (10 yen/kg in FY2011)	
Owari-Tobu Sanitary Union (Aichi Prefecture)	CP Center Co., Ltd.	■ Collection methods Incombustible waste is brought first to the Union’s Haruoka Center, from which used small home appliances are separated for recycling. ■ Collection volume The volume of small home appliances: approx. 6t (during the experimental period between Dec. 2010 – Feb. 2011) ■ Recycling method Sold (1 yen/kg during the experimental period; bidding to be carried out when the project is launched full-scale)	■ Treatment ・ Used small home appliances are classified into groups by product, then manually dismantled into 20-40 pieces including metals, plastics, wires, motors and printed substrates. ・ Metal, etc. is classified, reduced in volume by compressors and sold. ・ Rare metals included in pieces classified are extracted and sold; plastic is shredded and sold. ■ Use of treated waste ・ Metals, etc. are sold to refining companies.

			・ Substrates and other residues including precious metals are sold to precious metal refining companies. ・ Plastics, etc. are sold to manufacturers capable of thermally processing and recycling plastics.
Kariya-Chiryu Environmental Union (Aichi Prefecture)	Toei Corporation	■ Collection methods Local citizens bring used small home appliances to the Union's clean centres and place them in designated containers; intermediate waste disposers collect them in hood roll trucks approx. three times a week. ■ Collection volume Volume of small home appliances: 275t/year (FY2010); approx. 70t (Apr. – Jun. 2011) ■ Recycling method Processed by intermediate waste disposers	■ Treatment ・ Items with printed substrates that contain valuable materials are manually dismantled. ・ Other items are mechanically sorted and processed with vibratory feeders. Then, iron is collected with magnetic separators, while other materials (aluminium, copper, printed substrates and non-ferrous metal) are manually classified. ■ Use of treated waste ・ Iron is sold via intermediate waste disposers to steel makers in Japan. ・ Aluminium is sold to secondary alloy steel makers. ・ Copper, printed substrates and non-ferrous metals are sold to refining companies. ・ Plastics are planned to be sold as raw materials or thermal fuels.
Handa (Aichi Prefecture)	Toei Corporation	■ Collection methods Local citizens separate used small home appliances from other incombustible waste and place them at designated points within clean centres. ■ Collection volume Volume of incombustibles: 1,701t/year, of which the volume of small home appliances: 46t/year ■ Recycling method The city contacts businesses and sells the used appliances to them.	
Chofu (Tokyo)	Re-Tem Corporation	■ Collection methods Used home appliances are collected together with oversized waste, dismantled to extract six types of recyclable items and stored. The six types are: (1) motors, transformers and magnetrons; (2) electronic substrates; (3) hard disk drives; (4) wires; (5) metal complex materials; and (6) plastics. ■ Collection volume Home appliances: approx. 11,000 items/year (50-60 items/day), approx. 30t/year ■ Recycling method The city contacts businesses and sells the used appliances to them.	■ Treatment Parts brought in are processed with an automatic complex line comprising a special shredder, crusher, separators and other devices, enabling them to be classified and compacted to iron, non-ferrous metals, precious metals and plastics. Metals are shipped as materials to raw material makers in Japan, while plastics are shipped as fuel. ■ Use of treated waste ・ Iron is sold to electric furnace steel makers. ・ Aluminium is sold to secondary alloy steel makers. ・ Copper and precious metals are sold to non-ferrous refining companies. ・ Stainless steel is sold to special steel makers.
Toyama, #2 (Toyama Prefecture)	Mitsutoyo Industry Co., Ltd.	■ Collection methods ・ Recycling stations (environment centres) are open from 9 a.m. to 3 p.m. on Saturdays, Sundays and national holidays. ・ Recycling services were expanded to all eight recycling stations in the city in October 2011. ■ Collection volume The volume of home appliances: approx. 5t (Oct. 2010 – Mar. 2011); approx. 1.7t	■ Treatment ・ Used home appliances are manually dismantled partly for the purpose of collecting data (first time). ・ Parts containing a large amount of precious metals and non-ferrous metals are dismantled manually and in a precise manner to extract such metals. Low-quality materials and parts are processed at low costs with, for example, crushers, magnets, magnetic separators and air classifiers

		(Apr.-Jun. 2011) ■ Recycling method Sold to successful bidders (21 yen/kg in FY2010) (Bidders are required to recycle 90% or more of used home appliances, analyse the composition and report the results of the analysis.)	(second time). ■ Use of treated waste ・ Iron is sold to steel makers. ・ Aluminium is processed with a melting furnace of the partner business itself. ・ Non-ferrous metals and precious metals are sold to refining companies.
Toyota City (Aichi Prefecture)	Toyokin Co., Ltd.	■ Collection methods Contractors at waste stations separate small home appliances from metal waste brought in. (The process has been carried out full-scale from October 2010.) ■ Collection volume Volume of small home appliances that the contractors separated: 103t, of which the volume of appliances manually dismantled: approx. 59t (Nov. 2009 – Mar. 2011). ■ Recycling method Sold (0.5 yen/kg)	■ Treatment ・ Used small home appliances are manually separated from metal waste collected by the city and divided into those to be dismantled manually and those to be processed at a plant. ・ Appliances to be dismantled manually are classified into groups, and substrates are removed. Then, wires, aluminium, copper motors and batteries are separated from the appliances. ・ Appliances to be processed at the plant are shredded. The shredded materials are classified into ferrous metal (to be sold to steel makers), non-ferrous metals (to be sold to non-ferrous refining makers), and shredder dust (to be returned to the city). ■ Use of treated waste ・ Iron is to be sold to steel makers. ・ Aluminium is sold to refining makers. ・ Substrates are sold to refining makers. ・ Residues (dust) are returned to the city.
Nagaoka (Niigata Prefecture)	Nagaoka City Chamber of Authorized General Waste Disposers	■ Collection methods Small home appliances are brought to collection points and separated by type of item on Saturday and Sunday mornings and transferred to a treatment facility on Monday. ■ Collection volume Expected volume of small home appliances: 20t (Jul. 2011 – Mar. 2012) ■ Recycling method The partner business that has contracted with the city manually removes substrates, metal and plastic from appliances. Substrates are sold to refining companies in Japan, and metal and waste plastic is sold via existing businesses to steel makers, refining companies, etc.	■ Treatment Used small home appliances brought into collection points are dismantled and classified into plastics, steel, non-ferrous metals, and substrates and other useful materials containing rare metals. ■ Use of treated waste ・ Iron is sold to electric furnace steel makers. ・ Copper and other non-ferrous metals are sold to refining companies. ・ Aluminium is sold to secondary alloy steel makers. ・ Substrates and other useful materials containing rare metals are sold to refining companies in Japan.
Nago (Okinawa Prefecture)	Miyazato Inc.	■ Collection methods Waste is classified into several groups for separate collection, collected in waste collection vehicles on specified days and stored at city storage facilities. ■ Collection volume Volume of small home appliances: approx. 5t/month ■ Recycling method	■ Treatment Used small home appliances are manually dismantled, classified, mechanically crushed, and divided into iron and non-iron with magnetic separators and eddy-current separators. ■ Use of treated waste ・ Iron scraps are sold to steel makers outside the prefecture.

		Sold to successful bidders (5 yen/kg)	・ Scrap non-ferrous metals are sold to refining companies outside the prefecture. ・ Plastics are sold to pellet companies.
Yasugi (Shimane Prefecture)	Kyoudou-Kaishu Co., Ltd.	■ Collection methods ・ Metal waste collected separately from other waste is transferred to a clean centre once a month and manually classified into small home appliances, substrates, game machines, mobile telephones, non-ferrous waste, iron scrap and other items. (The process began in FY2007.) ・ Recycling boxes are situated in locations where local citizens can put used small home appliances in them. ■ Collection volume Volume of home appliances: 27t/year, of which the volume of substrates, game machines and mobile telephones: 480kg/year (FY2010) ■ Recycling method Sold to recycling businesses (8.4 yen/kg for small home appliances; 99.75 yen/kg for substrates; 66.15 yen/kg for game machines; 899.85 yen/kg for mobile telephones; prices include transport costs)	■ Treatment ・ The partner business purchases scraps of small home appliances from businesses, including those in the same business (225t/month), municipalities, including group collection (10t/month), and general consumers, including EcoRich Co. (15t/month). Of all scraps purchased, the volume of small home appliances is 60t/month (at the price 10 – 1,200 yen/kg). ・ Used home appliances are dismantled and shredded with a new recycling device equipped with separation/exfoliation functions. Then, scrap substrates, iron, copper, stainless steel, aluminium and plastics are manually extracted. ■ Use of treated waste Extracted metals, etc. are sold to large refining makers, copper refining makers, stainless steel makers, large aluminium sash makers and plastics recycling companies in Japan. The partner business runs 12 “EcoRich/Eco” outlets and recycling stations in Kagawa Prefecture jointly with a recycling shop, EcoRich, that sells precious metals, brand products, used mobile telephones, shopping vouchers, cosmetics and other second-hand goods. The “EcoRich/Eco” outlets, unlike the EcoRich shop itself, are equipped with containers for recyclable items such as small home appliances, iron scraps, paper waste, plastics, etc.

3-3-2 Mobile Telephones, PHS Handsets

As for collecting and recycling mobile telephones and personal handyphone system (PHS) handsets, the Telecommunications Carriers Association (TCA) and the Communications and Information Network Association of Japan (CIAJ) jointly established, in April 2001, a Mobile Recycling Network (MRN) to enhance promotion of the voluntary collection of used mobile phones (main bodies, batteries and battery chargers). Apart from this, home appliance retailers and mobile telephone outlets also commit themselves to voluntary collecting and recycling used mobile telephones.

(1) Items subject to collection and recycling
Used mobile telephones, PHS handsets and other terminal devices (main bodies, batteries and battery chargers)

(2) Collection methods
Figure A3-3-1 shows the schematic flow of collecting and recycling used mobile telephones and PHS handsets through the MRN. With some 9,000 collection points on the premises of mobile phone outlets across the country, the network offers free services to take back used terminal devices regardless of the telecommunications service provider and regardless of manufacturer. The roles of consumers, mobile phone outlets and other suppliers, and recycling businesses are shown below.
- Consumers: Drop off used devices at mobile phone outlets free of charge
- Mobile phone outlets, etc.: Take back used devices from consumers and deliver them to recycling businesses
- Recycling businesses: Take back used devices from mobile phone outlets and recycle them

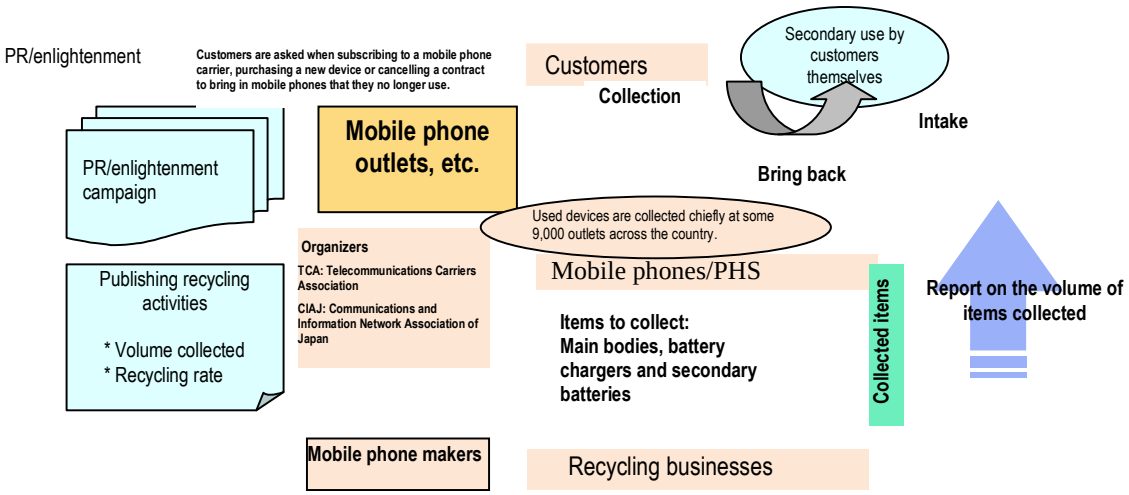


Figure A3-3-1: Schematic flow of collection and recycling through the Mobile Recycling Network[52]

(3) Actual collection and recycling
Table 3-3-4 shows the number and volume of used mobile telephones, PHS terminal devices (main bodies, batteries and battery chargers).

The number of main bodies collected has remained more or less steady ove surveyed, while the numbers of batteries and battery chargers have increased over the same period. The cumulative number of used main bodies collected over the ten years since the establishment of the MRN is 85.6 million.

[52] Mobile Recycle Network http://www.mobile-recycling .net/flow/index.html

In July 2011, the Ministry of Economy, Trade and Industry established a Council for Promotion of Recycling of Mobile Telephones to boost the recycling of used devices in collaboration with businesses and local governments participating in the Council and on the initiative of mobile telephone outlets, which serve as direct contacts with mobile phone subscribers. The care of personal information recorded in used mobile phones is another issue. It is necessary to consider new methods to collect and destroy devices so that any information contained is not subject to improper use.

Table A3-3-4: Actual collection of used mobile telephones and PHS handsets[53]

	Fiscal year										
		After establishment of the Mobile Recycle Network									
Item	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
No. of main bodies collected [thousands]	13,615	13,107	11,369	11,717	8,528	7,444	6,622	6,443	6,174	6,920	7,343
Weight [tons]	819	799	746	821	677	622	558	544	533	602	696
No. of batteries collected [thousands]	11,847	11,788	9,727	10,247	7,312	6,575	6,133	7,198	8,388	9,188	10,085
Weight [tons]	304	264	193	187	159	132	125	145	167	191	198
No. of battery chargers collected [thousands]	3,128	4,231	3,355	4,387	3,181	3,587	3,475	3,706	4,776	6,255	6,120
Weight [tons]	328	361	251	319	288	259	234	250	355	467	461

3-3-3 Bill for the Promotion of Recycling of Used Small Electronic Devices

The government has been exploring small home appliance recycling systems in order to increase momentum for recycling. In January 2012, the Central Environment Council submitted to the Environment Minister a report on recycling systems for small electric and electronic appliances. The Council suggested in its report that first there should be an examination of existing efforts by municipalities to recycle small electric and electronic appliances other than the model projects for the collection of used small home appliances and other model projects. The report also suggests establishing a system in which the parties concerned cooperate with one another to create collection and recycling methods that appropriately address the situations of the parties concerned, rather than instituting regulations that oblige them to recycle.

In line with the report, a bill targeting the recycling of small home appliances was submitted to, and approved by, the Cabinet on March 9, 2012. The bill aims to promote recycling of used electric and other devices by establishing a system to certify business establishments as being able to ensure appropriate recycling of devices and by undertaking special measures under the

[53] Data from the Mobile Recycle Network

Waste Disposal Act and other necessary measures to support the system. The system will address electric and mechanical devices that can be efficiently collected and transported and contain materials whose recycling is especially encouraged, except for devices covered by the Home Appliance Recycling Act.

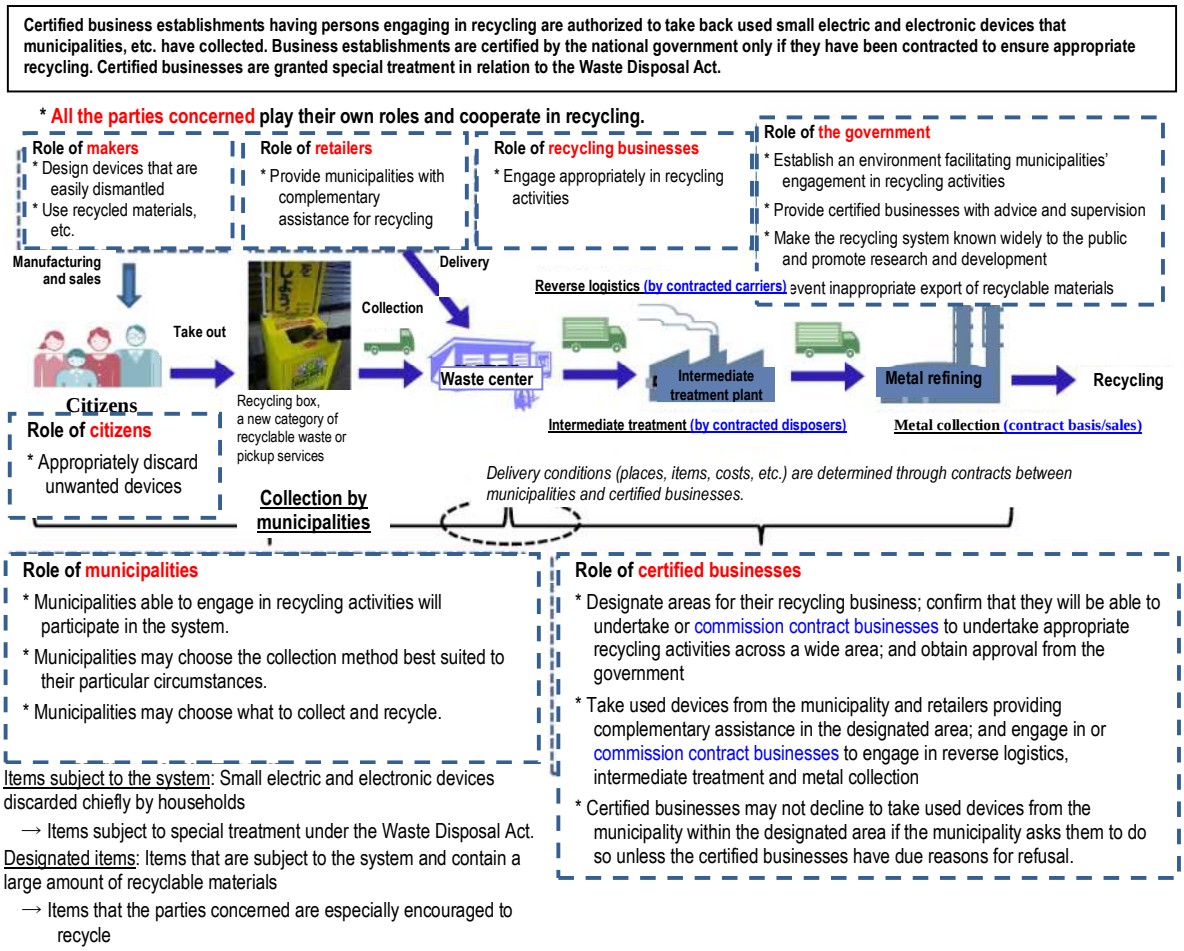


Figure A3-3-2: Schematic flow of recycling system for used small electric and electronic appliances[54]

[54] Ministry of the Environment

3-4 E-waste Treatment through the Participation of the Private Sector

In July 2011, UNEP/IETC held a WEEE/E-waste Management Workshop on Take-Back Systems in Osaka, Japan. During the three-day workshop, participants delivered presentations on private sector efforts to manage E-waste in Japan and around the Asia-Pacific region. Some of the themes that emerged in these presentations are the value of achieving economies of scale whether across a corporate group or through partnerships with other businesses in the same field, the importance of making drop-off points highly visible and easily accessible to consumers, and the need to recognize that approaches need to be tailor-made not only to the particular circumstances of each country within the region but also to local areas within a single country. These presentations are summarized below.

Title	Panasonic's Initiatives for Recycling
Speaker	Panasonic Corporation
Outline	Scheme under the Home Appliance Recycling Act and manufacturers' role
Company's commitment	・ Panasonic Corp. and Toshiba Corporation belong to Group A of the recycling scheme established by the Association for Electric Home Appliances in accordance with the Home Appliance Recycling Act. The two manufacturers jointly established a recycling management company, Ecology Net, that takes on the obligations of manufacturers in Group A concerning recycling. Ecology Net developed a system to administer and operate 36 recycling plants and 379 designated collection points. ・ Group A adopted a geographically dispersed recycling system utilizing existing contractors through the administration of Ecology Net.

Title	3R + Proper Waste Processing in ORIX's Leasing Business
Speaker	ORIX Eco Services Corporation
Outline	Collection and recycling of end-of-lease assets
Company's commitment	・ ORIX Eco Services Corp. has built a nationwide network for collecting and recycling end-of-lease products of the ORIX Group, promoting the 3Rs (reduce by re-leasing and reuse by selling or recycling) and appropriate waste disposal. The company also offers this network to its customers. ・ Among end-of-lease products for disposal, IT-related ones are transferred to and stored at a yard in Chiba Prefecture while others are transferred to collection points in each region. ・ IT-related products collected at the Chiba yard will be, after data inside is deleted, classified into those still usable, which will be sold as used products, and those which will be dismantled for recycling of individual materials, such as iron, plastics and wires. Recyclable materials will be used as resources or for chemical/thermal treatment. ・ Economies of scale achieved by the network make it possible to streamline the operation of various business systems, improve bargaining and resource sales strengths, and advertise the Group's efficiency and expertise in waste arrangements.

Title	The Ink Cartridge "Satogaeri" Project
Speaker	Canon Inc.
Outline	Joint project for collecting and recycling used ink cartridges supported by six printer manufacturers in Japan

<table>
<tr><td>Company's commitment</td><td>・ Six printer manufacturers in Japan launched the Ink Cartridge “Satogaeri” Project to promote the collection and recycling of used ink cartridges,.
・Consumers put used ink cartridges made by the six participating manufacturers in collection boxes situated at the premises of post offices, city halls, and other public places. The cartridges collected are delivered by postal parcel services to makers' sites to be classified by printer maker and then delivered to makers' plants for recycling.
・ Used ink cartridges are recycled as, for example, reused cartridges, recycled cartridges, pallets/containers for spare parts, reused IC chips, construction materials and advertisement materials.
・ Achievements of this collection and recycling endeavor are as follows.
<table>
<tr><td></td><td>FY20 8</td><td>FY2009</td><td>FY2010</td></tr>
<tr><td>No. of i ems collected</td><td>0.7million</td><td>1.3 million</td><td>1.6 million</td></tr>
<tr><td>Effects on CO_2 reductions [t-CO_2]</td><td>30</td><td>52</td><td>66</td></tr>
<tr><td>Effects on CO_2 reductions [n. of cedars]</td><td>2,200</td><td>3,700</td><td>4,700</td></tr>
</table>
・ The sites for classifying used ink cartridges support the employment of disabled people and donate 3 yen per collected cartridge to the United Nations Environment Programme (UNEP).
・ The project, supported by the Singaporean Ministry of Environment, started activities to recycle materials in August 2011 and is planning to expand its activities to major cities in Asia.</td></tr>
</table>

Title	Environmental Management & Recycling Business of DOWA
Speaker	Dowa Eco-System Co., Ltd.
Outline	・ Collection and recycling of small home appliances in Japan ・ China's recycling system for home appliances ・ Waste management in Southeast Asia
Company's commitment	・ Dowa-Eco System supports a model project to collect used home appliances implemented by the Ministry of Economy, Trade and Industry and the Ministry of the Environment. ・ In China, the company is committed to collecting resources from metal scraps, used home appliances, circuit boards and other products containing recyclable materials, such as gold, silver, copper, aluminium, iron and plastic. Both the wet and dry processes are applied in its recycling system. The company's recycling bases for home appliances are located in Suzhou, Tianjin, Jiangxi and Hangzhou. ・ In Southeast Asia, the company engages in recycling and waste management – collection, transport, incineration and landfill – in Thailand, Indonesia and Singapore. ・ There is a need to build a recycling system in Asia that is based on the recycling systems and appropriate waste treatment systems of individual countries in the region.

Title	Mitsui's Global Engagement in Recycling Business
Speaker	Mitsui & Co. (Thailand) Ltd.
Outline	・ Collection and recycling of small home appliances and mobile telephones in Japan ・ Operation of an international resource recycling system

	・A recycling program in Thailand
Company's commitment	・Recycling projects in Japan that Mitsui participates in include a recycling campaign for used mobile telephones carried out from November 21, 2009 to February 28, 2010 on the initiative of the Ministry of Economy, Trade and Industry. A total of approx. 570,000 used mobile phones were collected at more than 1,900 recycling points, from which 22kg of gold, 79kg of silver, 5,670kg~~Mt~~ of copper and 2kg of palladium were collected. ・The company also participated in recycling campaigns for used small appliances in Tokyo (Koto Ward and the city of Hachioji) arranged by the Ministry of Economy, Trade and Industry and the Ministry of the Environment. The campaigns set 122 collection boxes on the premises of community centers, supermarkets, train stations, etc. and also held 35 special events, resulting in the collection of approx. 10,000 used home appliances (such as mobile telephones, digital cameras, camcorders, portable music players, and mobile game machines). ・The company assists the international resource recycling system of Fuji Xerox Corporation. Under this system, photocopying machines and their parts discarded by nine marketing companies in the Asia-Pacific region are exported to Fuji Xerox Eco Manufacturing in Thailand, dismantled and classified into various items, and sent to partner businesses for recycling. ・The company promotes a recycling program in Thailand, targeting mobile telephones, wireless telephones and their accessories (84,000 items); printers, multi-functional printers and facsimile machines (8,400 items); and media players, portable game machines, VCD/DVD players and digital cameras (25,540 items).

References:

1. Jain, Amit. Perspective of Electronic Waste in South Asia: Current Status, Issues and Application of 3Rs, Promoting Reduce, Reuse, and Recycle in South Asia, *Synthesis Report of 3R South Asia Expert Workshop*, Kathmandu, Nepal, 30 August – 1 September 2006, Organized by ADB, IGES,UNEP
2. Jain, Amit and Rajneesh Sareen; E-waste assessment methodology and validation in India, *Journal of Material Cycles and Waste Management*
3. March 2006. Volume 8, Number 1, Springer-Verlag.
4. Prepared for Resource Recovery Fund Board, Nova Scotia, by PHA Consulting Associates, 31st March 2006. *Electronics Waste Recovery Study*, Annexure J, Table No J1
5. United Nations University, United Nations Environment Programme, 2006. *Compendium on National WEEE Legislation*
6. Sinha-Khetriwal, Deepali, Philipp Kraeuchi, Markus Schwaninger, A comparison of electronic waste recycling in Switzerland and in India, *Environmental Impact Assessment Review* 25 92005 492-504, ELSEVIER.
7. Cork Institute of Technology and Environmental Protection Agency, Ireland, 2001. *Waste from electrical and electronic equipment in Ireland: A status report.* EPA Topic Report, pp 68–69
8. E-waste in New Zealand, Taking Responsibility for End of Life Computers and TVs, CANZ, Ministry of Environment, July 2006.
9. Hai-Yong Kang, Julie M. Schoenung, Electronic waste recycling: A review of U.S. infrastructure and technology options, Resources Conservation & Recycling 45 (2005) 368-400, Elsevier
10. Implementation of the Waste Electrical and Electronic Equipment Directive in the EU, European Commission, Directorate General, Joint Research Centre, IPTS, 2006.
11. Information Technology (IT) and Telecommunication (Telecom) Waste in Canada – 2003, Final Draft, Updated, Environment Canada, 2003.
12. IRGSSA (2004) Management, handling and practices of E-waste recycling in Delhi. IRGSSA, India.
13. Jirang Cui, Eric Forssberg, Mechanical recycling of waste electric and electronic equipment: a review, Journal of Hazardous Materials B99 (2003) 243-263, Elsevier
14. Management of Waste Electrical & Electronic Equipment, ACRR 2003.
15. Mechanical Recycling of Consumer Electronic Scrap. Licentiate Thesis 2005:36, Luleå University of Technology, Luleå, Sweden, Cui.j, 2005.
16. QWERTY and Eco-Efficiency analysis on cellular phone treatment in Sweden. TU Delft, the Netherlands, 2004.
17. R. Hishier et al. Does WEEE recycling make sense from an environmental perspective? The environmental impacts of the Swiss take-back and recycling systems for waste electrical and electronic equipment (WEEE), Environmental Impact Assessment Review 25 92005) 525-539
18. Report on the Survey of the import and Environmentally Sound Management of Electronic Wastes in the Asia-Pacific Region, Asia-Pacific Regional Centre for Hazardous Waste Management Training and Technology Transfer, Basel Convention Regional Centre in China, December 2005.
19. Recycling Technology Products, An Overview of E-waste Policy Issues, Office of Technology Policy, Department of Commerce, USA, July 2006.
20. Synthesis report [ENV.G.1/FRA/2004/0081, Study No.16], Gather, process, and summarize information for the review of the waste electric and electronic equipment directive (2002/96/EC), European Commission DG Environment, Bio Intelligence Service

21. Toxics Link (2003) Scrapping the high-tech myth: computer waste in India. Toxics Link, India, p 13.
22. Transposition of the WEEE and Rohs Directives in Other EU Member States, Perchards, UK, November 2005.
23. WEEE Directive (EU, 2002a).
24. WEEE & Hazardous Waste, A report produced for DEFRA, March 2004, AEA Technology.
25. Waste from Electrical & electronic Equipment, Environmental Protection Agency, Ireland, May 2001.
26. Waste Electrical and Electronic Equipment (WEEE), Pilot Scheme Report, Producer Responsibility Unit Environment and Heritage Service, Government of U.K., 2005.
27. Waste from electrical and electronic equipment (WEEE) – quantities, dangerous substances and treatment methods, EEA Copenhagen, 2003.
28. Alam H; E-waste Management Practices in the Arab Region; R'09 World Congress; Davos, Switzerland, 2009.
29. Bernhard Steubing, Christian Ludwig, Heinz Boni, Uca Silva; E-waste Generation in Chile: Analysis of the Generation of Computer Waste using Material Flow Analysis.
30. Bernhard Steubing, E-waste Generation in Chile, situation analysis and estimation of actual and future computer waste quantities using material flow analysis, in Institute of Environmental Science and Technology / Technology / Technology and Society Lab. 2007, Federal Institute of Technology (EPFL) / Federal Institute for Material Testing and Research (EMPA): Lausanne / St. Gallen Switzerland.
31. Bernhard Steubing, Master's Thesis; E-waste generation Chile, Situation Analysis and an Estimation of Actual and Future Computer Waste Quantities Using Material Flow Analysis; School of Architecture Civil and Environmental Engineering (ENAC), Institute of Environmental Science and Technology (ISTE), Environmental Sciences and Engineering Section (SSIE), Swiss Federal Institute of Technology Lausanne (EPFL), July 2007.
32. Brazil Launching Inventory of E-waste Recycling in Anticipation of Waste Law, May 17, 2010, http//:www.eiatrack.org/r/2148
33. Consultation Paper: A National Waste Policy: Managing Waste to 2020; Department of the Environment, Water, Heritage and the Art, Australian Government, 2009
34. Daniel Ott, Gestion de Residuos Electronicos en Colombia; Diagnostico de Computadores y Telefonos Celulares. 2008, Federal Institute for Material Testing and Research (EMPA).
35. E-waste Management Initiative; Pilot activities by BCRC_Egypt; www.baselegypt.org
36. Gustavo Fernandez Protomastro, Estudio sobre los circuitos formales e informales de gestion de residuos de apartos Electricos y Electricos en Argentina. 2007, e-srap, Ecogestionar-ambiental del Sud SA: Buenos Aires.
37. Guillermo Roman, Diagnostico sobre la generacion de basura electronica. 2007, Instituto Politecnico Nacional Mexico, Centro Interdisciplinario de Investigaciones y Estudios sobre Medio Ambiente y Desarrollo Mexico D.F.
38. Global-E-waste-Market; http://www.electronics.ca/presscentre/articles/71/1/, December 2007.
39. Heinz Boeni; Uca Silva; Daniel Ott; E-waste Recycling in Latin America: Overview, Challenges and Potential; Global Symposium on Recycling, Waste Treatment and Clean Technology, October 12-15, 2008 Cancun, Mexico.
40. Jordan-E-waste threatens public health, environment February 2010; http//:www.menafn.com/qn_news_story_s.asp.
41. John MacGibban, Laurence Zwimpfer; E-waste in New Zealand, Taking Responsibility for End-of Life Computers and TVs; An investigation by the Computer Access NZ Trust (CANZ) with financial support from the Minister for the Environment's sustainable Management Fund which is administered by the Ministry of the Environment, July 2006.

42. Keith Repley, Reaching Critical Mass. Resource Recycling, 2008, January 2008.
43. Kahhat, RF, Williams ED; Adoption and disposition of new and used computers in Lima, Peru; Resources, Conservation and Recycling, 2010.
44. Laissaoui, Rochat D**; Morocco:E-waste country Assessment (2008)
45. Moroccan Cleaner Production Centre (CMPP), Casablanca, Morocco,
46. ** Swiss Institute for Materials Science & Technology (Empa), St. Gallen, Switzerland.
47. Msthias Schluep, David Rochat; E-waste Management in Western Africa; EMPA-Swiss Federal Laboratories for Materials Science and Technology, www.empa.ch; SBC-Geneva, May 2009.
48. Oscar Espinoza, et al., Diagnostico del Manejo de los Residuos Electronicos en el Peru. 2008, IPES Lima.
49. Osibanjo, A; Electronic Waste: A Major Challenge to Sustainable Development in Africa; R'09 World Congress; Davos, Switzerland, 2009.
50. Prof. Dr. Hani Moubasher, Director, Basel convention Regional Center for training and Technology Transfer for the Arab States-Cairo University-Egypt; Basel convention Regional Center for Training and Technology Transfer for the Arab States.
51. Prof. Oladele Osibanjo, Director, Basel Convention Coordinating Centre in Nigeria; E-waste Africa Project; Building local capacity to address the flow of E-wastes and electrical and electronic products destined for reuse in selected African countries and augment the sustainable management of resources through the recovery of materials in E-wastes.
52. Press release. Basel Conference addresses electronic wastes challenge; United Nations Environment Programme. Details available at http://ww.unep.org/ Documents.Multilingual/Default.asp? DocumentID=485 & ArticleID=5431 & 1=en, December, 2007..
53. Qatar drafts law on electronic waste, Habib Toumi, June 2010; http//:gulfnews.com/news/gulf/Qatar-drafts-law-on-electronic-waste-1.641398.
54. Sander, K, Schilling S; Transboundary shipment of second-hand Electric and Electronic Equipment/E-waste – Analysis and proposal for optimizing of material flows; OEKOPOL – Institute for Environmental Strategies, Hamburg, Germany; German Federal Environmental Agency, 2010.
55. Schluep, M; E-waste management in Africa – Rising up the political agenda; Recycling material; April, 2009.
56. Streicher-Porte, M; An introduction to 'Best of 2 Worlds project, 2009.
57. Statistic on the Management of Used and End-of-Life Electronics; www.epa.gov/epawaste/conserve/materials/ecycling/manage.htm, 2007.
58. The E-waste Training Workshop for Asia and the Pacific, Hanoi, Vietnam, August 2009; Basel Convention Regional Centre for South-East Asia, Jakarta, Indonesia.
59. Volume-I: E-waste Inventory Assessment Manual; United Nation Environmental Programme (UNEP), Division of Technology, Industries and Economics, International Environmental Technology Centre, Osaka/Shiga.
60. Volume-II: E-waste Inventory Assessment Manual; United Nation Environmental Programme (UNEP), Division of Technology, Industries and Economics, International Environmental Technology Centre, Osaka/Shiga.
61. Waste Electrical and Electronic Equipment; Regional Environmental Center; United Nations University Bonn, Germany, AEA Technology, Didcot, Regional Environmental Center for Central and Eastern Europe, Szentendre, Hungary, TU Delft-Design for Sustainability, Netherland, August 2007.
62. Manomaivibool et. al., Extended Producer Responsibility, Prospect of Extended Producer Responsibility: Waste Electrical and Electronic Equipment, Thai Context and Policy; Journal of Industrial Ecology, Volume 15, No. 2, 2011.

List of Websites:

1. www.usepa.gov/epaoswer/hazwaste/recycle/ecycling/index.htm
2. www.defra.gov.uk/environment/waste/index.htm
3. www.ec.gc.ca
4. www.environment.gov.au
5. http://eng.me.go.kr/docs/index.htm
6. www.doe.gov.my
7. http://ec.europa.eu/environment/waste/weee/index_en.htm
8. www.env.go.jp/en/
9. http://english.sepa.gov.cn
10. www.ewasteguide.info
11. www.basel.int
12. www.unep.org
13. www.step-initiative.org
14. www.cpcb.nic.in
15. www.ehsni.gov.uk
16. www.elretur.no
17. www.sens.ch

About the UNEP Division of Technology, Industry and Economics

Set up in 1975, three years after UNEP was created, the Division of Technology, Industry and Economics (DTIE) provides solutions to policy-makers and helps change the business environment by offering platforms for dialogue and co-operation, innovative policy options, pilot projects and creative market mechanisms.

DTIE plays a leading role in three of the six UNEP strategic priorities: **climate change, harmful substances and hazardous waste, resource efficiency**.

DTIE is also actively contributing to the **Green Economy Initiative** launched by UNEP in 2008. This aims to shift national and world economies on to a new path, in which jobs and output growth are driven by increased investment in green sectors, and by a switch of consumers' preferences towards environmentally friendly goods and services.

Moreover, DTIE is responsible for **fulfilling UNEP's mandate as an implementing agency for the Montreal Protocol Multilateral Fund** and plays an executing role for a number of UNEP projects financed by the Global Environment Facility.

The Office of the Director, located in Paris, coordinates activities through:

> **The International Environmental Technology Centre - IETC** (Osaka), which implements integrated waste, water and disaster management programmes, focusing in particular on Asia.
> **Sustainable Consumption and Production** (Paris), which promotes sustainable consumption and production patterns as a contribution to human development through global markets.
> **Chemicals** (Geneva), which catalyses global actions to bring about the sound management of chemicals and the improvement of chemical safety worldwide.
> **Energy** (Paris and Nairobi), which fosters energy and transport policies for sustainable development and encourages investment in renewable energy and energy efficiency.
> **OzonAction** (Paris), which supports the phase-out of ozone depleting substances in developing countries and countries with economies in transition to ensure implementation of the Montreal Protocol.
> **Economics and Trade** (Geneva), which helps countries to integrate environmental considerations into economic and trade policies, and works with the finance sector to incorporate sustainable development policies. This branch is also charged with producing green economy reports.

DTIE works with many partners (other UN agencies and programmes, international organizations, governments, non-governmental organizations, business, industry, the media and the public) to raise awareness, improve the transfer of knowledge and information, foster technological cooperation and implement international conventions and agreements.

For more information,
www.unep.org/dtie

For more information, contact:
UNEP DTIE
International Environmental Technology Centre (IETC)
2-110 Ryokuchi Koen, Tsurumi-ku
Osaka 538-0036, Japan
Tel: +81 6 6915 4581
Fax: +81 6 6915 0304
E-mail: ietc@unep.org
www.unep.org/ietc

www.unep.org
United Nations Environment Programme
P.O. Box 30552 Nairobi, Kenya
Tel: ++254-(0)20-762 1234
Fax: ++254-(0)20-762 3927
E-mail: uneppub@unep.org

UNEP

This manual aims to build the capacity of practitioners and decision makers to guide and assist them in understanding, planning, designing and implementing WEEE/e-waste take-back schemes for use by cities or other localized areas or for use at a nation-wide level.

This manual focuses on WEEE/e-waste collection, transport and the financial mechanisms for funding these efforts.
The manual describes various components of Policy Framework, including regulatory systems and collection and transport systems, along with financial aspects and case studies of schemes currently underway. It also contains detailed description on collection systems and transport modes and associated mechanisms, and explains the financing mechanisms through different models for financing e-waste take-back activities.

Finally it also provides take-back system case studies, from both developed and developing countries. The case studies should provide the practitioner examples of schemes currently being implemented to facilitate adoption, whether by a city or other localized area or by a country.

DTI/1673/JA