

WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT

The EU and India: sharing best practices

EU-INDIA ACTION PLAN SUPPORT FACILITY – ENVIRONMENT

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The EU and India: sharing best practices

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List of Abbreviations

APSF	Action Plan Support Facility – Environment Component. APSF is an EU-funded project to promote policy dialogue between the EU and India. It works in the areas of waste, chemicals, water, air and climate change.
B2C	Business to Consumer
BAN	Basel Action Network
BFR	Brominated flame retardants
CAGR	Compound Annual Growth Rate
CECED	Conseil Européen de la Construction d'Appareils Domestiques ; European trade and industry organisation representing the interests of manufacturers of household appliances.
CCC	Collective Compliance System; also referred to as WEEE compliance system (or scheme) or WEEE system. This system assumes producers' responsibilities towards EPR.
CFCs	Chlorofluorocarbons. CFCs are also commonly known as Freon and are widely used as refrigerants, propellants and solvents.
CRT	Cathode Ray Tube. A vacuum tube, used in television sets and computer monitors, which consists of one or more electron guns, possibly internal electrostatic deflection plates, and a phosphor target.
EC	European Commission.
EERA	European Electronics Recyclers Association; organisation representing the interest of the e-waste recycling companies in Europe.
ELC	European Lamp Companies Federation; European trade and industry organisation representing the interests of lamp manufacturers in Europe.
EPR	Extended Producers Responsibility; a political strategy to hold producers liable for the costs of managing their products at end of life.
ERP	European Recycling Platform; pan European competitive collective WEEE compliance system.
EU	European Union

INR	Indian Rupee
Kabadiwala	Informal waste collector in India
MoEF	Ministry of Environment and Forests
NGO	Nongovernmental Organisation; a legally constituted civil society organization created by natural or legal persons with no participation or representation of any government.
OECD	Organisation for Economic Co-operation and Development; an international economic organisation of 30 countries. Most OECD members are high-income economies with a high Human Development Index (HDI) and are regarded as developed countries.
PRO	Producers Responsibility Organisation; assumes the responsibilities of its members (producers) towards EPR.
OEM	Original Equipment Manufacturer
RoHS	Restriction of Hazardous Substances; restricts the use of six hazardous materials in the manufacture of various types of electronic and electrical equipment.
StEP	Solving the E-waste Problem; an international initiative, created to develop solutions to address issues associated with e-waste.
UNU	United Nations University; a United Nations agency to research into the pressing global problems of human survival, development and welfare.
WEEE	Waste of Electric and Electronic Equipment; e-waste, describes discarded, surplus, obsolete, or broken electrical or electronic devices.

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SUMMARY

On request of the Ministry of Environment and Forests (MoEF), the EU-India Action Plan Support Facility – Environment, Technical Assistance project has contributed to the exchange of knowledge on Waste Electrical and Electronic Equipment (WEEE or e-waste). The EU-India workshop conducted in New Delhi on 2 February 2010 resulted in a positive exchange of best practices. An expert team was then assigned to describe situations and practices, and performed an analysis of the relevant lessons learned.

E-waste management in India

E-waste collection, transportation, processing and recycling is dominated by the informal sector. The sector is well networked and unregulated. Most of the e-waste in India is recycled, but often all the materials and value that could be potentially recovered is not recovered. In addition, there are serious issues regarding leakages of toxins into the environment and workers' safety and health.

Collection of valuable discarded equipment is done by numerous kabadiwalas (waste collectors), who buy and sell it on to traders at a profit. Most specialised informal processing and recycling units are located in (urban) villages or unauthorised settlements and are engaged in dismantling the equipment, burning the PVC covering of wires, etc. They sell the parts to industry that processes the materials and, if possible, reassembles electronic goods from parts of dismantled equipment. Equipment or parts thereof that have too little value or need recovery technology not easily available are discarded at largely unknown locations, posing a risk to health and environment.

A certain quantity of e-waste is dumped from abroad through illegal trade or covered up as donations of second-hand equipment. There are various reports to substantiate dumping of e-waste into the country but there are uncertainties of quantification owing to the unauthorised nature of business operations. Permitted import and export exists, but is very limited.

The formal recycling sector is still small: there are 16 units licensed by the Central Pollution Control Board (CPCB), and most of them do only partial processing and recycling.

India's Hazardous Waste Rules (2008), which would cover e-waste, are not taking the dispersed nature of e-waste into account. Therefore, the MoEF and the CPCB have prepared and released a first draft of E-waste Rules for comments from stakeholders. Civil society had lobbied for this new law, made prior suggestions and had already commented extensively on the draft text.

Best practices from EU

The EU has about 10 years' experience of developing and implementing e-waste policy—the EU WEEE Directive. This directive prescribes principles and objectives for EU member states, which are allowed to create their own solutions taking local circumstances and national legal frameworks into account. The Polluter Pays Principle has been legally translated into Extended Producer Responsibility (EPR), which specifies that producers have to ensure that end-of-life equipment is recovered and recycled adequately.

This has led to diverse and sophisticated systems in the EU. India can adopt and adapt relevant parts of these systems. 'Compliance systems' run by independent associations that are funded by producers take on the financial and physical burden of e-waste management. They use the payment to finance separate schemes for historical waste and for new products, such as collection (by municipalities), recycling, etc. Such services are often provided by various parties such as municipalities, private service providers and associations.

The EU has come a long way in improving e-waste management with the installation of collection, recycling and financing systems in all 27 member states. However, while currently about one-third of all discarded equipment is properly recorded to be separately collected, treated and recycled, full documentation on the remaining two-thirds is still to be achieved. Particularly small equipment still tends to end up in the normal municipal waste. The evaluation of experience is prompting the EU to recast the WEEE Directive to ensure high performance for the full waste stream, establish ambitious collection targets adapted to the reality of each member state and reduce administrative burdens.

Possible actions for India

India is in the position to take advantage of its own comparative advantages and leapfrog through learning from international experiences. Based on basic principles of good e-waste management as evolved internationally, the following goals and possible actions could be relevant.

- Goal 1:** Producers collect and recycle discarded appliances as well as provide necessary funding (implementing EPR).
- Goal 2:** All producers accept responsibility for and contribute to e-waste management.
- Goal 3:** Tasks and duties for compliance are distributed effectively and clearly (creating compliance systems).
- Goal 4:** E-waste is collected and transported to authorised agencies/recyclers.
- Goal 5:** E-waste is processed and recycled adequately.
- Goal 6:** Relevant and correct information is made available to regulators and policy makers about compliance.
- Goal 7:** Sufficient funding is made available for collecting and recycling.
- Goal 8:** Awareness is created among citizens regarding the toxicity of e-waste and the hazards of improper e-waste disposal.

Instruments relevant for India

The principle of Extended Producer Responsibility (EPR) is increasingly being applied for management of e-waste across many countries, and its relative effectiveness and success has been demonstrated in EU countries. Instruments for implementation of EPR can be a mix of economic, regulatory and voluntary/informational.

The success of the e-waste policy should have measurable targets for environmental, economic and social objectives, such as for collection and recycling amounts, material recovery, employment effects, health benefits, etc. A phased approach that increases the product scope of equipment with the highest content of toxic materials to all equipment would be advisable, considering capacity constraints of both the government and the private sector.

While producers are responsible for e-waste management (EPR), consumers, retailers, state governments, municipalities and other parties (for example, post offices) should all play an appropriate role in collection, facilitation and creation of infrastructure to make e-waste management a success. This is especially the case for collection, often the bottleneck for successful e-waste management.

Compliance systems should be formed, and government can invite industry to suggest their preferred model. Collective systems are preferred from the regulatory point of view, although systems set up by one producer (assuming Individual Producer Responsibility (IPR)) may also be acceptable. Compliance systems will have to use the outsourcing model for various services; some of them could be based on public-private partnerships (PPP). Transparency is of utmost importance, and free riders should be punished and quickly incorporated into the system.

The crucial requirement for setting norms and standards for the compliance mechanisms will need to be developed quickly to provide a level playing field for all and to prevent a “race to the bottom”. Such crucial quality issues could include a collection quota across different product categories, and adherence to minimum standards for treatment as prescribed by regulators.

Consumer fees (visible or invisible) and/or deposit/refund schemes could be introduced to cover additional costs, but the Indian consumer mentality, enforceability and price elasticity should be taken into account.

Material bans, harmonised with global standards such as the EU Restriction of Hazardous Substances (RoHS) Directive, could be considered in India.

Introduction of minimum recyclable content standards is highly relevant for India, taking the nature of recycling into account (highly labour-intensive compared to the EU).

Other instruments such as landfill and incineration bans, material taxes, subsidies (for example, for pilot projects) and green procurement, could be options for consideration when determining a smart and effective mix of instruments for operationalising and implementing improved e-waste management. The EU experience also shows that varied implementation across different member states can create a high degree of complexity, even perceived as market barriers inside the EU by some stakeholders. India has the opportunity to learn from this experience, and ensure that the core requirements and principles of the WEEE regulatory system are implemented in a harmonised fashion from the very start.

1 INTRODUCTION

1.1 BACKGROUND

The Action Plan Support Facility (APSF) Environment, Technical Assistance project carries out events and expert analyses to promote policy dialogue between the EU and India in the areas of waste, chemicals, water, air and climate change. The Ministry of Environment and Forests (MoEF) has requested the APSF to contribute to exchange of knowledge on Waste Electrical and Electronic Equipment (hereafter referred to as e-waste), ship dismantling and the remediation of contaminated sites. For e-waste, an EU-India workshop was conducted in New Delhi on 2 February 2010, which had a positive result in terms of presentations from high-level experts, exchange of views and analyses of best practice. An expert team has conducted an analysis corresponding to questions originating from the MoEF and the Central Pollution Control Board (CPCB). This report represents the result of this expert analysis. It follows the common APSF project methodology, describing the situation in both India and the EU, subsequently comparing the issues and practices to identify the potential of sharing lessons learned and finally working out various options for

improving e-waste management in India that emerge from the EU experience



Growing e-waste is a global concern

The growth in global electrical and electronic equipment (EEE; hereafter also referred to as appliances) production and consumption has been exponential in the last two decades, fuelled by rapid changes in equipment features and capabilities, product obsolescence, decrease in prices and the growth in Internet use. This has created a large volume of

obsolete electrical and electronic devices, or e-waste. E-waste comprises waste from equipments such as, mainly, computers, mobile phones, television sets, photocopiers, DVD players, washing machines, refrigerators and other household consumer durables. E-waste is growing at almost three times the rate of municipal waste globally. It now makes up 5 per cent of all municipal solid waste worldwide. According to current estimates, the global e-waste market is forecast to reach 53 million tonnes by 2012 from 42 million tonnes in 2008 — a 6 per cent compound annual growth rate (CAGR). This rapid growth and increased globalised trade of this complex and toxic waste poses a serious challenge for its management and causes serious environmental concerns both in developed and developing countries.

The main problems related to inadequate management

E-waste is highly complex to handle and often contains highly toxic chemicals such as lead, cadmium, mercury, beryllium, Brominated Flame Retardants (BFRs), PVC and phosphorus compounds. These materials have serious human health concerns and require extreme care in its disposal at the downstream to avoid any adverse impacts. This warrants the need for an extensive collection network, recycling infrastructure, sound technology and a supporting regulatory framework for handling and disposal of toxic waste. Though many developed countries have developed stringent norms for recycling these products to avoid adverse impacts on environment and human health, the absence of facilities and norms in developing countries are posing serious challenges. Environmentally unsound recycling of e-waste in countries like China and India has raised concerns globally. While the domestic generation of this waste continues to pose serious challenges, in addition, increasing globalised illegal trade of this waste further aggravates the problem for India.

The Indian situation and its urgency for action

India, with a population of over 1 billion, is a growing economy and increasing appliances consumption is estimated to generate approximately 400,000 tonnes of waste annually (from computers, mobile phones and television sets only), which is expected to grow at a rate of 10-15 per cent per year. The processing of this waste is largely carried out in an informal backyard set-up, which is unregulated and does not follow the prescribed environmental norms for handling hazardous substances. The operations are mostly rudimentary in nature and cause extensive damage to both environment and human health. Dismantling and recycling is often inefficient, which results in loss of valuable and scarce materials.

The Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008, which apply to e-waste, deal primarily with industrial waste and lack elements to deal with the complexities of e-waste, and are recognised as inadequate. In 2007, the CPCB issued separate guidelines on e-waste management. However, these guidelines were voluntary and had limited impact. Stakeholders have been



active in voicing the need for a separate regulatory framework for e-waste. This would provide a level playing field to the industry and also encourage growth and improvement of the recycling infrastructure in the country.

E-waste management in the EU

Before the legislation, most discarded appliances ended up in the municipal waste stream. From a resource and environmental point of view, that situation was highly undesirable. Therefore, policies on e-waste have been initiated to

- prevent e-waste;
- increase the re-use, recycling and other forms of recovery of such wastes so as to reduce the final disposal of waste in landfills; and
- improve the environmental performance of all operators involved in the life-cycle of electrical and electronic equipment.

To achieve these goals, the Waste Electrical and Electronic Equipment (WEEE) Directive was implemented in 2003. This Directive was partly on pioneering European legislation on e-waste management and shifting responsibility to producers.

Despite the Directive, only about one-third of e-waste in the EU is reported as separately collected and appropriately treated. The efficiency of the legislation therefore clearly leaves room for improvement. The EU is presently recasting the directive especially to define more effective and compelling collection targets.

EU experience and its relevance to the emerging Indian scenario

The EU WEEE Directive and the legislation on the member state level are progressive, incorporating the environmental management drivers of due diligence and Polluter Pays, and have been applied to e-waste management by various governments.

The WEEE and RoHS Directives place the EU at the forefront of policy and legislative developments. Member countries have adopted different approaches to enforce the WEEE Directive with varying degrees of success and challenge. These experiences generate learnings that could be very useful in the development of regulation in different conditions. India, which is developing a legal framework, could greatly benefit from the options emerging from the EU experience, and should try to incorporate the principles and instruments suitable to the local situation.

1.2 OBJECTIVE AND METHODOLOGY

1.2.1 Objective

The main objective of this study is to provide insights and options to support the decision-making process in India on a future e-waste management system, using lessons learned from the European WEEE Directive and its implementation in EU member states.

1.2.2 Main questions

The most important questions that are answered in this document are:

- What are the instruments used in Europe supporting EPR and what would be relevant for India?
- How can India promote setting up compliance systems and how can the EU experience be used to define this?
- Who are the stakeholders in India and how could the experience from the EU be used to engage them in e-waste management?
- Which lessons learned and/or best practices in Europe can be used in the development of instruments relating to
 - logistics,
 - recycling and dismantling facilities,
 - funding and
 - reporting and information on waste streams and recycled quantities?

1.2.3 Sources of information

The knowledge generated for this study has the following main sources:

- Information and insights already available with the expert team attained through their extensive combined experience
- Analysis of deliverables already produced by the APSF Environment TA, including documents and presentations generated during the project
- The results and report of the 2 February 2010 workshop on e-waste management
- Study of other existing secondary sources, such as documents, legislative texts, etc.

Some enquiries with stakeholders were undertaken to fill the gaps.

1.2.4 Methodology

The following approach has been used:

- Examine the current e-waste management situation in India
- Map stakeholders in e-waste management in India and the EU
- List existing instruments used in Europe
- Distil preconditions of sound e-waste management from the EU experience
- Create understanding about the similarities and differences in the current situation in India and the EU
- Determine the relevance of EU policy instruments for India
- Determine the EPR instruments relevant for India
- Suggest options for India using the learnings from the EU

1.2.5 Limitations of the study

The document provides insights into practices, particularly the experience, in the EU and analyses the possible usefulness for continued development of e-waste policy in India. The document does not intend to formulate any policy itself or make choices for specific options, which the project considers the full responsibility of the competent authorities.

2 E-WASTE MANAGEMENT IN INDIA

Issues concerning e-waste in India were first highlighted in the year 2003. Subsequently, there have been assessments, surveys and reports published leading to intense and engaging discussions. Many of these reports and studies have been undertaken by civil society organisations and independent consultants. Extensive media reports, both national and international, have also helped in reaching out to larger audiences and kept the conversation ongoing. The Hazardous Wastes Rules and Guidelines, 2008 issued by the Government of India have been the basis of the existing legal framework. In recent years, the need for a specific policy and a law on e-waste has emerged, which is reflected in various sources.

2.1 MAIN SOURCES OF INFORMATION

Besides the important documents listed below, various multi-stakeholder meetings and interactions in the field by the authors have been major sources of information and knowledge.

- **Toxics Link, 2003, Scrapping the Hi-tech Myth:** This was the first report in India highlighting the issue of e-waste in the country; it brought forth the issue of improper recycling practices, especially in Delhi. The study mapped the areas in and around Delhi, which were engaged in hazardous dismantling and recycling processes. The report also documented the disposal patterns, trade networks and the illegal imports in the country.
- **A National Workshop in Electronic Waste Management held in New Delhi in 2004** indicated the magnitude of the e-waste problem in India and recommended carrying out a WEEE assessment study in the country. Under the ASEM programme of GTZ and the CPCB by an independent consulting firm, IRGSSA. The report was not officially published by the CPCB but the data emerging from this has been extensively used by most stakeholders, including the MoEF.
- **Indian e-waste guide:** This website was developed under the aegis of the SECO-funded Swiss e-waste programme and is supported and updated

by EMPA. The online guide is designed to serve as a knowledge base on e-waste, focusing on the present scenario in India. The guide also has information on various projects and researches undertaken on the issue. Some of the study reports of the project are available on the EMPA website.

- **GTZ-MAIT, 2007, E-Waste Assessment in India- A Quantitative Understanding of Generation, Disposal & Recycling of Electronic Waste in India.** This e-waste assessment study took into account waste generated from PC, mobiles phones and television and also analysed the quantity available for recycling.
- **ELCINA, 2009, Study on status and potential for e-waste management in India.** This report focused on identifying the technological gaps existing in the organised e-waste processing sector and also analysed the economic viability issues faced by the industry.
- **Ministry of Environment and Forests, 2008, The Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008.** The Hazardous Wastes Rules was first issued in 1989, but has been since revised and amended few times. These Central Government Rules govern management of hazardous waste, including e-waste.
- **CPCB, 2007, Guidelines for Environmentally Sound Management of E-waste.** In 2007, the Central Pollution Control Board of India issued a Guideline under the Hazardous Wastes Rules for e-waste management. The guidelines focus on EPR and suggest the need for restriction on hazardous substances, but implementation is voluntary.
- **E-waste: Implications, regulations, and management in India and current global best practices.** Experts on the issue have contributed to this book by TERI which focuses on various aspects of e-waste management.
- **Reports by Greenpeace.** This international organisation has been engaged in **compiling guidance and ranking reports** for some of the leading IT brands in the country. Their guide ranks leading mobile phone, game console, TV and PC manufacturers on their global policies and practices on eliminating harmful chemicals and on taking responsibility for their products once they are discarded by consumers. Companies are ranked based on information that is publicly available and on clarifications and communications with the companies. The guide is published at frequent intervals.
- **Reports by Toxics Link.** This Indian environmental NGO has been working on the issue of e-waste for over six years and has carried out assessments in a few cities as well as other reports to assess the e-waste situation. The organisation's website contains valuable reports and articles on e-waste and its current management practices. The reports on Mumbai, (**Mumbai: Choking on E-waste**) and Kolkata (**E-waste: Flooding the city of joy**) provided valuable information related to generation of waste as well as informal waste recycling in these cities.
- Some projects websites like **eWaste Guide** and **ieewaste** also provide useful information, especially on the informal sector.
- UNEP, in partnership with the **Maharashtra Pollution Control Board (MPCB)**, conducted a **rapid assessment** of the e-waste that is generated in the Mumbai-Pune region.
- A WHO-sponsored report on **Inventorization of e-waste in two cities in**

Andhra Pradesh and Karnataka (Hyderabad and Bangalore) has been published by the Environment Protection Training & Research Institute, Gachibowli, Hyderabad. This report assesses the waste generated in Hyderabad and Bangalore from computers, mobile phones and televisions.

- Performance Audit of Management of Waste in India by Comptroller and Auditor General of India. The report was released in September 2008, and concluded that the waste management hierarchy needs to be emphasized in our policies and summarized its observations on the current waste management situation in the country.

2.2 MAIN STAKEHOLDERS

The main stakeholders in e-waste generation and management are the manufacturers, distributors/importers, refurbishment centres, consumers, collectors, recyclers, policy makers and policy implementers are as described in Table 2.1.

Table 2.1 Stakeholders and their interests and influence in India

Stakeholders	Representatives	Interest	Degree of influence
Government: Environment sector Policy makers Enforcement	Ministry of Environment and Forests Central Pollution Control Board, State Pollution Control Board	Protect the environment and health of the population Set standards for environmental norms for processing e-waste and monitor compliance	High but limited in capacity High but limited in capacity High but limited capacity
Government: Other sectors IT Industry	Ministry of Information Technology Ministry of Industry and Commerce	Safeguard the interest of the IT industry in complying with the Rules; to minimise hazards generated from e-waste	Limited
Producers IT Household appliances Office appliances	Industry associations such as MAIT, CEAMA, TEMA, ELCINA Large producers	To comply with legal obligations in the country at minimum cost	High
Consumers Households Corporate Public	Ministry of Consumer Affairs, Food and Public Distribution	Safeguard consumer rights	Low
Recyclers: informal sector	Unorganised and hence not really represented well in this debate. Some civil societies representing their interest.	Maintain gainful employment Healthy work environment	Low
Recyclers: formal sector	Authorised recyclers, ERA (e-waste recyclers association)	Business interest and increasing scale of operation.	Low
Collectors	Individual scrap collectors (Kabadi wallahs)	Maintain gainful employment Healthy work circumstances	Low
Local government	State Pollution Control Boards Municipalities	Enforcement of the Rule in the state. Also minimise interstate dumping	Low
NGOs	Toxics Link GTZ-ASEM Greenpeace Chintan TERI	To protect environment and health. To safeguard consumer interests Protect livelihood for the informal sector	High

2.3 PRESENT PRACTICE AND SYSTEMS

2.3.1 Current volumes and disposal methods

The electronics and electrical industry has, in recent years, emerged as one of the fastest growing segments of Indian industry in terms of production, internal consumption and export. A decade ago, the electronics market was primarily city-centric, leaving the rural areas with the least access and purchasing power. In 1990, the Government of India adopted a policy of economic reforms and liberalisation, leading to the opening up of the economy, which resulted in significant growth in communication and information and communication technology (ICT) infrastructure. Although the penetration of India's market for consumer durables is substantially lower than that of developed countries, the size of India's market in absolute terms is larger than many high-income countries. The growth of emerging new markets, coupled with higher obsolescence rate and lifestyle choices, has resulted in accelerating consumption patterns and increased generation of e-waste.

One of the first reports on e-waste in India, 'Scrapping the Hi-tech Myth', was prepared by Toxics Link in 2003. This report highlighted the issues of increasing e-waste generation, dumping from developed nations and recycling practices in the informal sector. Subsequently the issue of e-waste was taken up by other organizations resulting in the generation of reports and assessment studies and deepening of engagement with the issue. In 2004, International Resources Group System South Asia (IRGSSA) carried out an assessment on the total e-waste generation in the country. Another waste estimation was carried out by GTZ-MAIT in 2007.

Gaps in assessments of e-waste

Assessments on e-waste have been conducted by various groups and organisations in India using different methodologies and assumptions. The two most widely used methodologies are the penetration method and the market supply method. The results obtained through these methods are likely to vary. Apart from methodology, the selection of products included in the survey also has significant bearing on the results. Agencies and organisations involved in assessments of e-waste have not followed uniform criteria for including products in their studies; hence, different kinds of data are projected through such studies. Most organisations have largely included IT products such as computers, mobile phones and television sets in such studies because these products have a very short life and have a rapid turnover. The sample size used for such studies has varied and are not representative of the population, leading to criticism. Most data generated in the country on e-waste can at best be considered estimates. There is hardly any data on total imports of e-waste, both legal and illegal, into the country. While carrying out assessments, few organisations have focused on waste generation from households, which are major users of domestic appliances. The need for the generation of credible data covering a wider range of products across sectors is critical and requires immediate attention.



The IRGSSA study was carried out in 2004 and assessed e-waste generated from computers, televisions, refrigerators and washing machines. The study also documented the processes for the processing of such waste in the informal sector. The report, though not officially published, has been quoted extensively. It was the first effort towards estimation of e-waste and the methodology used is based on market penetration. Only computers, television sets, refrigerators and washing machines were taken into account.

The main findings from the IRGSSA report were:

- A total of around 146,000 tonnes of e-waste is generated annually in India (estimation)
- Ten states contributed to 70 per cent of total generation, with Maharashtra and Tamil Nadu leading the list
- Mumbai, followed by Delhi and Bangalore, are the highest e-waste generating cities in the country

The GTZ MAIT study, which was carried out by IMRB, assessed e-waste generated from computers, mobiles and television. The report also tried to assess waste illegally imported in the country. The main findings from the report were:

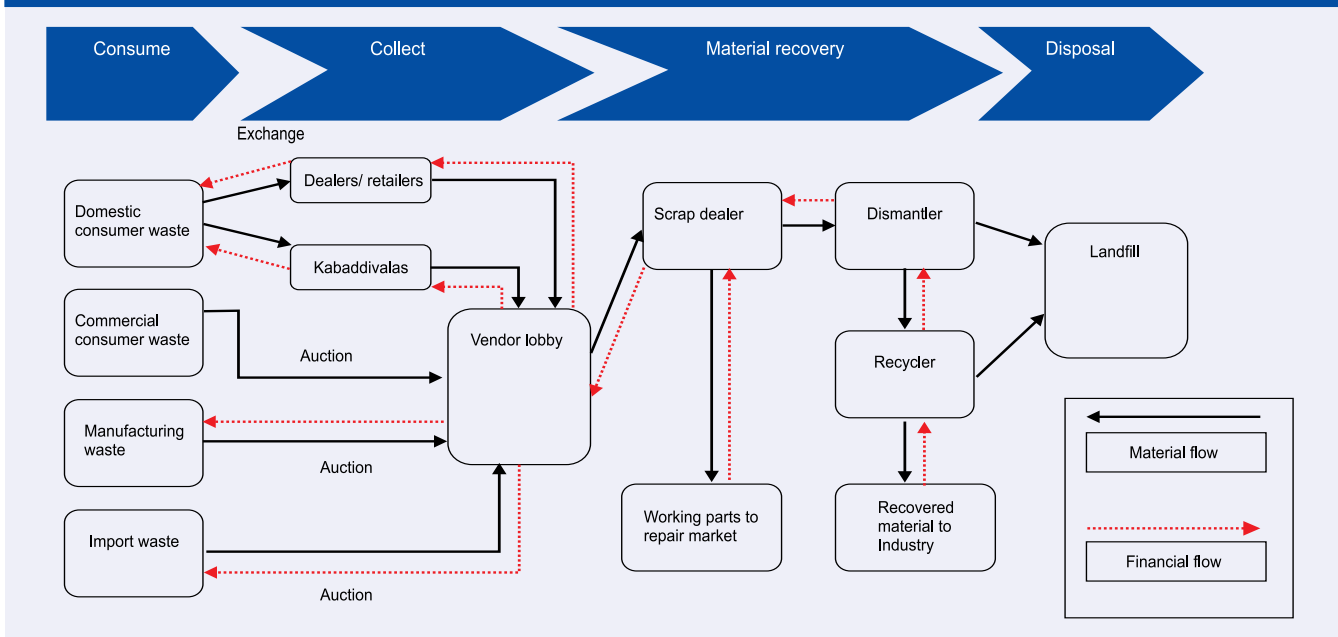
- Around 330,000 tonnes were generated in 2007 (estimation)
- Only computers, mobile phone and televisions were covered
- 50,000 tonnes per year are illegally imported
- 19,000 tonnes are recycled yearly in the formal sector
- Almost 95 per cent is recycled in the informal sector

The report suggests that the equipment discarded completely is small, as a large amounts get refurbished, re-used or relocated to smaller towns or villages. The formal sector ends up with a small percentage of this, but this scenario has been changing gradually in the past two years. There has been an increase in the waste flows moving to the formal recycling units as the number of formal recycling facilities has more than doubled since 2007.

Domestic e-waste disposal mechanisms

Most studies suggest that the largest generators of e-waste in India are businesses and the government, while individuals and households contribute a smaller percentage of the total waste generated. This is mainly because most assessments on e-waste have focused on wastes from computers, mobile phone and television sets and do not take into account household consumer durables which are larger in volume and weight. There is no documented study on the waste generation from domestic goods such as washing machines, refrigerators etc. The larger electronic appliances also have a relatively longer useful life in India compared to the developed nations, resulting in comparatively lower waste generation from this sector. In future, it will be important and useful to take into account waste generation from households and individuals, as this would constitute a significant percentage of total waste generation in the country and necessitate measures to deal



Figure 1 E-waste flows in India

with such waste. The present data on waste suggests that computers and mobile phones have the highest or fastest obsolescence rates and account for a large segment of the total waste generated. These wastes are mainly disposed of to informal waste dealers and traders.

As part of the study done by the IMRB on behalf of GTZ-MAIT in 2007, a sample survey was conducted among the end users of EEE, both households and businesses, to understand the disposal patterns. Some of the key findings are described below.

Business disposal mechanisms

- Ninety four per cent of the organisations do not have any policies on the disposal of IT products. This would effectively mean that they are free to dispose of their waste to unauthorised recyclers or traders.
- Eighty per cent of the replaced computers directly enter the e-waste stream either through scrap dealers or second hand markets and exchange or buy-back schemes.
- A large quantity still continues to be stored within the premises.
- In the government and PSUs, these are mainly auctioned off through tenders to informal scrap traders.
- A small percentage of waste from the government and businesses has started to flow to formal recyclers.

Promising existing take-back practices in India:

- Nokia, the largest mobile handset company in India, accepts mobile phones and accessories from consumers free of charge
- Wipro runs a take back-system for the computing system and charges the consumer for the logistics cost

- Dell has introduced a take-back system for consumers, and pay monetary incentive to consumers for returning the waste
- HCL, an Indian brand, also extends take-back facility to its consumers, online as well as through collection centres in major cities

Due to limited information, it is hard to comment on the success of above initiatives.

Individuals/Households

- A large number of computers, television sets and mobiles when no longer needed are passed on to family, friends or people in the neighbourhood for further use, thus increasing their total life and reducing waste generation.
- More than 25 per cent of the total electronic products from households or individuals are estimated to enter the e-waste market directly (through second hand or scrap markets or through exchanges).
- Some of these wastes comprising smaller products is sold or disposed of to local kabadiwalas (waste collectors).

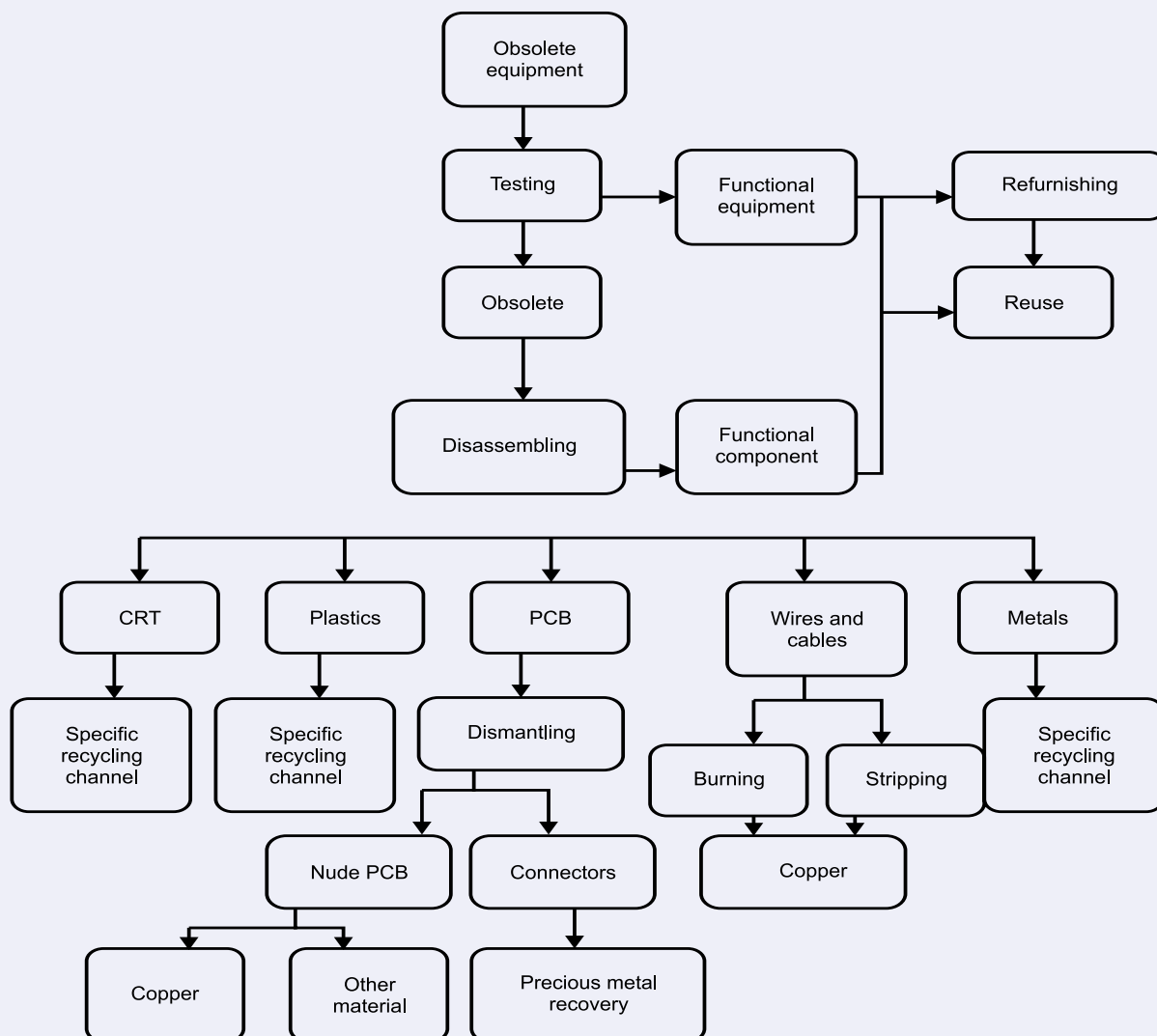
2.3.2 Waste flows: informal sector

The informal sector, though unorganised, is part of a very well-oiled machinery and well-defined hierarchy and structure, as elaborated in various reports by Toxics Link and GTZ- MAIT. It is interesting to view this structure and understand the waste flows. The waste collectors or kabadiwalas are the most important link in this waste flow and are responsible for the collection of waste from all consumers and manufacturers. There is another set of operators, waste traders with better financial capacity, who bid for larger volumes of waste being discarded by companies and organisation through auctions. The waste then flows down to scrap dealers, who at the first stage cannibalise the functional components, re-use them, also engage in refurbishing some of the computers and then shift the waste to the dismantlers. It is here that the waste is further separated as monitors, CPU and other parts and then broken down to individual components and materials. The waste then finally reaches the recycler by materials as glass, plastics, metal and circuit boards for material recovery. The recyclers in a particular cluster are generally engaged in a specific set of activities and operations. For other equipment like refrigerators, washing machines or air conditioners, the segregation is more material-based, and plastic and metal parts are separated and treated in specific streams. Some useful components such as power supplies or motors are taken out for further use if possible.

Since most electronic and electrical products have a value at the end of their useful life, the informal sector is able to pay the consumer to acquire this waste. The formal sector, because of its larger infrastructure and operational costs, finds it hard to compete with the informal sector.



Figure 2 E-waste flows in India (informal sector)



2.3.3 Financial flows

The financial flow in the informal e-waste sector is very well-organised. The huge network of collectors, traders and recyclers make financial gain through re-use, refurbishment and recycling. Reports suggest that each player in the trade value chain makes at least a 10 to 15 per cent profit. The low infrastructure set-up and operational costs enable the informal sector to make profit from select end-of-life equipment.

The economics of e-waste in India is also very different from that of developed countries. In contrast to most EU countries, where consumers pay a recycling fee, in India it is the waste collectors who pay consumers a positive price for their obsolete or end-of-life appliances, as can be seen in Table 2.2. The small collectors in turn sell their collections to traders who aggregate and sort different kinds of waste and then sell it to recyclers, who recover the metals. The reusable equipments and components are segregated and attract a higher price in the market. An ELCINA report estimates the total annual turnover in unorganised sector e-waste processing in 2007-08 at INR 430 million.

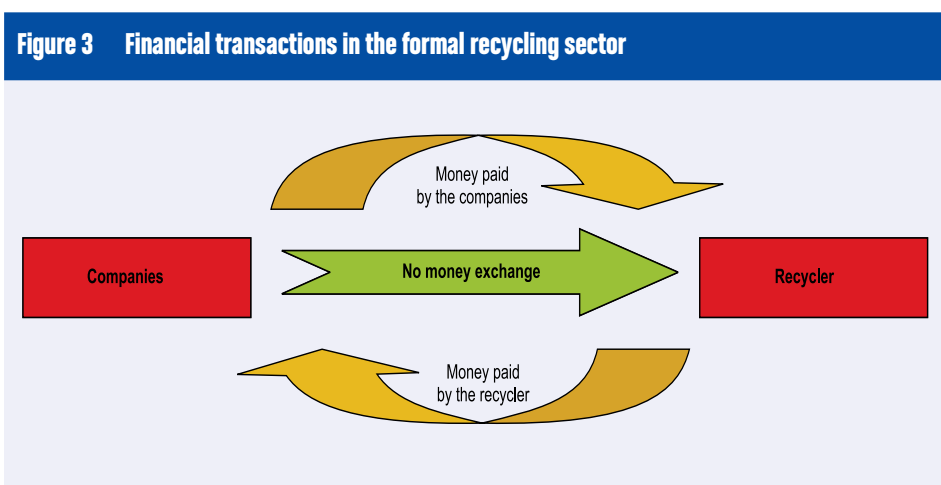
Table 2.2 Trading price for some components in the unorganised sector		
Component	Value in INR	
	If it can be re-used	If it cannot be re-used
PCB	100-500 per piece	12-20 per kg
IC	50-250 per piece	200 per kg
Colour CRTs	700-1200 per piece	100-200 per piece
Floppy Drives	100-150 per piece	12 per piece
Inkjet Printer	300-3000 per piece	100-300 per piece
Keyboards	100-200 per piece	15 per piece
Capacitors	2-10 per piece	90-20 per kg
CPU (Pentium IV)	2000-3500 per piece	150-175 per piece

Source: GTZ survey 2006

In case of large companies and PSUs, the flow is a little different. As the quantity is large and auctioned through tenders to highest bidders, only waste dealers with large financial capacities can participate in this trade. At times the dealers jointly bid for the scrap and share the total waste among themselves for further processing.

Most dismantling and recycling units are owned by individuals who make good profit, but the workers employed in these facilities earn less than minimum wages (as mandated under the Minimum Wages Act).

The formal sector economics, though, works very differently as illustrated in Figure 3. The financial arrangements vary for different users as well as for recyclers. Most users sell their waste to these authorised e-waste recyclers and hence get paid for the waste; this mainly involves an auction process where recyclers bid for waste. Another mechanism is where the users dispose of their waste without any cost, the recycling cost and the profit from material recovery being the recyclers' responsibility. A small segment of users has also emerged recently who are willing to pay for recycling services, including data destruction.



Since there is no separate legal framework on e-waste, there are no mandated financial mechanisms for collection or recycling of this waste. Most transactions are ad hoc and can vary from case to case, as explained above.

Financial mechanisms in e-waste management

The country has witnessed the implementation and enforcement of some important waste management regulations in the past decade, incorporating environmental principles of precautionary approach, where the polluter pays. The bio medical waste rules clearly stipulate that operators should be charged. Accordingly, it is recommended that the cost to be charged from the healthcare units shall be worked out in consultation with the State Pollution Control Board/Pollution Control Committee and the local medical association. In management of hazardous waste also the generator has to pay a fee for treatment and disposal of waste.

The Batteries Rule, 2001 states that it is the responsibility of the dealer to:

- ensure that the used batteries are collected back as per the Schedule against new batteries sold and
- give appropriate discount for every used battery returned by the consumer

These regulations on waste management have clearly stipulated and introduced the concept of a fee for treatment and disposal of waste which has found acceptance among sections of society.

2.3.4 Imports

Developing countries including India have been a destination for various types of hazardous wastes from the developed world, and e-waste is no exception. Traders in developed countries find it financially more profitable to dump such waste in developing countries than to bear the more elevated cost of recycling in their own countries. Lack of stringent environmental regulations, weak enforcement mechanisms, cheap raw materials, an ill-informed population and the unorganised nature of the sector all contribute to the growing imports of e-waste in India.

Accurate data on such imports is not available, largely owing to the informal nature of the trade. A study carried out by GTZ-MAIT in 2003, 'E-Waste Assessment in India', suggests that around 50,000 tonnes of e-waste is imported by India annually. Reports of field visits by some civil society organisations to the dismantling and recycling units have also suggested that large quantities of the e-waste being recycled in the informal sector in India are not domestic. This waste is imported via the sea routes and India having a vast coastline provides the requisite induction points for such waste.

Basel Action Network studies have also pointed out that illegal e-waste follows very circuitous routes; it originates from developed or OECD countries, but is channelled through many intermediaries before landing up at one of the Indian ports.

The import of e-waste is legally restricted in India and the importers are required to seek clearance from the MoEF. To date, only one such permission has been granted to a formal recycler in the country. According to the Toxics Link report "Time is Running Out", the informal sector continues importing e-waste; most of these goods are brought in under different nomenclature, like mixed metal scrap or as goods meant for charity. The operation of Special Economic Zones also provides an opportunity to waste traders to import waste and part of it finds its way into the informal domestic waste market in the country.

2.3.5 Present processing practices

INFORMAL SECTOR

The processing of e-waste in India is largely carried out in an informal backyard setup, which is unregulated and does not follow the prescribed environmental norms for handling hazardous substances. It is estimated that around 25,000 people work in the informal e-waste sector (people working exclusively on e-waste, not taking into account the material recycling population) and it is on account of their efforts that most of the waste is recycled and prevented from being dumped in landfills. Some of the processes and activities practised by the informal sector have serious environment and social impacts (use of toxic chemicals, poor working conditions, child labour, etc.). The recycling chain of e-waste consists of two sets of processes, one being dismantling and segregation of components and the other being material recovery.

The first stage of waste processing involves cannibalisation of serviceable parts and refurbishment of components and products.

- All unserviceable components and products are then shifted to dismantlers.
- Individual products such as monitors, keyboards or CPUs are then dismantled and broken down to individual components using bare hands and basic tools such as hammers and screwdrivers.
- Blowtorches and heaters are used to loosen solders to remove the components attached to the circuit boards.
- Printed circuit boards are placed directly above the heaters, allowing the solder to melt and drop.
- The process of dismantling is carried out in unventilated rooms without any semblance of housekeeping or concern for occupational health.
- These segregated components are sorted by their material composition and then shifted for material recovery.
- Most material recovery processes consist of acid bath for recovery of copper from circuit boards.
- Flame retardant-laden plastic is processed through crushers and extruders to create new materials and products.
- Cathode ray tubes are handled by bare hands and broken with hammers in an open environment to separate glass, which is used in small furnaces.
- Copper extraction by burning PVC is also prevalent.

These result in the release of some toxic materials into the environment through emissions or effluents, which poses a serious health concern to workers and communities.

Until a few years back, most of these informal recycling centres were in major metro cities such as Delhi, Mumbai, Bangalore, Chennai and Kolkata, but they are quickly spreading as many such centres grow in smaller towns. Some of the more toxic



and dangerous practices and activities are increasingly moving to the smaller towns far away from large cities and are tucked away deeply to avoid regulators' scrutiny. The abundant supply of raw materials and profitability has, in the past few years, attracted many new players in this field, formal as well as informal, with the numbers increasing manifold. An entire new economic sector has evolved around trading, repairing and recovering materials from redundant electronic and electrical devices.

Some of the processes used in the informal sector to recover material are described in the boxes below.

COPPER EXTRACTION FROM WIRES

Two kinds of processes are followed:

1. Manual drawing of wires for copper

In this process, the edge of a wire is cut with a knife and then the copper is extracted from the PVC with pliers (as shown below). The copper is sold to copper smelters and the PVC is used for plastic graining.

Figure 4 Extraction of copper from wires through manual drawing



2. Extraction of copper by burning cables

The general practice for material recovery from a wire is simply to put it in fire either in closed or open drums. At some places, such burning takes place in front of the storehouses, in broad daylight. At a few places, the use of drums was observed for recovery of copper from PVC wire. The top of a big-sized drum is cut and a thin layer of iron net fixed in the middle. Sometimes the drum is fixed to the ground with mud, and a small opening is made to light the material and to remove the sludge. This layer of iron acts as a filter and allows only ash to go down. Both processes, open or closed drum burning, are extremely harmful for the environmental and pose a serious occupational health hazard.

Figure 5 Extraction of copper by burning the cables



PRINTED CIRCUIT BOARD RECYCLING

The recycling of circuit boards drawn from monitors, CPUs, printers, etc. involves a number of steps. First, gold-plated pins and the integrated circuits (IC) that can be re-used are manually removed. The core of each motherboard has a flat, laminated gold plate. These laminated parts are cut down and sold to goldsmiths for recovery of gold. The next step is heating on a stove to remove resalable components like ICs, condensers etc. Low heat is maintained to loosen only the chemical bond between solder and plastic. Then, resalable chips, condensers, etc, are plucked out from these plates. Then the pre-heated circuit boards are taken by other dealers for recovery of solder (which consists of lead and mercury). The method of solder recovery is very rudimentary. A burning kerosene gas kit is placed in a small water tub to store molten lead. The circuit boards are simply put on top of the stove; tongs are used on all sides. The lead extracted through heat application goes into a water tub - it floats due to low density. After de-soldering, the circuit boards are roasted or put in an acid bath and copper is recovered from them. Some places, such as burning takes place in front of the storehouses, in broad daylight. At a few places, the use of drums was observed for recovery of copper from PVC wire. The top of a big-sized drum is cut and a thin layer of iron net fixed in the middle. Sometimes the drum is fixed to the ground with mud, and a small opening is made to light the material and to remove the sludge. This layer of iron acts as a filter and allows only ash to go down. Both processes, open or closed drum burning, are extremely harmful for the environmental and pose a serious occupational health hazard.

The copper retrieval is done through two processes:

1. Open burning

After separating all remaining components, boards are sent to be burned in open pits to extract the thin layer of copper foils laminated in the circuit board. After charring, it is distilled through a simple froth-floating process. The ash content is washed out and copper, with some carbon impurity, goes to another recycling unit. Defective IC chips and condensers, which do not have a resale market, are also burned in small enclosures with chimneys, to extract metallic parts.

Figure 6 Open burning of PWB for copper extraction



2. Acid Bath

In this process, first, the collected motherboards are dipped in the acid for few hours. Then, the acid, along with the motherboards, is heated in a big container to formulate crystal copper sulphate and then, in the rest of the acid, iron chips are added and sludge-containing copper is extracted, which is further put into an ion exchange process so that copper may be recovered from it.

Figure 7 Acid Bath Process**PLASTIC RECYCLING**

Plastics scrap from computers is manually fed into the shredder/grinder and is shredded into flakes or grounded or cut to reduce the size of plastic parts. After the grinding process, the plastic is segregated into FR plastic and non-FR plastic by use of salt water in sink-float tanks. The FR contaminated-plastic pieces settle at the bottom of the container of saline water and are collected separately. These grinded plastic pieces are then dried and packed and are bought by pellet-making units.

At the pellet-making units, situated mainly in the same areas as grinding units, these grinded plastic pieces are first washed to remove dirt. The plastic granules are then dried in a dryer or in the open, after which they are treated in a mixture machine. The friction and the heat thus generated make the material soft and pliable. After preliminary processing, the recycling of plastics involves extrusion to make new products. It is at this stage that virgin plastic is added to these recycled granules. Polymer processing extrusion is the most important step. In this, the input material is fed in through a shaft and is melted by passing it through a heated chamber.

As illustrated in the boxes, environmental and health concerns of informal sector processes are related to processes for recovery of materials that are being widely applied by recyclers in the informal sector. Some of the concerns identified are:

- Open burning of PVC cables releases toxins into the environment
- Burning of PCB releases a cocktail of toxic gases into the environment
- Use of mercury (a known neurotoxin) for recovery of gold releases mercury into the environment
- Concentrated acids are thrown on to open land flowing into surface water
- Heating of circuit boards for loosening of integrated circuits and other components release lead, mercury, chromium etc into the environment
- Residues are thrown into open land and dumpsites allowing leaching of toxins into land and surface water
- The workers do not have any protective clothing and inhale all poisonous gases released during the processes
- Many workers are women and children who work with bare hands and

constantly use caustic soda and acids for washing and cleaning of boards, and stripping causing pain to their hands and other body parts

- Workers inhale fumes of acids during these processes
- In the absence of work benches they continue to sit in odd positions for long hours
- Poor housekeeping of chemicals and reagents cause accidents and physical harm to workers

FORMAL SECTOR

The formal recycling sector in India is in a nascent stage. All **formal recycling facilities**, currently 14, are registered with the regulators and have the requisite permission to engage in set of processes for e-waste disposal and management. These have been granted permission under the Hazardous Wastes (Management, Handling and Transboundary) Rules 2008 and need to comply with the provisions listed in it. As per the CPCB list, a total annual recycling capacity in this segment is around 62,000 MT.

Many of these facilities have been established in recent years and a few more are in the process of being set up. These facilities have different capacities and are mostly engaged in pre-processing. The processes implemented in these facilities include dismantling and segregation, shredding of PCBs and magnetic separation. These fractions are subsequently transferred to specialised recyclers who are experts in recycling materials such as plastics or glass. Most formal recyclers are currently exporting their shredded consignments of PCBs for recovery of precious material to foreign facilities like Umicore, Xtrata and TESSAM.

There is a steady increase in the volume of material flows to foreign facilities and the Indian suppliers have developed well-established networks for export of this waste. Some of these recyclers the current business operation of exporting of waste is beneficial to both the exporters and the facilities receiving this waste. The participation of serious entrepreneurs and sound investment practices are growing, and financial institutions are willing lend for setting up facilities. These entrepreneurs are also keen on policy formulation, which would provide needed clarity for scaling up business ventures.

The formal recycling companies are faced with one of the biggest challenges of material supply as they are in direct competition with the informal sector who usually outbid the formal operators due to their very low operating costs. It is estimated that of the total waste available for processing almost 95 per cent is handled by the informal sector and only 5 per cent by the formal sector. To overcome the shortage of material supply, one recycling company has sought and obtained approval from the government to import waste.



2.4 PROBLEMS AND ISSUES

2.4.1 Environmental hazards

When e-waste is disposed of or recycled without any control, there are negative impacts on the environment and human health. Presently, the informal processing of e-waste in India is not monitored for compliance with environmental regulations, and as a result, the crude methods used to reclaim materials may cause pollution, creating serious problems to environmental ecology and human health. E-waste contains more than 1,000 different substances, many of which are toxic, such as lead, mercury, arsenic, cadmium, selenium, hexavalent chromium and BFR. The recovery process being rudimentary has limited efficiency of material recovery, resulting in loss of significant amount of precious metals and disposal of residues of toxic materials into water bodies and soil, which creates serious issues of water and soil pollution. There are also issues of cross-contamination of materials as plastics containing BFR is recycled and mixed with virgin materials and other plastics for manufacture of new plastic products.

The other important aspect is the wide dispersal of toxic chemicals and elements into the environment due to the highly dispersed recycling units across the country, resulting in problems such as

- emissions of dioxins and heavy metals like lead, cadmium, mercury in air;
- release of BFR;
- indiscriminate dumping of spent fluids/chemicals (contaminating soils);
- groundwater contamination (through leachate); and
- land filling of non-recyclables.

2.4.2 Occupational health issues

In the informal sector, there is little regulation in place to safeguard the health of those who handle e-waste. Workers are poorly protected in an environment where e-waste from PC monitors, PCBs, CDs, motherboards, cables, toner cartridges are burned in the open and release lead and mercury toxins into the air. Many workers are also engaged for long hours, sitting cramped in unventilated rooms with inadequate lighting. Most people involved in informal recycling are the urban poor with low literacy levels, and hence with very little awareness regarding the hazards of e-waste and the recycling processes. There is a sizeable number of women and children who are engaged in these activities who might be more vulnerable to the hazards of this waste. Many of these workers complain of eye irritation, breathing problems and constant headaches, but in absence of any epidemiological studies, significant data is available. The workers also do not have access to any counselling or regular health check-ups. Some critical occupational health issues are

- inadequate working space;
- poor lighting and ventilation, straining the eyes and breathing polluted air;
- no work bench hence sitting cramped on the ground for long hours;
- inhaling toxic fumes;

- exposure of body parts to fire, acid and other chemicals; and
- unavailability of clean drinking water and toilets.

2.4.3 Shortage of materials and its recovery

The existing formal recycling companies, though, have reflected growth in the last few years, but complaints of non-availability of raw materials and their inability to source adequate materials keep coming. They face direct and stiff competition from the informal sector, especially in sourcing raw materials from the market; the informal sector enjoys the distinct advantage of a wide collection network. These recycling companies are also in various stages of setting up and consolidating their operations, hence the associated teething issues. These are further complicated in the absence of any larger policy and regulatory framework, which provides a level playing field for the operators. The informal traders and recyclers are at a further advantage due to their minimal infrastructure and low operational costs. The low awareness among the consumers regarding the environmental concerns of improper recycling of discarded equipment means that they give no thought to proper disposal.

2.5 INITIATIVES TO MANAGE E-WASTE

2.5.1 Current policy framework

Currently e-waste in India is broadly covered under the Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008. The Ministry of Environment and Forests, Government of India, is the nodal agency at the Central level. The Environment (Protection) Act 1986 is an umbrella act that covers hazardous and other wastes and provides broad guidelines to address these.

The Hazardous Wastes Rules provide for the control of generation, collection, treatment, transport, import, storage and disposal of wastes listed in the schedule annexed to these rules. The ones applicable to e-waste are mentioned in Table 2.3. Schedule 2 of the Hazardous Waste Management and Handling Rules lists waste substances which should be considered hazardous unless their concentration is less than the limit indicated in the said Schedule. Some of these may be applicable to appliances.

Table 2.3 Processes generating hazardous waste relevant to e-waste under the Hazardous Wastes Rules, 2008	
Processes	Hazardous waste
Electronic Industry	Process residues and wastes Spent etching chemicals and solvents
Secondary production of copper	Spent electrolytic solutions Sludges and filter cakes Flue gas dust and other particulates
Secondary production of lead	Lead bearing residues Lead ash/particulate from flue gas

E-waste is also covered under Schedule III which governs export/import. Clauses A1180 in Part A (import requiring PIC) and B1110 in Part B (PIC not required) lists certain e-waste components.

E-waste is also covered under Schedule IV, listing hazardous wastes that require registration for recycling/ reprocessing.

The Rules are implemented through the State Pollution Control Boards and Pollution Control Committees in the States and Union Territories. The rules were introduced in 1989 and have been since then amended and revised in 2000, 2003, 2008 and 2009.

Besides the Hazardous Wastes Rules, the following rules cover other kinds of waste.

- Municipal Solid Wastes (Management and Handling) Rules, 2000
- Bio Medical Waste (Management & Handling) Rules, 1998
- The Batteries (Management and Handling) Rules, 2001

The existing Hazardous Waste Rules were drawn up primarily to address issues of waste generated in industrial processes. A consensus has emerged that this is inadequate to cover issues related to specificity of e-waste. The government after prolonged deliberation issued a guideline for safe management of e-waste. This guideline is a voluntary instrument and is largely attempted to address the technological gap. While the guideline was a step forward, it did not provide the requisite drivers for changing the ground situation. The voluntary nature of the guideline was a limiting factor as it failed to provide a level playing field to the brands and trigger significant actions.

Some of the stakeholders, led mainly by civil society groups and industry associations, suggested that a mandatory regulation specific to e-waste would be the most desirable way forward. There is a strong case for separate rules for e-waste due to the distinct features in the flow of e-waste and its hazardous waste requiring mandatory controls.

The Hazardous Wastes Rules address the needs for hazardous wastes which are in-process wastes originating from a defined source. E-waste generation by consumers and businesses is widely dispersed. Thus the flow of e-waste needs to be regulated by clearly specified responsibilities and liabilities of each stakeholder: producer, consumer, waste collector, dismantler and recycler.

2.5.2 The Union Government's new e-waste rules

The Ministry of Environment and Forests took up the e-waste issue in 2004 and has recently engaged with various stakeholders to receive inputs and perspectives on the issue. The government, until a few years back, was of the opinion that the current Hazardous Wastes Rules with certain amendments would be adequate to cover aspects of e-waste. However, due to pressure from civil society groups and public opinion, the Central Pollution Control Board issued a guideline for safe management of e-waste. Later, the inadequacy of both the Hazardous Waste Rules and the voluntary nature of the guidelines has been acknowledged by all stakeholders,

including the MoEF. The ministry has drafted the E-waste (Management and Handling) Rules, 2010 that incorporates some of the best practices and experiences from across the globe.

As part of the regulation framing process, the draft rules are open for receiving comments and suggestions for a period of 60 days. Civil society organisations and industry associations have been organising consultation meetings in various parts of the country.

2.5.3 Initiative from civil society to lobby for e-waste legislation

Civil society organisations in India have been voicing the need for a separate regulation on e-waste, and have lobbied for an appropriate regulation for management of e-waste in India. These groups were able to create a unique common platform for all stakeholders to come together and create a common ground on the e-waste issue.

Environmental groups along with the industry association and GTZ were able to communicate with the industry and seek their support for commencing work on a regulatory framework for e-waste. This led to many rounds of meetings and consultations with various stakeholders. The first meeting in this series was organised in Bangalore in April 2008, where civil society group and industry representatives discussed the issue and decided to draft rules on e-waste. There was a series of meetings held in a few major cities in the country to seek inputs and opinions from various stakeholders including the producers and recyclers.

A core group comprising of members from Greenpeace, MAIT, GTZ and Toxics Link then took up the task of developing a framework for the regulation. It was a very transparent and consultative process involving all stakeholders across cities and took almost a year to finalise the text. The final text was handed over to the MoEF for their consideration in 2009.

2.6 MATERIALS AND POSSIBLE PRIORITIES

E-waste is a hugely complex waste stream, mainly due to the large variety of equipment included in this flow. Different levels of hazard content in equipments and the variable recycling potential present a challenge. It might be very difficult to include all kinds of equipment in a single regulatory framework, hence the need to identify parameters and rate these products.

In the case of e-waste, two of the most critical parameters could be the hazard and the recyclability value of these products. The term recyclability here is being used to denote the value of recyclable materials and not the percentage of recyclability, as tube lights have been placed in the category of low recyclability



since the value of materials recovered post recycling is likely to be very small and low in value, whereas the recycling value of materials from a computer is expected to be high and hence placed in the category of high recyclability.

An effort is being made to rate these products on these two parameters and to use the results for prioritising the urgency for safe disposal of these products. However, it is not being suggested that only a few products be taken up for safe management and disposal, but only setting the priority for inclusion in the list. This methodology provides for results in safe management of toxic products and gradual cover of all products.

2.7 MAIN CHALLENGES FOR POLICY AND ENFORCEMENT

2.7.1 Lack of capacity for enforcement

India is known to have some of the finest laws across sectors and issues; however, implementation has been the biggest challenge. Besides lack of funds and capacity in government for enforcement, this drawback also stems from low awareness on issues, literacy levels, poverty, highly bureaucratic structures and attitudinal issues. The Right To Information Act is a move towards bringing in more transparency and accountability to the system and improving governance. Environmental regulations also suffer from the malaise of low compliance due to many compounding reasons such as lack of capacity and resources of the regulators and awareness among stakeholders. There is no allocation of a separate budget to cover costs of implementation in the regulatory framework, hence there are serious bottlenecks in implementation. The issue of technology and capacity of the regulators and the monitoring agency also is an important factor to be considered in the regulatory process. Both the Central Pollution Control Board and the State Pollution Control Boards have limited capacity in terms of technical expertise and human resources, as observed in the Performance Audit of Management of Waste in India by the Comptroller Auditor General (CAG), in 2008. The need to build their capacity and place additional resources at their disposal will be of critical importance for improving compliance levels and ensuring better implementation of the regulation. The need for building transparency in systems and bringing in technology to improve compliance will also be important.

2.7.2 Business interests and lobbies

In India, the producer market is divided between branded and non-branded participants. Most branded producers are part of product specific industry associations like MAIT (IT), CEAMA (consumer electronics), TEMA (telecom) or of larger industry associations like FICCI and ASSOCHAM. The branded producer lobby exercises a great influence on government institutions and their accountability is also larger.

The unbranded market, which is close to 50 per cent, is mainly constituted of independent players and has limited influence on the policy-making processes. But

they do pose a tough competition to the branded market because of the low pricing points. They may also pose a big challenge in the emerging e-waste management system, as they could emerge as free riders.

2.7.3 Concerns of loss of employment

The emergence of formal e-waste recycling units and an equally emphatic demand for a separate regulation on the issue are being perceived as some of the biggest threats to the informal sector. The fear of the sector being labelled as unauthorized and the workers losing their livelihoods is one of the biggest concerns of the informal sector.

Any legal instrument will need to deal with this apprehension and suggest components in the framework, which uses their strengths and skills and helps in integration and cooperation among the formal and informal sector so as to maximize the benefits to all sections of society. The experience of the informal sector workers and their vast and well-oiled networks can be very effectively utilised for collection and dismantling of products and should be brought on board in any regulatory framework being contemplated.

It may not only be appropriate to provide right drivers for inclusion of the informal sector; it is also important to send out the right signals to them assuring the informal sector of the protection of their interests.

2.7.4 Measurement of flows and information management

On the national or state level, the government currently has no mechanism or information management system to determine the number or volume of equipment put into the market. There have been, though, some attempts by individual industry association such as MAIT to capture such information for computers and peripherals in their annual reports. Lack of data for other equipment has been a serious bottleneck in assessing the total quantity of e-waste generated in the country.

Currently e-waste is mostly dealt with by the informal sector. In the absence of any information management system for the informal sector, the e-waste flows go unreported. There is no data available on the quantity collected, re-used, refurbished and recycled in the informal sector. There is a critical requirement to develop an information management system to track e-waste flows along the value chain for its sound management.

2.7.5 Extended Producer Responsibility in India

Though Extended Producer Responsibility (EPR) has been used widely in various countries, especially in the European countries, in India it is yet to explore its full potential. The only environmental legislation that has components of EPR is the Batteries (Management and Handling) Rules, 2001. But its implementation is not yet considered successful. The rule assigns the responsibility of ensuring that the used

batteries are collected back to the manufacturer (including importer, assembler and refurbisher). It also makes it mandatory for the manufacturers to set up centres for collection of used batteries from consumers or dealers. They are also responsible for ensuring safe transportation, creating public awareness and making sure that the used batteries are sent to the registered recyclers.

Until recently in India, milk and soft drinks were sold in returnable, refillable bottles where producers took back the empty containers. This is an example of producer responsibility extending beyond the sale point. (Though soft drinks are still sold in glass bottles, plastic containers are fast replacing them on the shelf.)

Another instance of EPR proposed in the Indian legislation concerns plastics. The report submitted by the Committee on Plastic Waste Disposal formed under the guidance of Ranganath Misra contained elements of EPR. The Committee, constituted by the MoEF in 2001, recommended a buy-back policy in the Recycled Plastic Manufacture and Usage Rules, 1999. Under this, the plastic industry was to be made responsible for retrieving empty packaging material and have proper disposal system. The committee also proposed establishment of collection centres with 90 per cent recycling targets for polyethylene terephthalate (PET) bottles. The recommendations are yet to be implemented.

2.8 KEY OPPORTUNITIES

2.8.1 Livelihood Opportunities

The formalisation of the informal sector into a transparent recycling system is crucial for a better control on environmental and human health impacts. At the same time, it bears the advantage to benefit from their extensive reach and protect the related employment.

There have been some attempts towards integrating the existing informal sector in the emerging scenario. Organisations like EMPA and GTZ have developed alternative business models in guiding the association towards authorisation. These business models promote a city-wide collection system feeding the manual dismantling facility and a strategy towards best available technology facilities to yield

higher revenue from printed circuit boards. By replacing the traditional wet chemical leaching process for the recovery of gold with the export to integrated smelters and refineries, safer practices and a higher revenue per unit of e-waste collected are generated. There have been a few examples of informal recyclers coming together and they formed association or companies such as 4R and E ward.



2.8.2 Economic opportunities

E-waste is a rich source of metals such as gold, silver and copper, which can be recovered and brought back into the production cycle. This particular characteristic has made

e-waste recycling a viable and lucrative business. There is significant economic potential in the efficient recovery of valuable materials in e-waste. The e-waste industry in India can provide income-generating opportunities for both individuals and enterprises, as waste is sold and traded among collectors, processors, second-hand dealers and consumers.

2.9 STRENGTHS AND WEAKNESSES OF THE CURRENT SYSTEM

Main strengths of the current system:

- The total amount of historical e-waste in India is still low; hence it will be simpler to deal with this aspect.
- Most computers in use are with the governmental or corporate sector which makes it easier to control generated e-waste.
- Experiences from informal collection systems exist and could partly be applied to e-waste collection.
- There is a recycling industry, which could absorb the plastic and ferrous metals and aluminium fractions.
- Availability of human resource leads to more mechanised processes and reduce cost.
- Ability of informal sector to recycle and extract value from most e-waste prevents landfilling of such waste.

Main weaknesses of the current system:

- There is no specific policy or legislation for e-waste management.
- There is no special infrastructure available for the formal collection and recycling of e-waste.
- The problem of imported computer junk seems to be serious.
- The informal activities associated with e-waste might lead to the exposure of individuals to hazardous substances and local pollution of the environment.
- Improper recycling and disposal of e-waste lead to an increase of pollutants in environment.
- There is a general lack of awareness among consumers and collectors of the potential hazards of e-waste to human health and the environment.
- There are weak regulatory and monitoring mechanisms in the country.
- Disproportionate sharing of profits among the informal recycling community.



2.10 PROJECTS AND ACTIVITIES

2.10.1 Projects on e-waste in India

Indo-German Swiss e-waste Initiative

The Swiss Federal Institute for Material Science and technology (EMPA), implementing agency of the Swiss State Secretariat for Economic Affairs (SECO), and GTZ-ASEM independently carried out activities related to e-waste and hazardous waste at Bangalore. During 2005, these organisations, along with the Ministry of Environment and Forest (MoEF) formally decided to work together on e-waste management. This resulted in the formation of the joint Indo-German-Swiss e-waste initiative with the implementation period from January 2006 to December 2008. The project was extended to December 2009, and it ended with the implementation of activities such as desk studies, training, establishing a clean e-waste channel, association building activities in Delhi and a health study to assess the impact of e-waste recycling on the health of informal sector workers.

UNEP Project

UNEP's Division of Technology, Industry, and Economics (DTIE) undertook a number of activities to support cleaner production and sustainable production and consumption, environmentally sound technologies, waste management and related issues. As part of UNEP's global initiative on e-waste, Mumbai was chosen for an in-depth assessment of the nature and size of the e-waste problem. A number of activities were undertaken under this project:

- Rapid Assessment of e-waste in the Mumbai-Pune Region
- Informal sector networking and training
- Support in formulation of national WEEE legislation
- Awareness campaign

IEe Waste Project

The Indo European e-Waste Initiative for Improved Technology and Skills for Indian e-Waste Management (IEe) project was co-financed by the EU and GTZ and was carried out by GTZ-ASEM and MAIT, Adelphi Research GmbH (Germany) and AREC Austria Recycling, between 2006 and 2008. The main project objectives were:

- Reduce environmental degradation by providing improved technologies and skills for e-waste management and recycling in India
- Extend income generation opportunities of (informal) e-waste recyclers through improved e-waste management
- Pilot cooperation model between the formal and the informal sector in Delhi to create safe workplaces and a stable income
- Improve environmental, health and living conditions of the predominantly unskilled and semi-skilled workers and the local population of surrounding areas

Under this project, national assessment of e-waste was carried out. The project also worked towards forming associations in the informal sector in Delhi.

2.10.2 Forthcoming Initiatives

SWITCH-Asia Project

The project, sponsored by the European Commission, will seek to institutionalise a collection system and channel e-waste for recycling using environmentally sound technologies involving SMEs in the informal sector. The project will be implemented by GTZ, Aldelphi Research, MAIT and Toxics Link in four cities, Delhi, Bangalore, Pune and Kolkata with the objective of reducing the pollution due to recycling of e-waste in the unorganised sector. This four-year project begins in 2010.

Tamil Nadu Policy on e-waste

The Ministry of Information Technology, Tamil Nadu has been working on an e-waste policy for the state. The e-waste policy is expected to be released in 2010.

2.10.3 Forthcoming reports

E-waste Assessment study in Kolkata

The Indian Chambers of Commerce, Kolkata in partnership with West Bengal Pollution Control Board and GTZ-ASEM initiated an e-waste Inventorization Study in Kolkata Metropolitan Region for the estimation of e-waste quantities being generated in the region and for projecting the growth of generation quantities over the next ten years. This study is currently in progress.

E-waste study in Mumbai

The National Environmental Engineering Research Institute (NEERI), appointed by the state of Maharashtra in 2009 to study and suggest measures for management of e-waste in Mumbai, will submit its report by April 2011.

3 ANALYSIS OF SYSTEMS AND BEST PRACTICES

In this chapter, best practices are described and evaluated for their potential merit in India. While the details on e-waste policy and management are in Annex 1, the most important instruments related to Extended Producer Responsibility (EPR), which is the core of EU e-waste policy, are described in detail in Annex 2. After that, the situations in the EU and India are compared and the preconditions of good e-waste management as relevant for India are described.

3.1 EXTENDED PRODUCER RESPONSIBILITY (EPR)

3.1.1 Fundamentals of EPR as applied in the EU

In summary, EPR is an application of the Polluter Pays principle. The concept places the responsibility for a product's end-of-life environmental impact on the original producer and seller of that product. A crucial element of EPR is to make producers and retailers responsible for the take-back of discarded equipment (physical responsibility) and oblige them to cover the costs (financial responsibility).



In the application of EPR under sector policy such as e-waste, the government is responsible for enacting legislation to set specific collection targets and recycling rates, define categories, and prescribe data collection and reporting to monitor compliance.

To implement EPR, there are regulatory instruments, economic instruments and voluntary/informational instruments. These are described in detail in Annex 2.

3.2 THE SITUATION IN INDIA AND THE EU COMPARED

In order to qualify the relevance of lessons learned and best practices of e-waste management in Europe, the differences between the Indian and European situation should be identified.

The main differences can be summarised as stated in Table 3.1.

Table 3.1 Comparison between the situations in EU and India		
	India	European Union
System/practice	<p>No regulated system or practice, but strong traditional system, mostly run by the informal sector.</p> <p>The system is operated on the economic principles of value of recoverable materials.</p> <p>The system is mostly manual and low-tech, pays for itself, but it has unacceptable problems for the environment and worker's health</p>	<p>A new system was created as previously appliances were generally not recycled, but ended up in the municipal waste.</p> <p>Presently there are regulated systems and processes from collection to recycling. EPR is operationalised, and producers pay costs using consumer visible fees.</p> <p>The system is expensive due to high collection, transport, and capital investments in recycling machinery.</p>
Collection	<p>Multiple collection streams are handled by the informal sector. Take back by producers is limited to some IT equipment, and a few formal collection centres of recyclers, which are only functional in a few larger cities.</p>	<p>Discarded appliances should be offered to designated retailers, locations and/or collected by municipal collectors organised and paid by (collective) compliance system(s). The collection of appliances is driven by law.</p> <p>Much e-waste is still ending up in the municipal waste, and some is channeled to developing countries illegally.</p>
Recycling	<p>Mainly handled by the informal sector. Adherence to safety standards and environmental regulations is low.</p> <p>Authorised e-waste recyclers should follow norms laid out under the Hazardous Waste (Management, Handling and Transboundary movement) Rules, 2008.</p>	<p>Highly automated processing on a large scale using prescribed targets of reducing the environmental impact and allow re-use of raw materials.</p> <p>E-waste policy in place focusing on reducing load on landfills and promoting recovery of materials.</p> <p>Main objective is an environmentally sound way of recycling.</p>
Funding	<p>The informal sector is self-funded through profit made from refurbishment and material recovering during dismantling/recycling.</p> <p>The formal sector relies on supplies of a limited range of appliances that it can recycle/refurbish with profit</p> <p>The consumers are paid for e-waste in most instances.</p>	<p>Collection, recycling and information campaigns are funded by producers and/or visible fees according to the EPR principle.</p>
Reporting	<p>Reporting and generation of information is absent in the informal sector</p> <p>Formal recyclers should report based on the Hazardous Waste (Management, Handling and Transboundary movement) Rules, 2008, and licences issued by the CPCB.</p>	<p>Producers have to report on new appliances put on the market, as well as on discarded appliances collected and recycled.</p> <p>The detail of information required varies by EU member state.</p>

3.3 RELEVANT INSTRUMENTS FROM THE EU

A description of the EU policy and instruments and its lessons learned can be sourced from Annex 1. The sections below highlight the instruments that India can consider, taking the EU experience into account.

3.3.1 Compliance systems

For waste from households, most producers in the EU are part of a Producer Responsibility Organisation (PRO). A PRO basically assumes all responsibilities of its members. One or more PROs use a collective compliance system for collection and recycling, funding, reporting on results, creating awareness and recruiting participants.

The main relevant features of compliance systems in Europe are listed below.

- Collective compliance systems are legal entities and are formed as foundations, joint stock companies or limited liability companies.
- The number of collective compliances varies widely per member state, from one to more than 40 systems.
- More than one compliance system does not necessarily mean competition, as systems may cover different products, and opinions vary widely about the balance of pros and cons of multiple systems.
- Some collective compliance systems are formed by the trade and industry associations, others by groups of producers depending on situational and practical considerations.
- The collective compliance system is financed by contributions from producers.
- Collective compliance systems generally outsource transport, recycling and treatment operations to specialised operators.

Individual compliance systems use reverse logistics to collect their appliances when discarded.

3.3.2 Collection

In the EU, various kinds of models have been implemented by member states for the collection of e-waste. Many countries have organised drop-off facilities run by the municipalities and promote return of equipment through retailers or other commercial entities. Best practices that may contribute to successful collection in India include

- using existing infrastructure for the collection of household e-waste, by including municipalities and its collection systems;
- obligations for retailers to take back old appliances when selling similar new ones;
- the use of large distribution network of retailers providing a large platform for e-waste take back;
- organising drop-off locations at retailers and other commercial entities;
- raising the level of awareness among end-users to increase consumers participation in the system;
- collecting larger appliances used for replacement, such as cooling and freezing appliances, washing machines and dishwashers as part of the reverse logistics while delivering the new appliance; and

- creating a network of collection centres as dense as economically feasible, making disposing convenient to the end user.

3.3.3 Funding

The financing mechanism in the EU covers each aspect of e-waste management, such as collection, transportation and treatment costs of WEEE, but also operating the system and creating awareness. Key elements are listed below.

- In the context of EPR, producers are responsible for financing e-waste management.
- Some systems use an advanced disposal fee, which can be either visible or invisible, which is collected by the retailer when a new product is purchased by the consumer.
- Other systems levy a periodic charge on producers to contribute to the actual costs incurred to operate the system.
- The regulation mandates that the visible fee can only be charged for historical waste.
- A hybrid system (now being considered in the EU) can be used for financing both historical as well as current products.
- The practice in some EU member states (for example, the Netherlands) shows that amassing large funds from visible fees cannot be justified, and the government is taking measures to monitor and control the funding.



3.3.4 Recycling

The experiences of the EU member states on recycling practices vary from 'cutting edge' in most member states to quite basic in others. Recycling practices are as follows:

- Due to safety regulations and high labour costs most of the processes are highly mechanised (particles are separated and shredded automatically), while for some types of appliances, manual pre-treatment is required
- Appliances are processed on a large scale
- Appliances are processed in a limited variety of flows (roughly five flows in most systems), defined by the way of required processing, such as cooling and freezing appliances, discharge lamps and television sets
- Recyclers generally have to qualify through competitive bidding on a national or international tender (EU procurement regulations)
- Some collective compliance systems appoint a single recycler for the recycling of a particular category of e-waste because of economics of scale. Others appoint multiple recyclers, to reduce dependency on a single supplier.
- Most contracts are concluded for a short term period (one or two years); thus recyclers tend to compete on price, which may discourage recyclers to invest in long term investment such as research and development of new technologies

3.3.5 Reporting

Reporting and information management is key to measure the degree of success of e-waste management system. The relevant EU practices are listed below:

- On a national level, producers have to report on the quantities and categories of appliances put on the market, collected, recycled and recovered
- EU member states are required to keep a register of producers; in some member states these registers are maintained by private parties, in others by a governmental body
- The frequency of the reports and the contents of the reports, as well as the frequency of reporting varies by member state
- Reporting systems require all producers to be registered with a compliance scheme (individual or collective) and is hence effective in identifying free riders

3.4 LESSONS LEARNED FROM IMPLEMENTATION OF EU WEEE DIRECTIVE

In the first few years of the directive, a number of technical, legal and administrative difficulties became apparent. It became obvious that the directive's expectations in protecting the environment and health could not be achieved at current collection and recycling rates. Therefore a proposition was made to update and simplify the WEEE Directive. The main challenges that need to be addressed include the following.

Present collection target inadequate

The current target of collecting 4 kg/capita per year is not related to the volumes of appliances put on the market; a more adequate target is needed. Therefore, a variable collection target is proposed in function of the amount of appliances put on the market to reflect the disparities in member states' appliances /e-waste markets. The new target is set at 65 per cent of the average weight of products placed on the market in the two preceding years.



Not all appliances collected through formal channels

A large share of e-waste is not being handled according to the requirements of the directive, as a significant amount of illegal shipments of polluting e-waste finds its way to countries outside the EU. Therefore, EPR will be expanded to financing the cost of collection facilities of appliances from private households in order to ensure producers' access to waste. Also, minimum monitoring requirements are proposed for the shipping of e-waste and it is proposed to strengthen member states' inspection and monitoring. Additional inspections and monitoring rules requirements are set.

Scope and definitions EU WEEE directive not defined clearly enough

The scope and definitions of the EU WEEE Directive gave opportunity for multiple interpretations, leading to debate. Therefore scope and definitions will be clarified.

High administrative burden

As producers have to register in each member state separately and registration and reporting requirements differ by member state, the administrative burden has to be reduced.

The EU is working to harmonise registration and reporting obligations. By making the registers inter-operational, producers would need to register in only one member state for all their activities in the EU. Overall cost savings from harmonised registration and reporting is estimated to be about €66 million per year.

Pressure on recycling targets is discouraging re-use

Currently, the re-use of whole appliances is excluded from the existing recycling target. This discourages the re-use of appliances and provides fewer environmental benefits. In Europe, about 5 per cent of collected e-waste is suitable for re-use as a whole. Therefore, the re-use of whole appliances will be included in the existing re-use/recycling target.

Designating a party responsible for creating awareness

For good collection results, it is important that the public is aware of how and where they can dispose of discarded appliances. The WEEE directive requires awareness-raising but leaves it to the member state to decide who must take on that role, government and/or producer. In that case, both parties will tend to shift responsibilities to each other. It is therefore important to make only one party responsible. Also, SMART (specific, measurable, appropriate, realistic, time-bound) targets must be set to be achieved with communication to create awareness.

Learnings from the EU WEEE Directive can be summarised as:

Positive

- SMART (specific, measurable, appropriate, realistic, time-bound) indicators and clear objectives are making it possible to evaluate the success of policy
- Implementing the e-waste management system is based on pollution prevention, and the effective re-use of materials and Polluter Pays Principles are generally accepted
- Progressive and innovative approaches are effectively introduced
- Defined mechanisms and assigned responsibilities are established and working
- A consultative process with stakeholders led to acceptance of policy and regulations
- Clarity on strategy timelines for achieving objectives and targets
- Evaluating efficacy and incorporating amendments are to be built in and are leading to improvements

Negative

- Weight-based targets irrespective of type of end-of-life equipment are not appropriate if they do not have a relation with the appliances put on the market
- The directive is not distinctive in specifying and assigning product-based targets for collection and recycling
- High levels of consumer awareness are hard to achieve through compliance systems (they have no incentive to do that)
- Poor budgeting of e-waste management and not adjusting the fee timely led to overfunding in some cases
- There is too little incentive for consumers to bring smaller products to collection points
- Material leakages from the current system are still taking place

The learning out of this is that for India, targets could be made product- and scope-specific. India would need to prioritise in pushing the agenda of EPR, and in evaluating the performance of the regulations based on clear benchmarks that can be used in making corrections as it proceeds.

Re-use of equipment is under-utilised in the EU since high wages and high disposable consumer income are not conducive to input of manual labour required in disassembling. However, the EU does this on a limited scale at municipal recycling sites (for example, Belgium). In India, there is a larger potential to boost the re-use of items, based upon the number of products which are discarded in a working or repairable state. Local community groups can help organise the collection and subsequent testing provided that the collection mechanism does not contaminate or damage collected items.

3.5 FACTORS FOR SUCCESSFUL E-WASTE MANAGEMENT IN INDIA

To achieve successful e-waste management, it is important to meet certain conditions as applicable in India.

Extended Producer Responsibility applied

- Legislation and enforcement have to encourage producers to accept responsibilities and help producers to achieve targets
- Collection and recycling targets have to be stated SMART (specific, measurable, appropriate, realistic, time-bound)
- Producers have to (be able to) provide reliable information on e-waste collected and recycled
- Monitoring responsibilities must take a minimal effort with regard to administration and enforcement
- EPR must be affordable; costs have to be proportionate to its purpose

Proportionate contribution to e-waste management

- Government has to monitor fair and proportionate contribution of producers
- Monitoring and enforcement must be manageable and require least effort from the government
- Producers have to (be able to) provide reliable information on products put on market as well as e-waste collected and recycled

Compliance systems in place

- Due to the need to minimize governmental efforts on monitoring and complexity of the unregulated e-waste market, the number of compliance systems should be limited
- The burden on governmental capacity should be minimized
- Compliance systems should aim to collect as many appliances as possible and achieve the highest recycling efficiencies as possible
- Compliance systems should operate independent of the interests of producers

Collection effective

- Regulated take-back systems must not compete with existing collection channels, but use them as much as possible
- Effective and efficient collection must be achieved by using basic economic principles, such as the demand and supply for scrap metals or other raw materials
- Regulated take-back system must not lead to loss of employment.
- Collection must remain affordable
- There must be an effective monitoring of the receipt of appliances and payment of rewards

Recycling adequate

- New recycling facilities must not lead to loss of employment
- Innovating recycling technologies must be affordable
- Recyclers must be able to provide reliable data

Monitoring of e-waste management effective

- Register and monitoring agencies must be reliable and act independently of producers
- Required information must be available and provided
- Means for sanctions must be available for violating regulations
- Monitoring should be administratively set up as simple as possible, but still effective enough to be able to observe deviations
- Monitoring should include on-site examination

Funding of e-waste management

- Funding must be transparent, information on funding made available to the public



- Funds must be sufficient, yet must not abundant, and may only be used to finance e-waste collection and recycling
- Producers should not be allowed direct access to funds
- Funding must be monitored by government and/or public bodies

Reporting mechanism in place

- There must be resources to weigh and register e-waste at collection points and recyclers
- Documentation should be kept at collection points and recyclers
- Reliability of documentation at collection points and recyclers must be audited regularly

Creating awareness

- The use of different types of media must ensure that illiterate people also understand the message
- Government must set SMART targets to be achieved

A targeted policy and legislation

The policy and/or regulatory framework needs clear objectives and targets that are evaluated regularly.

Prevalence of environment and human health

As is the case in the EU WEEE Directive, protection of human health and environment is of prime importance. Besides, resource maximisation (for example, through re-use and recycling) and minimisation of waste (for example, being dumped at landfills) are other key objectives of an e-waste policy.

Need for a harmonised, simple and transparent system

To avoid the degree of complexity of systems as has emerged in the EU, India should aim for creating a more harmonised and uniform. While the regulatory framework should also promote flexibility of implementation and innovation for it to be more effective, as it does in the EU, adequate care must be taken to ensure that the system is manageable and easier to understand.

Reaching all users

The e-waste management system has to ensure that the system incorporates all kinds of users of equipment; households, businesses, and other institutions. The system should also have an adequate geographical reach to enable collection from all parts of the country.

Providing incentives and raising awareness levels

A successful collection system requires awareness among the users, collectors, producers and processors/recyclers so that they participate in the system according to assigned responsibilities. The system would also require an adequate incentive

for the end users and collectors to hand over the waste to the designated collection points. In India, end users attach certain financial value to e-waste; therefore, it can be considered an even more essential precondition than it is for the EU.

Including the informal sector

More specific for India, integration of the informal sector will avoid unwanted loss of livelihood and ensure that the reach of the collection system is wide and of low cost. Also, the existing skills of the informal dismantlers can be an advantage in terms of resource maximisation and costs of recycling.

Discouraging and eliminating free-riders

Elimination of free riders will be crucial for India where there are still many local manufacturers and assemblers that own a sizable share of the market. In due time, all producers should make a proportionate effort.

Sufficient numbers of dismantlers/recyclers

To ensure that e-waste can reach dismantlers and recyclers without prohibitive transportation costs, they should be enough in numbers and in specialisation. This would depend on financial viability of the recycling system. The recycling system will also require innovation depending on the local conditions.

Ensure closed systems

To ensure that all discarded appliances are collected and recycled in a responsible way, the systems have to be closed, or at least leakages minimised.

Funding should be available

To operate and sustain an e-waste management system, one requires funding. In the end, economic principles and financial motivators will play a crucial role in generating the systems and the capacity needed for proper functioning of collection, dismantling, and recycling.

Regular monitoring in place

To ensure that appliances are collected and processed in a way that meets the requirements, the entire system needs to be monitored. Monitoring systems set up should be as simple as possible, but still comprehensive and effective enough to be able to register deviations. The transparency of the system will ensure that the stakeholders are adequately informed to raise concerns and improve the system. Effective monitoring will also depend on the capacity of the regulatory authorities.

E-waste management needs to be monitored in order to ensure that all discarded appliances are actually collected and recycled in accordance with requirements. Monitoring should focus on collection points, compliance, recycling facilities and financial flows. The information generated by monitoring should provide feedback for the policy makers and regulatory agencies in order to make policies, enforcement, and the used instruments more effective.

Appropriate regulatory capacity

A country or region needs to build capacity in the government in order to exercise its regulatory functions.

Promoting the use of Best Available Technology (BAT)

The Best Available Technology (BAT) principle has effectively promoted the use of state-of-the-art treatment, recycling and recovery techniques that ensure high standards of human health and environmental protection. It also suggests minimum standards for such treatment technology to minimise its impact on humans and the environment.

4 OPTIONS AND SCENARIOS FOR E-WASTE MANAGEMENT IN INDIA

The EU experience provides India with a comparable variety of options and scenarios to choose from, which will be analysed in greater depth in this chapter.

4.1 ACTIONS TO BE CONSIDERED TO ACHIEVE GOALS OF E-WASTE MANAGEMENT

Actions that are listed in this section could be considered in India while making and implementing new legislation and initiate the use of suitable instruments for e-waste management according to stated goals.

Goal 1 Producers collect and recycle discarded appliances as well as provide necessary funding (implementing EPR)			
Present Situation	Possible actions	What is needed	Results are depending on
High costs of compliance and lack of regulation does not create favourable conditions for producers to accept EPR.	Imposing responsibilities expressed into targets to be achieved by producers. Ensuring that all producers contribute to e-waste management equally.	Legislation and enforcement have to encourage producers to accept responsibilities and assist producers to achieve targets. EPR must be affordable; costs have to be proportionate to its purpose. Targets have to be stated SMART.	The willingness of producers to accept responsibilities. The presence of sanctions in case producers fail to achieve their targets.

No reliable information on collection and recycling of e-waste	Generate information on collecting and recycling of e-waste.	Producers have to (be able to) provide reliable information on e-waste collected and recycled.	Availability of means to weigh and record waste. Proper information technology
Responsibilities are likely to be evaded.	Implementing effective EPR instruments and e-waste legislation. Assessing and if required adapting instruments and legislation.	Monitoring responsibilities must take manageable effort for administration and enforcement.	The extent to which legislation and enforcement is helping producers to meet targets. Effectiveness of monitoring by government

Goal 2 All producers own up responsibility and contribute to e-waste management

Present Situation	Possible actions	What is needed	Results are depending on
Little understanding of producers and the numbers of appliances put on the market.	Introducing a system to register new appliances, how producers fulfil their obligations, and to evaluate results.	Monitoring and enforcement must require manageable effort from the government. Producers have to provide reliable information on products put on the market as well as e-waste collected and recycled.	The presence of a register in which all producers of appliances are recorded as well as how each producer complies with obligations.

Goal 3 Tasks and duties for compliance are distributed effectively and clearly (creating compliance systems)

Present Situation	Possible actions	What is needed	Results are depending on
An unregulated market of e-waste impedes regulated collection of appliances.	Inviting parties to set up compliance systems. Authorizing parties to set up compliance systems. Creating a regulated take back system. Contracting collection points, transporters and recyclers that can process in the required way.	The number of compliance systems should be limited to be manageable. The burden on governmental capacity should be manageable. Compliance systems should achieve the highest recycling targets and efficiencies. Compliance systems should operate independently of the individual interests of producers.	Effectiveness of restrictions and government support to legal collection.

Goal 4 E-waste is collected and transported to authorised agencies/recyclers

Present Situation	Possible actions	What is needed	Results are depending on
High value leads to an unregulated trade of e-waste and unregulated collection channels.	Creating closed (regulated) take back systems.	Regulated take back system must incorporate existing collection channels as much as possible.	The willingness of consumers to hand in discarded equipment depends on a financial reward equal to the market price.
Collection is profit-driven and e-waste is brought to the highest bidder.	Create legal collection centres that pay market prices. Raising awareness regarding disposal facilities. Raising awareness about impact on environment.	Equal financial reward to be paid out by legal recyclers. Collection must remain affordable. Regulated take back system must not lead to loss of employment.	Producers willing to fund appropriate recycling.
Lack of data collected e-waste.	Improve information on collecting and recycling of e-waste.	Effective monitoring of collected appliances and prices.	Producers willing to fund appropriate recycling.

Goal 5 E-waste is processed and recycled adequately			
Present Situation	Possible actions	What is needed	Results are depending on
Processing and recycling of e-waste largely causes environmental issues and affects health of workers.	Introducing recycling standards.	Innovating recycling technologies must be affordable.	Availability of funds to invest and buy technologies.
Capacity and technologies of recyclers are insufficient	Promote creation of large scale recycling plants.	New recycling facilities must take employment interests into account.	Willingness of investors to invest in recycling plants.
Lack of data available on appliances processed and recycled.	Innovating recycling technologies.	Recyclers to provide reliable data.	The sharing of technologies by large (international) recyclers. A commitment of compliance systems for long-term cooperation with recyclers.

Goal 6 Good information to regulator and policy makers about compliance			
Present Situation	Possible actions	What is needed	Results are depending on
Lack of information on whole cycle of e-waste management	Creating register and monitoring agencies as part of producer's responsibility.	Register and monitoring agencies must be reliable and independent of producers.	Generation of good quality information and indicators.
Government's capacity for monitoring is limited.	Focusing monitoring tasks of government on: <ul style="list-style-type: none"> - assuring reliability of collection and recycling data and evaluating results; - equal contribution to e-waste management by producers; - mobilisation and use of funds by producers. 	Required information must be available and provided. Sanctions must be in place if regulations are not adhered to. Monitoring should be simple but still effective enough to be able to observe deviations. Monitoring should include on-site examination.	Availability of capacity and financial resources by government and independent monitoring agency. Willingness of producers to fund register and monitoring agency.

Goal 7 Sufficient funding available for collecting and recycling			
Present Situation	Possible actions	What is needed	Results are depending on
Only e-waste with sufficient resale value is collected and recycled. Prices do not take environmentally sound processing into account	Fund the collection and recycling of all types of e-waste, particularly kinds with hazardous materials.	Funding must be transparent and information made available to the public. Funds must be sufficient, yet not be excessive and strictly limited its purpose. Direct access of producers to funds should be made impossible. Funding must be monitored by public bodies.	Willingness of consumer and/or producer to pay a fee. Legislation implemented by government to regulate funding.

Goal 8 Awareness among citizens regarding toxicity and hazards of improper e-waste disposal			
Present Situation	Possible actions	What is needed	Results are depending on
<p>Insufficient knowledge of the environmental impact and health risks of handling e-waste.</p> <p>Disposal of appliances is driven by the value of the materials only.</p>	<p>Selecting a party responsible for creating awareness (either government or producer).</p> <p>Setting measurable goals.</p>	<p>Use of various types of media to ensure that all layers of the population understand the message.</p> <p>SMART targets to be achieved must be set by government.</p>	<p>effectiveness of the message and the chosen media.</p> <p>Availability of financial resources</p>

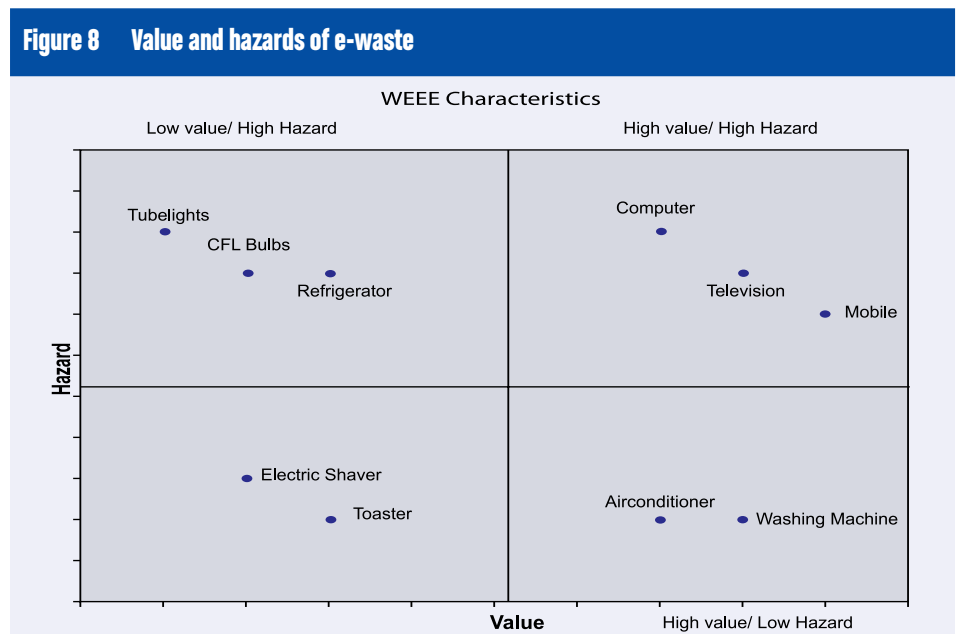
4.2 PRODUCT SCOPE AND PRIORITIES

The scope of products included in the currently operating WEEE management systems varies widely world over. For example, the EU WEEE directive covers a broad range of end-of-life equipments, but in other countries like Japan or Korea or some US states, the product scope is more limited. One of the key considerations is that discarded equipments vary in terms of hazardous contents and recycling value. For example, recycling of computers and mobile phones is more profitable than recycling electric shavers, but their hazard content is higher.

Since the e-waste management problem is complex for India for a number of reasons and the capacity of the government is limited, it is important to prioritise, and the introduction of policy and legislation could take a phased approach. Three main considerations are:

- Hazard of used materials to environment and human health (also when improper processing)
- The value of materials present in the products and thus economically interesting to recycle
- The volumes of products discarded

The dimensions value and hazard are shown in Figure 8.



High hazard content and high recycling value deserve priority, so that the immediate concern of environmental contamination and resource recovery is addressed. The low value/high hazard category also deserves priority, and needs application of the EPR principle to generate funding as it may not be profitable enough based on market value. The other product categories can be taken up in a later phase.

4.3 COLLECTION/TAKE-BACK SYSTEM

It will be a challenge for India to develop a cost-efficient collection mechanism with a wide reach. In particular, ensuring a closed system with minimum leakages from the collection points will not be easy, considering the number and variety of players (collectors, traders, recyclers, dismantlers, etc.).

India needs careful evaluation to set up **municipal collection sites**. Collection through a government agency or through municipal bodies might mean a uniform collection network, irrespective of large or small e-waste generation points. Smaller cities or villages, which may not be generating huge amounts of e-waste, may not be lucrative for private collection agencies, as the infrastructure costs would be high but the collection would be low. Assigning more responsibility to municipalities would also mean additional burden on local governments, which are already struggling with management of normal municipal solid waste. An advantage of involving local government is its large number of workers, its command on land for a disposal site, and its infrastructure of collection.

Existing institutions could also play a role, such as post offices, petrol stations, schools, etc. that are widely present, particularly to cover smaller cities, towns or villages. Compliance schemes can cooperate with such institutions.

Retailers provide a valuable interface with consumers when new products are being purchased, and play an important role in the EU in conjunction with the other systems. It is a very convenient option for the consumers, although retailers have been seen to resist the extra effort involved. India's retail outlet network is vast but is not mapped, and this may result in losing track of returned goods.

Producers or groups of producers setting up their own take-back system is a practice used in number of countries (for example, HP, Braun and Gillette in the UK). Individual Producer Responsibility has the advantage of producers assuming direct physical responsibility of its own product, and it may stimulate making waste-minimizing upstream changes in the product. In the case of India, the operations have to cover a very large geographical area, and it may be a challenge for individual producers to manage and operate such a system by themselves.

Special collection points set up by compliance schemes on behalf of producers is an option that should be explored. An important enabling condition is that there will be a market price paid upon receipt.

Door-to-door collection of bulky waste like refrigerators, air conditioners and washing machines should be considered, and a definite option is the compulsory take-back of old bulky appliance/equipment to be undertaken by the retailer while delivering.

Special collection events, which are used in the US, could also be an option an opportunity. It may also release equipment that users have stored in their houses and offices.

4.4 FUNDING

Some funding options for India are listed below.

- Visible fee: The producers charge a visible fee to the consumers for managing the cost of products they put in the market. (In the EU, it is used for historical products).
- Recycling or recovery fee: Another mechanism for charging consumers at the time of purchase of new products and related to the future cost of recycling of products;
- Reimbursed cost: Consumer deposits the cost of management of e-waste, which is reimbursed after receiving the end-of-life product.

In the Indian situation, it is imperative that the charges are small and preferably not disturb market vitality and consumer's purchasing power substantially. Otherwise, they may fail due to lack of acceptance, evasion and non-compliance.

5 CONCLUSIONS

India's informal sector recycles a high proportion of generated e-waste, but this happens unrecorded and causes serious hazards to the environment and workers. The formal sector is still small, but should be developed further and acquire improved technology.

Useful lessons from the EU WEEE Directive

The European Union Waste Electrical and Electronic Equipment (WEEE) Directive has a few significant aspects for consideration in India:

- It is an overall framework with highly progressive principles, most importantly Extended Producer Responsibility (EPR), which has gained acceptance among policy makers and some producers in India.
- It has clearly defined and well-stated objectives, and the status of progress towards objectives is measured.
- The rules have an in-built flexibility which can be adapted by member states to suit their local requirements (relevant for India's states).
- It spells out the mechanisms to achieve EPR and various instruments have been proven effective.
- It provides scope for member states to define clearly articulated systems to be developed and implemented.

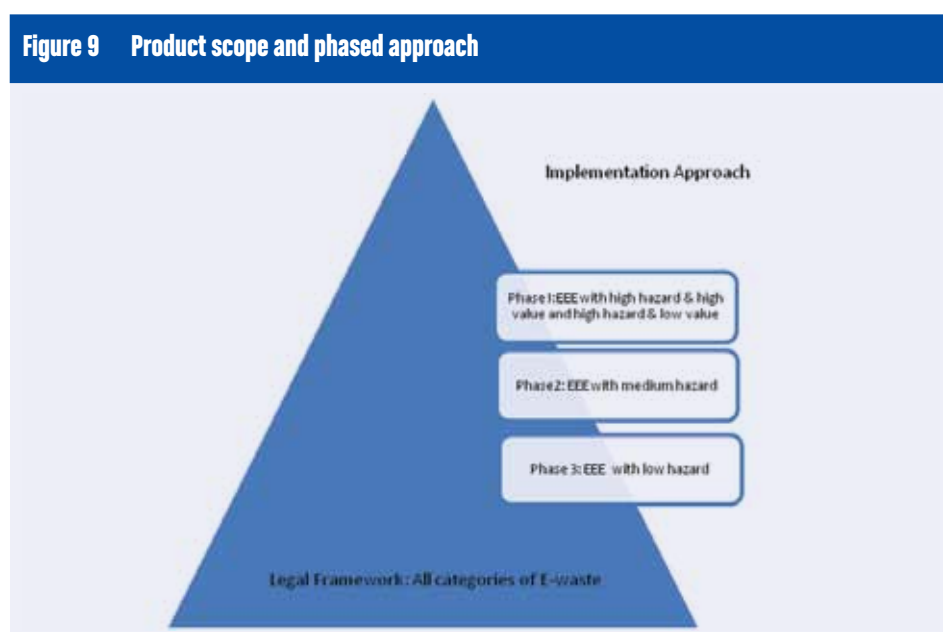
It is necessary to draw lessons from the EU WEEE Directive, both positive and negative. It is currently being implemented in 27 of its member states, therefore various approaches, models and experiences can be analysed. General learning on policy level includes:

- Application of legislation and instruments should be situation-specific.
- Each (member) state should adhere to overall objectives and articulate the mechanisms to achieve them.

- There should be a defined timeframe to achieve objectives and targets.
- Compliance systems act as drivers in achieving targets, but correct incentives should be put into place.
- The burden on the government should not be excessive.
- Flexibility to review and evaluate the rules should be built in.

Product Scope

The EU WEEE Directive's 10 product categories seem to be complete and adequate, although the original weight-based collection and recycling targets are now considered not sophisticated enough. For India, defining product scope assumes importance, as its more limited regulatory and financial capacity and infrastructure provisions call for a phased approach starting with the high-value/high-hazard and low-value/high-hazard types of equipment and components, a strategy depicted in Figure 9.



Collection and disposal infrastructure

The EU experience on setting up collection networks and using reverse logistics provides useful learning. Permanent and widespread collection points and creation of public infrastructure as an addition to general municipal waste collection are important features. Establishing local targets for collection is also effective to enhance performance.

Collection networks in India need to be widespread to enable the consumers to return e-waste conveniently. India's informal sector participants can be used as an asset, provided that the challenge of accountability is met.

Voluntary mechanisms for consumers do not work very effectively even in the EU, and in India it will be even more difficult considering that Indians are used to receiving money for e-waste.

For collection, the following options could be considered.

- Setting up permanent collection infrastructure in the country will be needed.
- Widely spread institutions could serve as return centres for e-waste (for example, post offices).
- India's size and variability will require many kinds of collection systems and combinations, and states and local governments should be allowed to develop and apply their own solutions to achieve compliance.
- How the large network of retailers could be used effectively for collection of e-waste needs to be explored.
- The reach of the informal collectors of waste (kabadiwalas) with value is a huge asset and must be very smartly harnessed to obtain the best results: the option of franchising collections to the kabadiwalas should be explored.
- Courier services also can be integrated into the system of reverse logistics for smaller products.

Figure 10 Key elements for collection



Funding

If EPR is applied in India, producers must be held responsible for funding e-waste management. The cost of recycling needs to be estimated carefully for each product range and levied somewhere. As India is a low-income country, low-cost solutions must prevail whenever possible. Indian consumers are highly price sensitive, and will reject the concept of upfront payment if it is too high.

Conclusions regarding funding are:

- Charging a visible fee for historical waste may be considered but can be discontinued after a given timeline as funds collected would be sufficient to deal with such waste.
- An invisible fee may be charged for the current waste (as considered in the EU); whether Indian consumers are willing to pay this small fee needs to be

studied and tested.

- The producers may use the option of charging a deposit at the time of sale and reimburse it when the consumer returns, which may work well considering Indians are used to receiving money for waste.
- A financial system needs to be transparent to instil and enhance consumer confidence.
- There is a need for securing a financial guarantee from the producers to meet the cost of orphan waste.

Compliance Systems

The EU's experience in establishing compliance systems is one of the most significant learnings for India, and seems essential to make any policy a success. It is the driver of e-waste management and provides financial and operational strength. The compliance system needs to be mandated by the regulatory agencies and would assume responsibility for the complete value chain. Producers can voluntarily or obligatorily become participants in a compliance system. The compliance system should also catalyse the growth of other business verticals such as collection, asset management, refurbishing and material recovery.

The most important learnings from the EU regarding compliance systems for India are:

- Development of a compliance system is feasible if cooperation from the associations of producers is secured.
- There should be a legal mandate to support the functioning of a compliance system and this should be harmonised with other relevant laws.
- There can be an option of single compliance systems for each product range.
- Pilot projects can be used to test compliance systems and producer in selected states.
- The number of compliance systems in a geographical area should be limited to ensure manageable oversight by the government.
- Competitive systems could drive the costs down, but are no guarantee for the best results and should therefore be chosen with care.

Data management and reporting on results

In India, it is widely agreed that while laws are strong, enforcement is generally weak and compliance rates are low. An efficient monitoring and reporting system is needed as an enforcement instrument to measure implementation and compliance, and to evaluate targets and objectives. The EU WEEE Directive has defined mechanisms of reporting that monitor its efficacy that seem useful for India if adapted for the situation and available capacity.

Options emerging from EU experience for data management are:

- Producers should report quantities and types of products put in the market

in order to establish levels of responsibility.

- Quantities collected through the different channels should be closely monitored.
- Use of the Internet for generation and submission of reports will help in achieving timeliness and transparency.
- Introducing a national registry for all producers and products will discourage/reduce free riders.
- Minimising the number of reports and variables to generate only essential data.
- Good indicators are needed to measure the efficacy of policy and regulations and establish a defined frequency.
- Imposition of penalties for non-compliance is imperative.

ANNEX 1

1 EUROPEAN UNION POLICY AND LEGISLATION ON E-WASTE

1.1 Objectives of e-waste policies in Europe

The WEEE Directive

Before legislation, in the European Union (EU), most discarded electric and electronic appliances (hereafter referred to as appliances) ended up in the municipal waste stream. From a resource and environmental point of view, that situation was highly undesirable. Therefore, the first priority of the European policies on e-waste has been the prevention of e-waste, and in addition, the re-use, recycling and other forms of recovery of such waste so as to reduce its disposal. Policies also seek to improve the environmental performance of all operators involved in the life-cycle of electrical and electronic equipment, for example, producers, distributors, and consumers and in particular, operators directly involved in the treatment of waste electrical and electronic equipment.

To achieve these goals, the EU has adopted the WEEE directive, which has to be implemented by all 27 member states. This directive focuses on the separate collection, treatment and recovery of discarded appliances, as well as the financing of the management and reporting on results. Following the Polluter Pays principle, it is imperative that the physical and financial responsibilities are taken by producers.

The RoHS directive

The Restriction on Hazardous Substances (RoHS) directive is closely linked with the WEEE Directive, and is part of the legislative framework to solve the problem on e-waste. The Directive aims to approximate the laws of the member states on the restrictions of the use of hazardous substances in electrical and electronic equipment and to contribute to the protection of human health and the environmentally sound recovery and disposal of waste electrical and electronic equipment.

Therefore, member states have to ensure that new electrical and electronic equipment sold on the market from 1 July 2006 does not contain lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE).

1.2 SUMMARY OF THE WEEE DIRECTIVE

A summary of the core elements and the most relevant parts of the WEEE directive for this study is stated below.

A Separate collection (Article 5)

1. The national government has to take measures to minimise the disposal of e-waste as unsorted municipal waste, and to accomplish a high level of separate collection of e-waste.
2. National governments have to achieve a rate of separate collection of e-waste from private households of at least 4 kilograms on average per inhabitant per year.
3. The final holder and distributor of electrical appliances can return e-waste at least free of charge and can return it to either a specific producer (where applicable) or a WEEE compliance system (where applicable), provided the e-waste is not contaminated and does not present a health and safety risk to personnel.
4. The final holder of a discarded product can return it to the distributor at least free of charge, when purchasing a similar new product.
5. Producers can set up and operate individual and/or collective take-back systems in line with the WEEE directive.

B Treatment and recovery (Articles 6 and 7)

1. Producers are to set up a system to provide for the treatment of e-waste using best available treatment, recovery and recycling techniques. The system can be set up by producers individually and/or collectively.
2. The establishment or undertaking carrying out treatment operations must have a permit from the competent authorities. The storage and processing has to be carried out in compliance with technical requirements.
3. The producers have to meet targets regarding recycling and recovery of waste electrical equipment. E-waste targets are stated by product category.
4. In order to calculate these targets, producers have keep records on the mass of e-waste, their components, materials or substances when entering (input) and leaving (output) the treatment facility and/or when entering (input) the recovery or recycling facility.

C Financing (Articles 8 and 9)

1. The producer is to provide for the financing of the management of e-waste from private households deposited at collection facilities. The producer can choose to fulfil this obligation either individually or by joining a collective scheme.
2. A distinction is made between appliances put on the market before the reference date (historical waste) and put on the market after the reference date (new waste). This reference date is 13 August 2005. Regarding new waste, the producer is responsible for financing the management of his own discarded products only. Regarding the historical waste, all producers existing on the market when the respective costs occur have to contribute proportionately.

3. The producer has to provide a guarantee when placing a product on the market showing that the management of all e-waste will be financed.
4. This guarantee may take the form of a blocked bank account, a recycling insurance or participation in a WEEE compliance scheme.
5. In respect of e-waste from private households, producers may use a visible fee to fund the management of historical waste. It is not allowed to finance new waste with a visible fee, explained later in this Annex.
6. In respect of other than private households, producers and users may conclude agreements stipulating other methods to finance the management of e-waste.

D Information for users and for treatment facilities (Articles 10 and 11)

1. The private households are to be given the necessary information about:
 - a. how to dispose of discarded appliances;
 - b. the return and collection systems available to them;
 - c. their role in contributing to re-use, recycling and other forms of recovery of e-waste;
 - d. the potential effects on the environment and human health; and
 - e. the meaning of the crossed dustbin symbol.
2. Measures are to be taken so that consumers participate in the collection of e-waste and to encourage them to facilitate the process of re-use, treatment and recovery.
3. National government may require that some or all of the information referred to in Clauses 1 and 2 shall be provided by producers and/or distributors.
4. Producers have to mark appliances put on the market with the crossed dustbin symbol. This symbol indicates equipment that should not be disposed of with the household waste.
5. Producers have to provide re-use and treatment information for each type of new appliance put on the market. This information has to be communicated to treatment and recycling facilities in order to comply with the provisions of the WEEE directive as well as the location of dangerous substances and preparations in appliances.

E Information and reporting (Article 12)

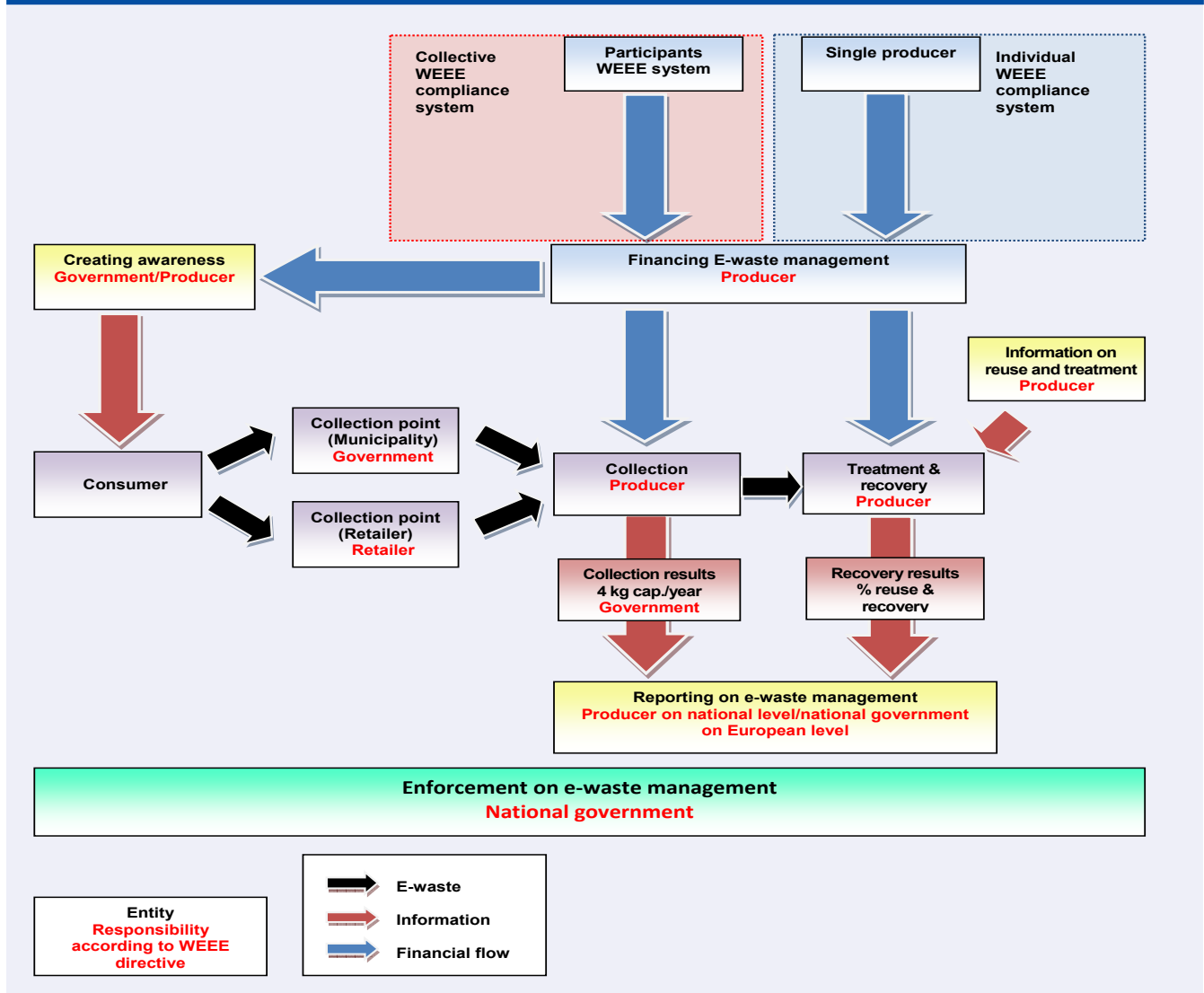
1. Producers have to supply information on the quantities and categories of appliances:
 - a. put on the market;
 - b. collected through all routes; and
 - c. re-used, recycled and recovered.
2. Producers supplying appliances by means of distance communication (internet sales) must provide information on the compliance with the requirements on financing and are to report on the quantities and categories of appliances put on the market of the where the purchaser resides.

F Penalties, Inspection and monitoring (Articles 13 and 14)

1. National government has to ensure that inspection and monitoring enable the proper implementation of the Directive to be verified.
2. National government has to determine penalties applicable to whom that fail to comply with the Directive.

The WEEE directive as summarized in the section can be simplified in the model shown in Figure 1.

Figure 1 Model of the intended functioning of the WEEE Directive



2 MAIN STAKEHOLDERS

The member states and producers are responsible for good e-waste collection and recycling results. But good results depend on more than just efforts of producers based on their legal obligations. There are several parties that also play an essential role. The first interests of those parties do not necessarily have to be good collection and recycling results. Therefore, for introducing effective regulation, it is important to know the interests of various stakeholders. The stakeholders are shown in Table 2.1.

Stakeholders	Representatives	Role	Interest	Degree of influence
Government: Environment sector Policy makers National governments Enforcement agencies.	European Commission National authorities Inspectorates	Creating a directive Creating legislation and enforcing Enforcement	To create effective coherent guidelines that will fit its purpose To maintain effective enforcement with available resources	High, by creating an effective, enforceable directive High, by consistently monitoring and penalizing offenders
Producers : Information Technology Household appliances Office appliances	Trade and industry associations Large producers Producer Responsibility Organisations (PROs).	Responsibility towards and financing of collecting and recycling discarded appliances Eco designing	To comply with the regulations at the lowest possible cost and strains. To have good image as a brand	High, can design appliances environmentally sound. Can set ambitious goals for collection and recycling
Collective compliance systems	System managers, which have created a joint platform: WEEE Forum	Collecting and recycling discarded appliances. Funding operations.	To meet needs and interests of producers regarding their responsibilities. To comply with WEEE Directive and RoHS. To keep costs low.	High, by setting effective collection and setting high recycling standards
Consumers Households Corporate Public	Consumer associations	Discarding appliances	To discard appliances with least effort	Limited, although associations are able to influence public opinion
Recyclers: informal sector	Transporters of illegal shipments Recyclers	Recycling discarded appliances	To make a profit on valuable materials	Negative influence on (registered) results in case e-waste is not recycled in a prescribed way
Recyclers: formal sector	Recyclers Recyclers associations	Recycling discarded appliances	To make a profit on responsible recycling	High, by achieving high recycling standards and innovating recycling techniques
Collectors (Municipalities)	Associations of waste management and environmental services	Collecting and/or accepting discarded appliances	To meet municipal duties Keep costs at an affordable level	High, by encouraging the public to separate e-waste

Stakeholders	Representatives	Role	Interest	Degree of influence
Collectors (retailers)	Retail associations Big retailers	Accepting discarded appliances	To sell appliances, To minimise effort of handling discarded appliances	High, by encouraging consumers to return discarded appliances to their shop
Waste handling companies: Collectors, sorting companies, recyclers	Transporters Sorters	Handling discarded appliances	To make a profit on waste handling	Low

3 VARYING APPROACHES IN IMPLEMENTING EU WEEE DIRECTIVE

The European legislation for e-waste management is binding on the member states as far as the results to be achieved are concerned, but leaves them choices in the form and methods within the framework of their internal legal order. The directive thus has to be transposed into national legislation and has to be implemented.

Essentially, the directive states that specific measures should be taken to prevent e-waste and to achieve a high separate rate of collection, rather than stating how they should be taken. This leaves much room for different choices in ways of implementation of legislation on a national level. For example, the WEEE directive states that awareness among the consumers towards e-waste should be created, but it is left to the member state to decide who must take on which role and who is to finance it—government and/or producer. There is also freedom in developing WEEE compliance systems, such as single and competitive WEEE compliance systems.

Between the various member states there are also differences between the priority and level of ambition in goals to be achieved towards the prevention of e-waste. There are also many options on the use of various policy instruments of e-waste management. As a result, the approaches in implementing e-waste policies in Europe also differ from country to country.

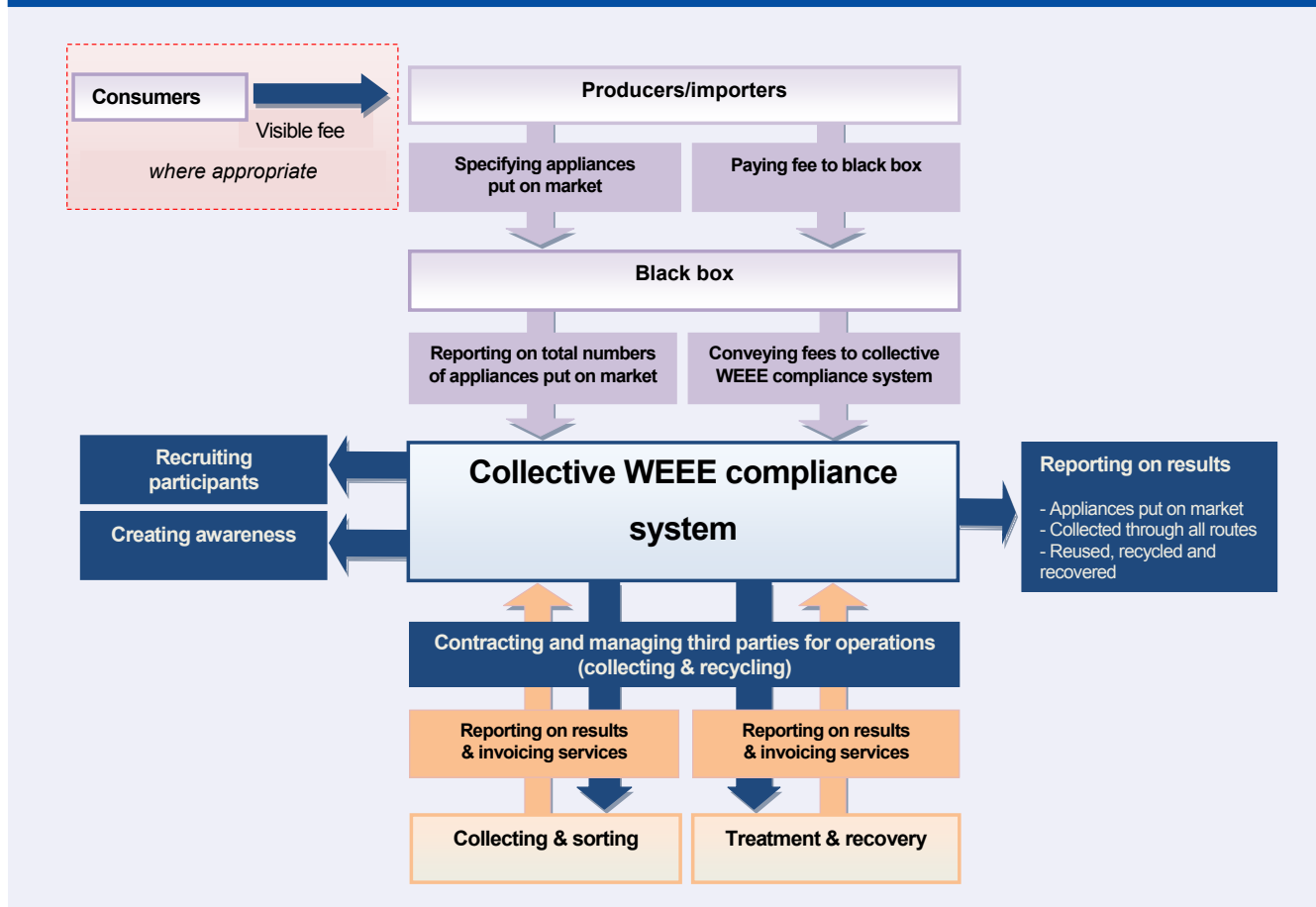
3.1 COMPLIANCE SYSTEMS

As stated in the directive, producers can set up and operate individual and/or collective take-back systems. For household appliances and consumer electronics, virtually all producers in Europe are member of a collective WEEE compliance system.

A collective WEEE compliance system assumes all the responsibilities of its members. The principle of a collective compliance scheme works as shown in Figure 2.

The figure shows that the system has five primary tasks.

1. Collecting financial contributions according to e-waste produced
2. Contracting and managing third parties for operations
3. Recruiting participants
4. Creating awareness
5. Reporting results

Figure 2 The principle of a collective compliance scheme

To perform these tasks, the system is funded by contributions from producers. This contribution may be through a periodic charge levied on producers or an advanced (visible) disposal fee. In other words:

- Producers are being made financially and/or physically responsible for the collection and responsible treatment and recycling of discarded appliances.
- A producer can set up individually a system for the collection and treatment of its own appliances (reverse logistics, feasible for industrial appliances) or he can join a Producer Responsibility Organisation (PRO) that collectively organises the collection and treatment.
- If he joins a PRO, he must pay a membership fee (sometimes) and a contribution calculated on the amounts and types of appliances that he has put on the market. The amount of the contribution is usually determined by the governing board of the PRO and is based on the estimated administrative costs of the PRO (staff, raising awareness campaigns etc) and of collection, recovery and disposal.
- The producer can recover the cost of his contribution that he pays to the PRO from the consumer through a fee that the customer pays for the product at the point of sale. The fee can be either visible or invisible (incorporated into the product retail price). Visible fees at the point of purchase are the clearest mechanism to make the consumer aware of the environmental implications of their purchase and to motivate them to change their purchase behaviour accordingly.

In Europe, the visible fee is only admissible for financing historic waste, and only in a transitional period. In case of a visible fee, the fee paid by the consumer is collected by the retailer and paid to the producer.

As a member of the system, the producer periodically pays the collected fees to the system. From the producers' side, due contributions to the PRO are calculated according to the number of appliances put on the market. To ensure the confidentiality of sales figures, most WEEE compliance systems provide a system that sales figures are quoted to a so-called 'black box'. The black box is managed by an independent accounting firm or division with a special confidentiality status that only discloses the billable amounts of the contributions to the system. The system then sends an invoice that is to be paid by the producer.

The black box remits the funds received to the collective system. The totals of types of appliances put on market are periodically reported to the collective system.

An example of a black box and more information on that black box can be found on the website of WEEE Register Society Ltd.

With the acquired funds, the system performs the aforementioned primary tasks or arrange for third parties to perform them.

Since the systems do not collect and recycle appliances themselves, the main services to be procured are collection and recycling. The procurement is through competitive bidding. Contracts are concluded for a fixed term, varying from 1 to 5 years for contracts with transporters and 1 to 7 years for contracts with recyclers.

Single and multiple compliance systems

Since producers can set up and operate individual and/or collective take-back systems, there can be more than one system in an EU member state. EU member states have a great variety of different systems in place, some with only one, some with many compliance systems and a clearing house. The main role of the clearing house is the supervision of the transport of e-waste from the collection site to the treatment facility. The UK operates a very specific system of tradable certificates. Producers that need to comply and that are not a member of a compliance scheme are breaking the law in the UK.

A member state can have more than one system: first, by specialisation, a specific WEEE compliance system focuses on one or more particular product categories, such as discharge lamps or ICT equipment only (in this case, the systems are complementary, not competitive); and second, by competition, with multiple PROs handling similar particular product categories. In that respect, there is a distinction between single compliance systems and competitive compliance systems.

The number of systems operating in each of the EU member states is shown in Table 3 1. More than one system does not necessarily imply competition since they may deal with different products.

Whether to promote competition between compliance schemes or not is a crucial question for successful implementation: competition between collection

and treatment systems can drive collection rates up and costs for collection and treatment down. On the other hand, competition without minimum quality standards (for example, on the transport of breakable e-waste, and on treatment) can lead to a "race to the bottom", endangering the objective of the WEEE Directive. Because different fractions of e-waste typically have a very different economic value (for example, from clearly positive in the case of washing machines to clearly negative in the case of mercury containing lamps), competition between general and specialised collection schemes, if unregulated and without a clearing house, can easily lead to "cherry picking". It is up to the regulator to define the targets to be met so that such cherry picking is ruled out.

Table 3.1 Number of compliance system in EU member states

Member state	No. of systems	Member state	No. of systems
Austria	4	Italy	4
Belgium	1	Latvia	2
Cyprus	0	Luxembourg	1
Czech Republic	5	Malta	1
Denmark	1	Netherlands	2
Estonia	1	Poland	2
Finland	2	Portugal	2
France	7	Slovakia	4
Germany	4	Slovenia	4
Greece	1	Spain	7
Hungary	4	Sweden	1
Ireland	2	United Kingdom	40

The situation of single or multiple compliance systems has occurred due to differences in historical and legislative contexts. For example, the first compliance systems were set up for producers to comply with national e-waste management legislation adopted before the EU WEEE Directive, for example, in Belgium and the Netherlands. In these cases, the initiative to set up a system was undertaken by only one party, often trade and industry associations, resulting in a single compliance system.

In some other countries it is the national legislation that has led to another outcome. For example, Germany has a law that prohibits a monopoly, and in Belgium, the national laws prescribe that the role of a collective compliance system can only be granted to legal entities established as non profit organisation.

Some producers (such as Braun, Gillette, Sony, Electrolux and HP) were dissatisfied with the functioning of monopolistic compliance systems for e-waste management in member states. They have founded the European Recycling Platform (ERP) and have opposed single (non-competing) compliance systems. The ERP operates in several countries in Europe, including Austria, France, Germany, Ireland, Italy, Poland, Portugal and Spain.

In Europe, the legal set-up of WEEE compliance systems uses common legal

forms such as foundations, (private) associations, joint stock companies or limited liability companies. While there is no distinction between systems founded by trade associations and systems founded by producers. Both types of systems have all these forms of legal entities.

Detailed information the compliance systems in Europe can be found in the document “Transposition of the WEEE and RoHS Directives in other EU member states”. Information can also be found in the white paper of StEP “E-waste Take-back System Design and Policy Approaches”, on pages 17 to 22.

Although the public access is limited and not all systems are up to date (March 2010), a comparison can be made on the WEEE Forum site. A list of some of the collective systems in Europe can be found in Table 4 in the appendix.

3.2 FUNDING

In Europe, there are basically two ways used to raise money to fund the collective compliance systems:

1. An advanced disposal fee can be used, which can be either visible or non visible, and either fixed or non fixed. The fee is collected by the retailer when purchasing a new product by the consumer.
2. A periodic charge can be levied on producers to contribute to the actual costs incurred to operate the system.

Visible fee

The visible fee has its origins in the so-called target pricing. Given a fixed sales price, a contribution in the costs for e-waste management would have a significant impact on profit margins. Therefore, the idea to charge a fee on top of the sales price took birth. To obtain support for the fee, the impression was given to consumers that the visible fee was some kind of eco tax that was levied by public authorities, while the funds are actually received and managed by collective compliance systems. This leads to annoyances to public and consumer organizations, since funding is obtained from the public and huge funds have accumulated by collective compliance systems. in some EU member states. More relevant information on the visible fee can be found in the study “The Producer Responsibility Principle of the WEEE Directive” on pages 56 to 58 and Table 18.

According to the present WEEE directive, a visible fee may be used, but only to fund historical waste. A visible fee for historical waste can be charged until 2011, and until 2013 for some appliances.

In some EU member states (Spain, France, Greece and Portugal), the visible fee is mandatory by national legislation to fund the historical waste. In the other member states it is optional, and there the visible fee is used in the majority of the systems. In member states such as Austria, Germany, Sweden and the UK, a visible fee is not used.

Funding new waste

To fund new waste, an advanced disposal fee may be used, but not a visible one. This means that a fee can be passed on to consumers only if it is included in the sales price calculation of producers.

Since producers are individually responsible for new e-waste, producers are required to finance the costs of waste management of their own products. It is not certain that producers on the market today will be active on the market when their products are collected as e-waste. Therefore, a financial guarantee is required so that these costs can be compensated in case the producer is not active on the market and his e-waste has to be collected and recycled.

Membership in a collective compliance scheme is interpreted to be an appropriate guarantee for new e-waste in most EU member states. More relevant information on the financial guarantee can be found in the study “The Producer Responsibility Principle of the WEEE Directive” on pages 49 to 55 and Tables 16 and 17.

3.3 COLLECTING AND SORTING

The collection of e-waste is arranged in different ways. For collective compliance systems, collecting e-waste has the following elements:

1. Issuing contracts with (often competing) transporters to retrieve appliances
2. Designing and managing an infrastructure for appliances to be retrieved

Mostly, collective compliance schemes will use existing infrastructure for the collection of household e-waste, given that in most countries e-waste is already being collected as part of the municipal solid waste stream. Municipalities continue to collect, but are now, since the implementation of the WEEE Directive, in most cases being compensated by the producers.

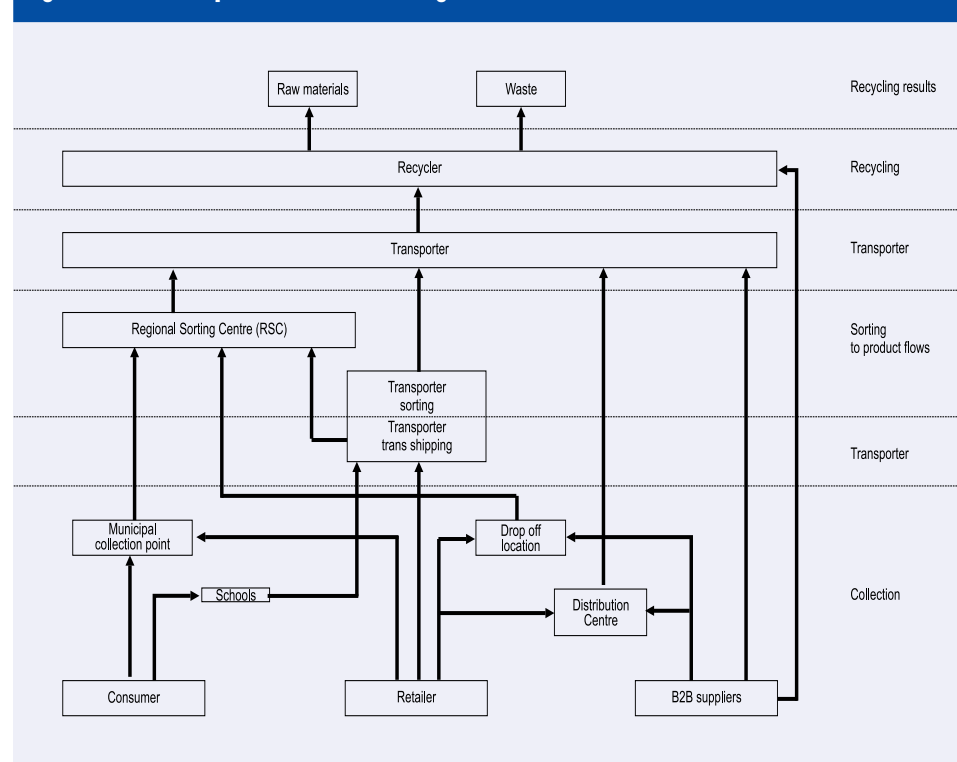
The infrastructure for collecting discarded appliances (with a degree of capillarity) is different in each member state. Regarding physical responsibility, the directive does not explicitly identify who should be responsible for setting up the infrastructure. It puts the onus on distributors to accept appliances from consumers on a one-to-one basis when selling new products, although member states can deviate from this requirement if they can show that an alternative procedure is just as convenient for consumers. According to the WEEE Directive, municipalities have to accomplish a high level of separate collection of e-waste. The producer is responsible for the collection of discarded appliances at least from the collection points onwards. It can be concluded that the directive indicates only two mandatory locations for collection points from which a producer has to collect discarded equipment: municipalities and retailers.

In the current practice, the design of the collection system largely depends on national legislation and on the goals and ambitions of the organisation running the collective compliance system. More information on collection can be found in the white paper “E-waste Take-back System Design and Policy Approaches”, on pages 6 to 8.

As different appliances require different ways of processing, they have to be sorted in product waste flows, and sent to different recyclers. Sorting can take place in various stages of the chain, given that a minimum product waste flow should be guaranteed. To sort appliances in categories, physical space is needed for a few containers depending on the number of waste flows and sorting beforehand. Sorting is only useful if appliances are transported to the recycler in that same way, and not become mixed up at the collection point. Therefore, in which stage e-waste is sorted depends on available space at a given location. The following options are available:

1. Sorting by the consumer and separated collection from households and other units
2. Sorting at a municipality collection centre
3. Sorting at a the distribution centre of a large retailer
4. A combination of the above

Figure 3 An example of an actual working e-waste collection infrastructure



3.4 RECYCLING TECHNIQUES AND PROCESSES

Discarded appliances are almost usually dismantled by machine processing, often after manual pre-treatment. Appliances are shredded and particles are separated in different automated methods. Some types of appliances call for a pre-treatment first. For example, CFCs have to be removed from refrigerators before they can be processed. But for most appliances, the recycling starts with shredding and segregation.

In the Netherlands, collected appliances are assigned to five main flows:

1. large household appliances
2. refrigerators
3. televisions
4. discharge lamps
5. other appliances

These five main flows have different processing methods. The flows can vary slightly, but in general all collective systems in Europe operate in a similar way.

Possible recycling techniques are shown in Table 3.2 (example: the Netherlands).

Table 3.2 Recycling practices for types of appliances (example: the Netherlands)			
Pre treatment	Treatment	What is needed	Results are depending on
<p>Large household appliances</p> <p>No manual pre treatment</p>	<p>Shredding, then:</p> <ul style="list-style-type: none"> - FERRO separation - Non Ferro separation 	<p>Reprocessing Non Ferro:</p> <p>aluminium</p> <p>copper</p> <p>residue</p> <p>Reprocessing residue:</p> <p>recovery</p> <p>residue</p>	<p>Smelter</p> <p>Smelter</p> <p>Smelter</p> <p>Reprocessing</p> <p>Energy generation</p> <p>Landfill</p>
<p>Cooling freezing appliances</p> <p>Manual removal of:</p> <ul style="list-style-type: none"> - cable - Capacitors / Mercury - wood <p>Tapping of:</p> <ul style="list-style-type: none"> - oil - CFCs <p>Removing compressor</p>	<p>Shredding, then:</p> <ul style="list-style-type: none"> - FERRO separation - Non Ferro separation 	<p>Reprocessing Non Ferro:</p> <p>aluminium</p> <p>copper</p> <p>residue</p> <p>Plastics reprocessing:</p> <p>polystyrene</p> <p>non Ferro fractions</p> <p>residue</p>	<p>Smelter</p> <p>Smelter</p> <p>Smelter</p> <p>Landfill</p> <p>Various smelters</p> <p>Landfill</p>
<p>TVs</p> <p>No manual pre treatment</p>	<p>Shredding, then:</p> <ul style="list-style-type: none"> - FERRO separation 	<p>Plastics reprocessing:</p> <p>plastics</p> <p>residue</p> <p>Reprocessing Non Ferro:</p> <p>aluminium</p> <p>copper</p> <p>Processing CRT glass</p>	<p>Smelter</p> <p>Plastics processors</p> <p>Landfill</p> <p>Smelter</p> <p>Smelter</p>

<p>Other appliances</p> <p>Manual removal of:</p> <p>- battery</p>	<p>Shredding, then:</p> <p>- FERRO separation</p> <p>- Aluminium separation</p> <p>- Plastics separation</p>	<p>Plastics reprocessing:</p> <p>plastics</p> <p>copper</p> <p>residue</p>	<p>Smelter</p> <p>Smelter</p> <p>Energy generation</p> <p>Smelter</p> <p>Landfill</p>
<p>Discharge lamps</p> <p>Sort by composition</p>	<p>Breaking lamps, then:</p> <p>- sieving Fluor powder</p> <p>- dry scrubbing</p>	<p>- Thermal processing</p> <p>- post treatment of heavy metals</p> <p>Glass winning</p> <p>Metal post-treatment:</p> <p>- Ferro separation</p>	<p>Glass industry</p> <p>Smelter</p>

As Table 3.2 shows, after a short pre treatment, in which some crucial components of the appliances are dismantled, appliances are shredded. By various separation techniques, based on material properties such as density, grain size, weight, magnetism, electrical conductivity or optical characteristics of the materials, fractions are separated. The shredded waste is roughly separated into categories that are reprocessed in post treatment, to be shipped as raw materials, or to be transported to the landfill.

Using post-treatment techniques, coarse fractions can be reprocessed to flows of copper, plastics, aluminium and residues. Discharge lamps are first sorted by type, such as fluorescent lamps, sodium lamps, metal halide lamps, mercury vapour lamps, to be processed differently in some cases. After breaking and extraction of gases, glass is separated through sieving, dry scrubbing and thermal processing. Metals are regained through ferro separation.

A reference document on the best available waste recycling techniques can be found on the website of the Joint Research Centre of the European Commission. A reference document on the best available techniques on waste incineration is also available.

Procurement of recycling

Recyclers generally have to qualify through competitive bidding on a national or international tender. Some collective compliance systems appoint a single recycler for the recycling of a particular category of e-waste because of economics of scale. A large flow of appliances to process can provide a strong position in the procurement of recycling services. The disadvantage is that there is a large dependency on a single supplier. If the only supplier cannot perform appropriately, production stagnates or cost issues emerge, there is no short-term possibility of shifting services to another supplier. Therefore, almost all systems that are member of the WEEE Forum have multiple recycling partners, some more than 20, others at least 5. Only one system has a single treatment partner.

A disadvantage is that long term investment might be limited in a market with many competitors where many recyclers tend to compete on the price. In Europe, most

contracts are concluded for a period of two years, many even for the duration of only one year. If there is not enough certainty towards recyclers on long-term continuation of contracts and if the waste streams are not significant, recyclers will reluctantly invest in long term investment such as research and development of new technologies. On the other hand, as in other markets with high competition (such as consumer goods markets), if a recycler manages to find a significantly more efficient solution, he has the chance to gain market share quickly.

3.5 RECRUITING PARTICIPANTS

According to national legislation following the WEEE Directive, every producer has to either set up his own compliance system or participate in a collective compliance system and thus fulfil its obligations towards e-waste management. Yet it appears that in the EU not every producer participates in a (collective) compliance system. To fund a collective compliance system, participants are needed, and therefore the systems are keen to recruit participants. Due to the fact that participants have to pay a contribution to the compliance scheme obligations that every producer has to assume EPR, it is in the interest of the collective compliance system that so-called free riders are discouraged. A free rider is a producer that enjoys the benefits accruing from the collective effort, but does not contribute financially to the effort, by neither joining a collective compliance system nor setting up an own individual compliance system. The government has also a significant interest in ensuring that all producers fulfil their obligations towards EPR.

Therefore, it is important that both the collective compliance system and government work together in tracing free riders and penalise those who avoid their legal responsibilities repeatedly. Policies and enforcement on tracing and penalizing free-riders are different in each EU member state. In some countries, such as the Netherlands, Belgium, Ireland and Italy, the situation is under control and non-compliance is not considered a problem particularly when there are clear and consistent proceedings and sanctions for non-participation. Other countries, such as the UK, Spain, the Czech Republic and Greece, seem to have a problem in obtaining accurate figures, and available information and estimates vary by system. In those countries, the number of free riders may still be as high as 15-20 per cent of market share.

3.6 REPORTING ON RESULTS

On a national level, producers have to report on the quantities and categories of appliances put on the market, collected and recycled and recovered. EU member states are required to keep a register of producers. Registration and reporting obligations for producers are not harmonized in the EU. As for the registration, Greece, Belgium and the Netherlands do not have one central government-run register. These three countries have a single collective compliance system active; therefore data collection is more straightforward. For example, in the Netherlands, a register is not required as the Ministry of Environment (VROM) considers all the individual and collective notifications of collective compliance systems/producers as the producers' register.

If a member state has more than one system, a government body has to collect data and record the performance of the policy. Even if a member has just one collective compliance scheme, it is the task of the government to verify the data that have been reported by that single scheme and to assess whether the collection and recycling targets have been met, and if not, they have to be enforced. The body also has the task to group and harmonise information to report on a national level.

The frequency and content of the reports varies by member state. Regarding frequency, reports vary from quarterly to annual. Regarding content submitted to the register, information varies from plain collection and recycling results to additional information on prices per kg and other information, such as a list of producers with declared participation in collective compliance systems and their market shares for collective compliance systems. The body keeping records also varies by member state. In some member states, such as Denmark, Ireland and Portugal, the registers are kept by private parties. In others, such as the UK, France, Sweden and Poland, registers are kept by a governmental body.

3.7 CREATING AWARENESS

For good collection results, it is important that the public is aware how and where they can dispose of discarded appliances. The WEEE directive states that awareness-raising is required, but it leaves it to the member state to decide who must take on that role—government and/or producer. In all member states, limited tasks of creating awareness are carried out by the collective compliance systems. Means used to raise awareness include websites, media campaigns (TV, radio, newspapers, magazines), event sponsorship, leaflets, posters and producing public annual reports. The level of effort and funds assigned vary from system to system. Some are limited to a website, some leaflets and free publicity; others use many of these resources. Some systems target retailers and municipalities, but not all provide this type of crucial information to important players in the system.

The Netherlands is an example of high ambitions on creating awareness, where a variety of campaigns are organised under a banner called 'Wecycle' (in the Dutch language). Campaigns together with retailers and schools, promotional campaigns, sponsoring events, a large national radio campaign and TV commercials and regional activities organised with municipalities that support Wecycle. More can be found on the website of NVMP as well.

4 RESULTS SO FAR AND MAIN ISSUES

4.1 COLLECTION OF DISCARDED APPLIANCES

The results in the collection and recycling of appliances vary by member state against the present collection target of 4 kg per capita vary greatly. The results of the systems associated with the WEEE Forum are shown in the Table 4.1.

Table 4.1 Results of the systems associated with the WEEE Forum				
Collected kg/capita	Minimum	Weighted average kg	Maximum	Number of systems
2006	0.06	3.7	16.5	25
2007	0.08	4.5	17.5	29
2008	0.05	4.0	16.4	30

Source: WEEE Forum

Table 4.1 indicates that some systems do not achieve the 4 kg per capita target, which was required starting 31 December 2006 for the EU's 15 "old member states". The present e-waste collection target of 4 kg per capita cannot be considered an appropriate indicator of successful collection. In a number of member states, mainly Eastern European countries, there is a significantly lower penetration rate of appliances. Therefore, the weights per capita of appliances collected should be compared with the weights per capita of appliances put on market by members of the system.

The weights per capita of the appliances put on the market are shown in Table 4.2.

Table 4.2 Weights per capita of the appliances put on the market				
Put on market kg/capita	Minimum	Weighted average kg	Maximum	Number of systems
2006	0,46	14,0	27,8	25
2007	0,53	15,3	30,5	29
2008	0,37	14,8	27,4	30

Source: WEEE Forum

Although not exactly a scientific approach, using the figures in the tables a more useful ratio can be determined, as shown in Table 4.3. The lowest figure of collection may not refer to the same member state that shows the lowest figure of appliances on the market. The same applies for the highest figures. The figures do not take account of growth in sales of appliances either, where there should be made a relation to historic sales. Therefore, the table only provides an impression about the collection rate.

Table 4.3 Weighted performance of the WEEE Directive implementation				
Collection rate	Minimum	Weighted average kg	Maximum	Number of systems
2006	13%	26%	59%	25
2007	15%	29%	57%	29
2008	14%	27%	60%	30

Source: WEEE Forum

According to this simplified calculation, on average less than one-third of the appliances put on the market are collected, and the best performance is about two thirds. Given these results, the European Commission has proposed to adjust the policy target as stated in the WEEE directive.

4.2 RECOVERY OF MATERIALS

As for the actual results on recycling and recovery of materials, no precise figures are available. E-waste processing results differ cross the EU. In member states that are leading, the required rates on recycling and recovery are easily achieved and in some cases exceeded. In other member states the targets are not met.

To address this problem, the EU has allocated a large budget to develop a quality label regarding recycling standards. The development of such a (currently not binding) label intends to achieve that all designated recyclers in Europe will use high quality standards in the processing of e-waste and also in this way will meet the required rates on recycling and recovery.

Table 4.4 Required rates on recycling and recovery in the EU		
Type of appliance	Re-use and recycling (per cent)	Recovery (per cent)
Large household appliances	75	80
Small household appliances	50	70
IT and telecommunications equipment	65	75
Consumer equipment	65	75
Lighting equipment	75	80
Discharge lamps	80	80
Electrical tools	50	70
Toys, leisure and sports equipment	50	70
Medical devices	50	70
Monitoring and control instruments	50	70
Automatic dispensers	75	80

Re-use means any operation by which e-waste or components thereof are used for the same purpose for which they were conceived.

Recycling means the reprocessing of waste materials for the original purpose or for other purposes, but excluding energy recovery.

Recovery means any of the 13 applicable operations provided for in annex IIB to Directive 75/442/EEC and the new Waste Framework Directive 2008-98-EC, for example, as a fuel to generate energy, solvent reclamation, oil re-refining or regeneration of acids or bases.

4.3 FINANCES AND EFFICIENCY

Regarding finances and rates of efficiency, the results vary by member state. The costs incurred for the collection and recycling are often compared by the members of the WEEE Forum. Cost centres are expressed in price per ton that is collected and recycled. These ratios can vary considerably by country. Differences found can be interpreted to reflect different levels of competition/efficiency, but also different levels of quality/care, as well as differences specific to each country (for example, urban vs rural collection costs).

On itself, these ratios do not mean that much, since the cost will depend on ambitions, logistics and used recycling techniques. Some systems have high ambitions and spend more money on campaigns to create awareness, a dense logic system and state of the art recycling techniques. In some member states, collective systems also have also the obligation to collect e-waste from the households.

When quantity of collection increases, overhead costs per ton will obviously decrease, although in some cases, the collection of more e-waste will cause the cost to rise disproportionately. This will happen if collection increases, through many small collection points, which entail many transports. An example is the collection of gas discharge in the Netherlands. The existing channel yielded a large flow of fluorescent lamps from professional installers, which were collected in large containers. When planning to collect more lamps, private households have to be targeted, which are more dispersed. These lamps have to be retrieved via retailers, which will require much more transports.

Recycling techniques can account for part of the cost difference, although in some systems, e-waste treatment costs difference is more than explained by techniques and are 3 to 8 times as high.

When recycling large household appliances, many systems are able to realise 'negative costs'. This means that the revenues on raw materials are higher than the costs of recycling. Within the WEEE Forum members, only one system seems to be able to make a profit on the recycling of large household appliances, after deducting all expenses. So generally, due to high overhead costs for collection and subsidies across the product categories, almost all collective compliance schemes need to be financed externally.

5 THE SUCCESSES AND CHALLENGES OF VARYING APPROACHES

5.1 COMPLIANCE SYSTEMS

Opinions are divided on what is most effective in e-waste management: single compliance systems or competitive compliance systems.

Single compliance system

The advantages and disadvantages of a single compliance system are summarized below.

ADVANTAGES

1. Economics of scale

When large e-waste streams are concentrated, this can be cheaper for collection as well as recycling. There are fewer transports from collection points, and the system is in stronger position to demand lower costs in the procurement of transport. The same is valid for recycling.

2. Easier to monitor by the government

It is easier to monitor if the flows are more concentrated, and sources of data are less.

In the UK, where more than 40 systems cover the same geographical area, the government experiences difficulties in monitoring these systems. This calls for a clear policy on reporting and verification that all producers are members of one of these 40 systems.

3. Easier to be held accountable for results

In the current situation in Europe, it is the national government who is responsible for the target of collecting 4 kg of e-waste per capita per year. There is no target set how much e-waste should be collected by product category. Without a ratio for each product category, it is currently only possible to evaluate the results on a national level. In this particular situation, only the single compliance systems can be held liable for achieving overall collection targets.

DISADVANTAGES

1. No competition

A system without competition can have disadvantages such as:

- little motivation to achieve cost savings
- less motivation to innovate
- little incentive to increase the collection results
- little incentive to increase quality and process efficiency

It should be noted that competition is no guarantee for quality of the service. It is conceivable that there will be cases in which the interests of producers are rather to achieve the lowest possible cost for compliance than achieving the highest possible collection and recycling results.

2. No benchmarking on a national level

With a single compliance system, it is not possible to compare results and costs of collection and recycling on a national level. At a European level, there is of course much information available regarding the collection and recycling results and costs to perform benchmarks. But the situation in one country may be different from another, as the level of ambition to collect, demographic characteristics, etc.

5.2 COLLECTION

The biggest challenge of e-waste management in Europe is to further increase the collection of discarded appliances as much as possible. It is estimated that only one third of e-waste in the European Union is reported as separately collected and appropriately treated. This does not necessarily mean that the rest ends up in the landfill. It is rewarding for other players to collect certain appliances, and therefore these appliances are not collected by the collective compliance systems, and therefore not registered. Having said that, still many appliances still end up in the dustbin, and therefore those are very likely to go to the landfill for final disposal. This is especially valid for small appliances.

In many EU member states, the current system of collection is basically a passive process. Discarded appliances are received at a collection point to be transported on a maximum scale to a recycler. In many cases, the consumer has to make an effort to properly dispose the appliance. In practice, when buying a new small appliance, there are not many consumers who take their old unit to the retailer. Even fewer people go to the municipal collection point to deposit appliances to be discarded, particularly when such appliances are small. Large appliances come back on reverse logistics: a new device is delivered at the household by delivery service of the retailer; the discarded appliance is taken back by delivery service as a practical service to the customer.

However, other innovative approaches to collection have been thought of or are being tested. For example, a deposit system could be used to ensure the return to retailers of low-value hazardous e-waste such as mercury-containing lamps. Also, a general obligation for retailers to take back e-waste free of charge, not only on a one-on-one basis as currently, would certainly help to facilitate take back. This system is currently applied for batteries in the EU. In Germany, projects are undertaken to collect e-waste together with packaging waste in one bin. More relevant information on this can be found on the website.

A target of 4 kilograms per capita seems not to be effective enough. In the recast of the WEEE Directive, the collection target as it exists now will have to change for the following reasons:

- There is no relation to the appliances put on market by producers
- It is not ambitious enough

- It does not represent the various product categories put on market
- It does not serve priorities in terms of toxicity of the materials processed in the appliances

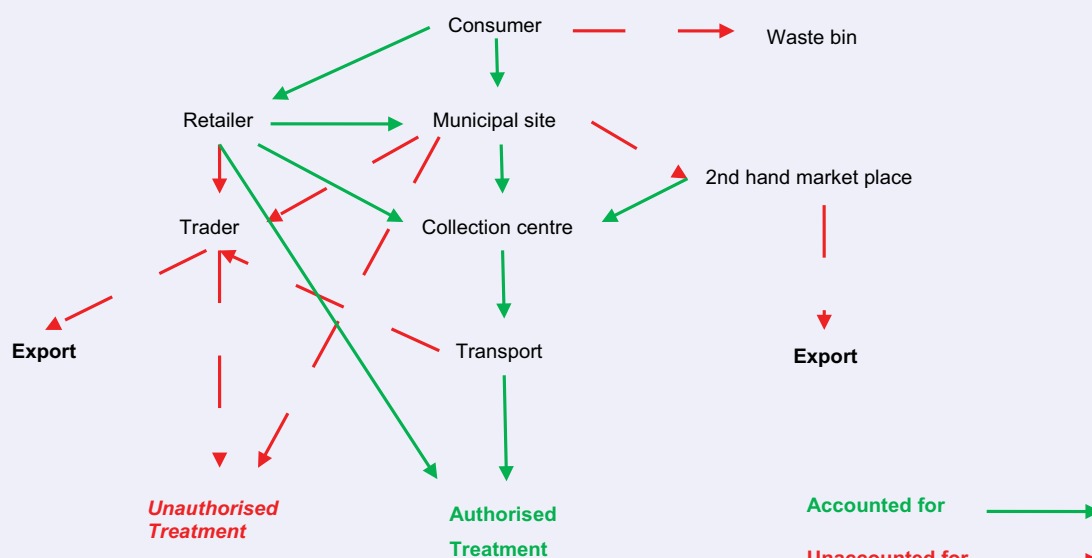
Therefore, a ratio for each product category seems to be needed: a percentage of collected equipment as compared to sold in the market. Such new targets will have significant impact on the collection systems. If the systems strive to achieve these new goals, then the logistics will have to be redesigned to make it much more convenient for the public to return their e-waste somewhere. Increased effort in awareness raising among the public on how and where to dispose of e-waste is highly necessary. This will entail a significant increase of the overall costs.

The so-called 'additional flows' are also a problem. Not all appliances that are collected end up in the collective compliance system: first, because they are not returned to a collection point but collected by others as recycling is profitable (although the method used may not always comply to set standards); and second, used appliances are sometimes sold by retailers and municipalities. Where appliances are responsibly processed by legitimate recyclers, it is not a reason for concern except that the information flows may become distorted.

Additional flows that are exported to countries outside EU are of more concern. Under the disguise of well-functioning equipment, faulty equipment vanishes out of Europe mostly to developing countries to be refurbished or processed in an environmentally unsound manner.

Figure 4 shows the potential (grey/illegal) paths e-waste separately collected can take instead of the proper reporting and treatment channel.

Figure 4 Potential paths of e-waste, including grey and illegal



Source: Towards sustainable WEEE recycling, EERA

5.3 RECYCLING

Within the EU, the treatment practices on recycling differ considerably. In some parts of the EU, post-shredder technologies are cutting edge, while in others there is practically no experience at all. In some member states, there is no sufficient assurance of the environmental performance of companies involved in collection, transport, pre-treatment (de-pollution), treatment and recovery and recycling.

The electrical and electronic equipment technologies undergo a rapid development process and emerging types of equipment, such as mercury-containing flat panel displays and mercury-containing gas discharge lamps, demand new treatment solutions. Due to the situation that some member states fail to secure proper enforcement of their e-waste legislation, some processing companies succeed in gaining a competitive advantage due to the application of cheaper but less environmentally sustainable practices. To deal with this type of unfair competition, the WEEE Forum is developing a quality standard for recycling called WEEELABEX, supported by EU financing. Detailed information on WEEELABEX can be found the website of the WEEE Forum.

Accurate reporting on the materials that were re-used and recovered out of processed appliances is another challenge for the WEEE compliance system. First, there might be different interpretations and definitions of recycling and recovery. Second, many electrical appliances are processed along with other waste that are not electrical appliances. Therefore, as a sample, periodically a batch of only electric appliances is processed to examine rates on re-use, recycling and recovery. When running such a batch, processing settings can be adjusted, which are not representative of the normal operation.

5.4 FUNDING

In many countries the visible fee / advance fee is used to establish financial reserves to fund the collecting and recycling of the historical waste. The financial reserves are used like a 'pension fund' for the historical waste. The growth of funds that have become very large (for example, in the Netherlands) has led to discussion and criticism going up to EU level. In its defence, it is not easy to make a proper estimate how much reserves are needed cover costs and revenues in the distant future. The deciding factors are:

- number of appliances to collect
- number of collection points
- number of transports
- number of appliances put on market
- actual collection costs per ton
- actual treatment costs per ton
- overhead costs, etc.

The collective system entails a risk of 'over funding'. Given that the money is raised from the consumer, it is important that the government frequently monitors the size of reserves and periodically evaluates its admissibility.

The visible fee may only be charged until 2011 (for some appliances in 2013) while many appliances have a life span of more than 20 years. Starting from 2002, there are approximately 9 years to save money for 20 years of waste. The visible fee was calculated based on assumptions made in 2002. Now that the targets will be changed, the strain on the funds will be higher, and in many cases it is questionable whether these targets can be met with available funds if there is only one year left to charge the visible fee.

How to deal with the distinction between historical and new waste is an important question. In the EU member states that use a visible fee, a proportion of the costs is allocated to new waste and charged from the producers separately. As previously mentioned, the visible fee funds can only be used for the historical waste, that is for products placed on the market before 13 August 2005. Now the debate is on about which equipment/recycling stream is historical and what is new. Information should be raised from taking representative samples accompanied by assumptions, but not all compliance systems in member states do make a concerted effort, let alone allocate funds to cover the costs to new waste and charge producers accordingly.

The visible fee itself has also led to disagreement. For example, by introducing a fee visible on discharge lamps in the Netherlands, there has been significant resistance. In particular, the sellers of cheap imported discharge lamps claimed that the amount of € 0.25 is disproportionately high considering the sale price of about € 1.

5.5 RECRUITING PARTICIPANTS

The successes achieved in discouraging free riders differ from country to country. This is mainly due to:

- efforts made by the collective compliance system to inquire and invite producers that are not participating
- the cooperation and communication between the collective compliance system and the government
- actions undertaken by the government to enforce

In the Netherlands, there is effective cooperation between the Dutch collective compliance system NVMP and the government. The NVMP periodically scans for possible new producers to admit to the collective compliance system. Producers who are not listed are being informed about their legal obligation by letter and subsequently invited to join. Producers who refuse to join are classified as free riders and registered as such in a database that is accessible to enforcement agencies of the government. The government imposes heavy fines on producers who fail to join after formal warnings. Employees of governments and collective compliance system have regular consultations on progress and outstanding issues.

5.6 CREATING AWARENESS

There is a major challenge in creating awareness towards the return of discarded appliances to the designated collection points. How well is the consumer informed and how can they be informed in a more effective way? Conducting campaigns

on TV and radio is very expensive. It requires a major financial contribution from the producers. It is also doubtful whether it is in the interest of producers to raise campaign to recover as much appliances as possible since when more appliances are returned, to the overall costs for the producers will rise. Therefore the correct incentive to make awareness successful is largely missing with the collective system. This is a flaw of the system that should be remedied.

There is no known case of member states where the government has formulated measurable objectives for awareness-raising. There are no member states that require producers and/or collective systems to spend a certain budget on communication. It seems unrealistic to expect collective compliance systems to give priority to awareness-raising in the present system. The targets set by the government should be such that the WEEE compliance systems have to run awareness campaigns to achieve the targets.

6 MAIN CHALLENGES FOR POLICY AND ENFORCEMENT

6.1 ENFORCEMENT

High on the priority list for enforcement are controlling waste shipments outside the EU and controlling waste recycling and treatment. E-waste is illegally exported to countries outside the EU. It is the task for inspectorates to detect and intercept illegal shipments. In countries like Belgium and the Netherlands, shipments are regularly inspected in port areas. But given the large numbers of shipments and the technical complexity and time consuming process to investigate whether appliances are regarded as used or are waste, only a fraction of these shipments is intercepted. The recast WEEE Directive proposed by the Commission would increase inspections and monitoring. A study from the European Commission published early in 2010 recommends setting up a dedicated European agency to help enforce European waste law, and could have positive impacts including in the area of e-waste.

The other main challenge for enforcement is controlling waste treatment within the EU. It is assumed that a large portion of waste equipment is collected and leaked to substandard treatment plants. Since national governments are unable to properly map the flows, the European Commission has proposed to extend producers' responsibility to collection from private households. This is meant to ensure producers' access to waste and avoid unaccounted collection.

6.2 BUSINESS INTERESTS AND LOBBIES

Most producers understandably see e-waste management as a burden and a cost factor. Many producers are reluctant to disclose sales figures. In any case, businesses in the sector are stakeholders and that they lobby for their interests is legitimate.

In Europe, most producers are members of some kind of trade and industry association. Some trade associations have an umbrella organisation at European level. The associations focus on a certain category products, such as CECED (Conseil Européen de la Construction d'Appareils Domestiques) and represent the interests of manufacturers of household appliances. The ELC (European Lamp Companies) Federation represents the interests of lamp manufacturers. At EU level, they seek to influence EU policies and propose policy changes if they conclude that their interests are affected.

In some member states, collective compliance systems have been set up by trade and industry associations in order to represent the interests of their members. Some producers with a strong market position in Europe have their own policy for the obligations of producers, or operate this independently of the branch. If possible, they set up their own competing compliance systems and aim to have an influence on policy making.

The WEEE Forum is the European Association of collective WEEE compliance systems. The WEEE Forum aims to a harmonised European approach towards e-waste management. The Forum is primarily founded to share experiences and knowledge regarding collection and recycling and all related activities. More than 40 systems are member of the WEEE Forum (February 2010). Within the Forum, figures and facts are compared. One important and useful function of the Forum is to develop tools that allow member systems to benchmark their results with those of others. Although detailed information is available to members only, some benchmark reports of 2006, 2007 and 2008 can be found on the WEEE Forum website.

The WEEE Forum developed a vision on the EU policies on e-waste management. Based in Brussels, the Forum obviously tries to make its vision understood with the EU.

Retailers also have associations and large supermarket chains are influential players themselves. Both are reluctant in accepting old appliances. They set conditions for accepting old appliances and collection resources in the shops. In some member states, they are able to impose a fee for their role in the chain. Retailers have a surprisingly high influence on policy, in some member states more than in others.

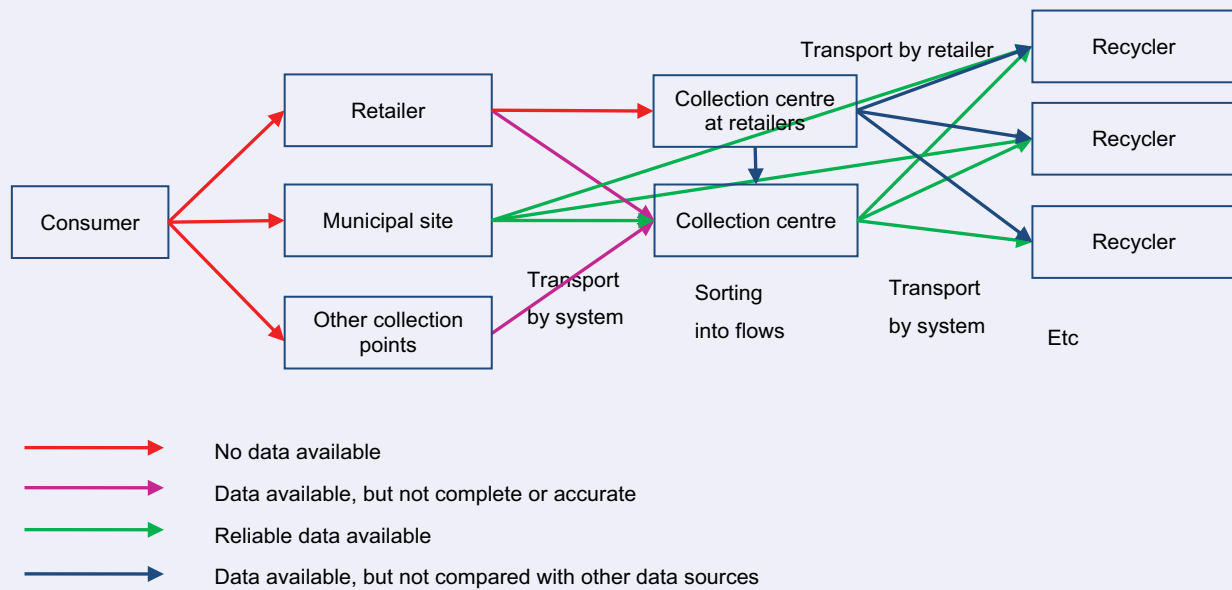
6.3 LOGISTICS

The European Commission has proposed to expand producers' responsibilities to financing cost of the collection of appliances from private households, starting point from the households and on. This means that the responsibility of producers would be expanded upwards in the collection chain. The EU also proposes to set new more ambitious targets on collecting e-waste. It could occur that the revised targets cannot be achieved with current collection points at municipalities and retailers. To maximise collection, returning appliances should be made as convenient as possible. Introducing new kinds of collection points could be a requirement that collective compliance systems should consider when they think about necessary changes in logistics. A new and denser infrastructure will entail more transport, leading to a significant increase in costs. A new challenge lies in creating a smart logistics design, where maximum collection results can be achieved with limited costs increase.

6.4 INFORMATION MANAGEMENT

Getting reliable information on logistics is a challenge for many collective compliance systems in Europe. The bottlenecks as they appear for some systems in Europe are shown in Figure 5.

As for the appliances that are offered by consumers to retailers and municipalities, most of the systems do not have any data available on what is returned. Appliances that are retrieved by retailers and other (small) collection points are often recorded in numbers only. Incoming appliances are not weighted at the collection centre. Some large retailers do have their own distribution links. Returned appliances are collected here from shops. Appliances are not weighed on entry or exit.

Figure 5 Bottlenecks in information systems


After sorting at the collection centre and transferred to bulk, the appliances are recorded in tonnes. Therefore, the input from retailers and other collection points in the flow cannot always be measured accurately. After transfer at the collection centres, the shipments to the recyclers and is received by the recycler are recorded. The reliability of data can be verified by comparing outgoing flows at the collection centres with incoming flows at the recycler(s).

When collection centres are retailers, data are less reliable, as outgoing flows at retailers' collection centres are not weighted and recorded. Therefore, incoming flows at the recycler cannot be compared with outgoing flows at retailers. So there must be a number of locations where valuable appliances disappear from the collective compliance system. There are problems associated with additional flows.

7 POSSIBLE IMPROVEMENTS BASED ON LESSONS LEARNED

The WEEE Directive has come into force on 13 February 2003. In the first few years of the directive, a number of technical, legal and administrative difficulties became apparent. It became obvious that the directive's expectations in protecting the environment and health could not be achieved at current collection and recycling rates.

Therefore, WEEE Directive was included in the EU's rolling programme for up-date and simplification. The EU is proposing to:

- harmonise the registration and reporting obligations for producers
- clarify the scope and definitions
- change the current collection target to a variable target that reflects on the economies of individual member states
- set a combined recycling and re-use target
- enhance environmental benefits and material savings by including recovery and recycling/re-use targets for medical devices
- set minimum inspection requirements for member states to strengthen the enforcement of the directive and include minimum monitoring requirements for shipping e-waste
- make member states, where appropriate, encourage producers to finance all the costs of separate collection
- allow producers to show to consumers at the time of sale the cost of collection, treatment and disposal of products

It should be noted that these are only proposals; it is not certain that these proposals will be adopted as presented.

7.1 HARMONISING REGISTRATION AND REPORTING REQUIREMENTS

The current directive requires producers to register and report differently in each member state where they place products on the market, causing them significant administrative burden. To reduce the burden of implementing the WEEE Directive, the EU proposes to harmonise registration and reporting obligations for producers by making the registers inter-operational. In this way, producers would need to register in only one member state for all their activities in the EU. Overall cost savings from harmonised registration and reporting is estimated to be about € 66 million per year.

7.2 CLARIFICATION OF THE SCOPE AND DEFINITIONS

The proposal clarifies the scope of e-waste and RoHS directives. All appliances in the 10 product categories covered by the annex of the RoHS Directive will fall under the scope of the WEEE Directive. Member states can go beyond these 10 product categories for the WEEE Directive (under Article 175 of the Treaty). The proposal furthermore clarifies the exclusion of certain products from the scope of the directives.

To clarify producers' financial and organisational obligation (being different for these two categories or products) are appliances as appliances for private households (B2C) and business appliances (B2B) categorised. The aim of categorising is also to reduce free riding in the market. Since the Directive now clarifies the term 'removal', harmonising definitions will improve coherence with other relevant pieces of EU legislation.

7.3 CHANGING THE COLLECTION TARGET

The current target of collecting 4 kg/capita per year does not distinguish between the different types of appliances that are discarded annually. Good results on the collection of large appliances can compensate for disappointing results on the collection of small appliances. The current target is clearly not ambitious enough and does not take into account the differences of the economies of individual member states.

Therefore, a variable collection target is proposed in function of the amount of appliances put on the market to reflect the disparities in member states' appliances /e-waste markets. The new target also includes non-household waste. This will provide a better account and control of this waste stream where only a fraction is reported as collected.

Producers would be made responsible for achieving the targets, which aims to ensure that the waste collected will be dealt with appropriately, recycled and accounted for.

The new target is set at 65 per cent of the average weight of products placed on the market in the two preceding years. This target would still apply globally for all product groups, but a re-examination of the collection target by end-2012 would look into the possibility of setting specific targets for certain critical product groups.

7.4 CHANGING RE-USE AND RECYCLING TARGET

In Europe, about 5 per cent of collected waste electrical and electronic equipment is suitable for re-use. Including re-use of whole appliances in the existing re-use/recycling target would encourage re-using appliances and provide greater

environmental benefits. The flexibility to choose the most sustainable treatment option (re-use or recycling) would remain. It would avoid making re-use an unattractive option by needing to meet higher recycling targets, even when this is economically and socially worthwhile.

Targets for the recovery/re-use and recycling of medical devices will ensure a high level of recovery of such equipment as well and lead to considerable environmental benefits.

The term re-use can be interpreted in various ways. Different definitions have created confusion among government, business and consumers. A definition of re-use is given in the new Waste Framework Directive 2008-98-EC. StEP has proposed their definition in the white paper One Global Understanding of Re-Use Common Definitions.

7.5 INTRODUCING MINIMUM INSPECTION AND MONITORING REQUIREMENTS

Due to implementation problems, a high share of e-waste is not being handled according to the requirements of the Directive. A significant amount of illegal shipments of polluting e-waste finds its way to countries outside the EU, where it has an impact on the health of local people at the receiving end. The new proposed target of 65 per cent of EEE (appliances) placed on the market (equivalent to 85 per cent of generated e-waste) would leave only 15 per cent for potential sub-standard treatment or leakage. To close the implementation gap further, the EU proposes to strengthen the enforcement of the WEEE Directive.

Therefore it is proposed to strengthen member states' inspection and monitoring, especially as controlling waste treatment and waste shipments is concerned.

Also, minimum monitoring requirements are proposed for the shipping of waste electrical and electronic equipment, as well as additional inspections and monitoring rules.

7.6 EXPANDING PRODUCER RESPONSIBILITY/FINANCING

It is proposed to encourage EU member states to expand the scope of EPR to financing the cost of collection facilities of appliances from private households. This is to ensure producers' access to waste and avoid separately collected e-waste going to sub-optimal treatment plants or illegally shipped abroad. This is also meant to harmonise producer financing across the EU, as some member states already make producers fully financially responsible for the whole of the e-waste collection. However, in view of the complex legal traditions and realities in the member states, this requirement is formulated only as a non-binding encouragement in the Commission proposal. It is proposed to maintain a visible fee that can also be used to fund the collection and recycling of new e-waste.

Summarised, the recast of the WEEE Directive represents a further shift of responsibilities towards the producers. Not only are targets set more stringently regarding collection and recycling, the scope of funding operations has also shifted more towards the producers.

In addition, scope and definitions are clarified to harmonize policies in the various member states. The minimum inspection requirements for member states will also be a very important change. It will strengthen the enforcement on e-waste management.

8 MAIN SOURCES OF INFORMATION IN THE EU

Studies and publications on e-waste management and EPR in Europe are numerous. Some studies originate from stakeholders with a certain point of view and therefore maybe biased. Others follow a more scientific approach, with an independent nature, and are thus a reliable and neutral reference. This source guide aims to assess the value of important sources. The views of stakeholders are important to understand the varying interests and the influence that they try to have on the policy makers.

To outline the situation in Europe, the Waste Electrical and Electronic Equipment (WEEE) Directive itself is the foundation of much of the situational analysis in this report. The 'recast' of the WEEE Directive, expected to be adopted soon after discussions and potentially changes introduced by the European Parliament and the Council, is used to describe the process of feedback into the policy cycle, and to foresee improvements based on the lessons-learned during the first seven years of the WEEE Directive and RoHS.

Some important background documents and information sources include:

- The 2008 Review of Directive 2002/96 on Waste Electrical and Electronic Equipment (WEEE) from the United Nations University (UNU). This study aims to complete the information needed for the review of the WEEE Directive. The writers of the paper have evaluated the current implementation of the Directive and have translated the information gathered into legislative and non-legislative options, in order to improve, further develop and simplify the current WEEE Directive. Running to 377 pages, the study is without doubt a comprehensive reference on the current issues on e-waste management in Europe.
- Various information sources available on the website of the WEEE Forum. As the European association of collective compliance systems, the Forum aims to a harmonised European approach towards e-waste management. Although detailed information is available to members only, some public information can be found on their website.
- Several studies of StEP (Solving the E-waste Problem). StEP is an initiative of various United Nations organizations with the aim to solve the e-waste problem. StEP initiates and facilitates approaches towards the sustainable handling of e-waste. Therefore the science sector actively participating in StEP seeks consultation with prominent members from industry, governments, international organizations and NGOs. StEP researchers have written a number of White Papers and other relevant documents, which can be found on their website:
 - E-waste Take-back System Design and Policy Approaches
 - One Global Understanding of Re-Use Common Definitions
 - On the Revision of EU's WEEE Directive - COM(2008)810 final

- The Producer Responsibility Principle of the WEEE Directive, Ökopool GmbH (The International Institute for Industrial Environmental Economics and Risk & Policy Analysis). Ökopool is an institute that develops environmental strategies and instruments which contribute to the sustainability of economic and political policies. To inform the planned review of the WEEE directive, the Commission has contracted this study that focuses on the Producer Responsibility Principle of the WEEE Directive and its implementation in the member states. The study gives a comprehensive account of the different approaches in Europe.
- Study for the simplification for RoHS/WEEE, Arcadis, Ecola & RPA. Arcadis is a international consulting company providing advisory services on sustainability.
- The implementation of the WEEE Directive in the EU25, Institute for Prospective Technological Studies. The Institute for Prospective Technological Studies (IPTS) is one of the seven scientific institutes of the European Commission's Joint Research Centre (JRC).
- A study by GfK (Research into complementary waste streams for e-waste in the Netherlands) shows that in the Netherlands 29 per cent of small household appliances and consumer electronics are thrown in the dustbin when discarded.
- Study on the feasibility of the establishment of a Waste Implementation Agency, Milieu Ltd, AmbienDura and FFact. Milieu Ltd, AmbienDura and FFact are consultancy firms focusing on international and European environmental law and policy. As the title indicates, it is a feasibility study to outline the benefits and costs of creating a dedicated agency to support the implementation and enforcement of EU waste legislation. Although the scope is a broader than just e-waste management, it gives an inventory on the problems associated with the enforcement of the policies on waste management on a European level. The study affirms the need for a dedicated EU body to ensure enforcement on waste management.
- Transposition of the WEEE and RoHS Directives in other EU member states, Perchards. Perchards is a government and public affairs consultancy firm in environmental compliance, packaging waste management, and related areas. The firm offers lobbying, monitoring and assessment of legislative developments in the UK, EI, and other jurisdictions. The firm has done a relevant study regarding the transposition of the WEEE and RoHS Directives. It is worthwhile mentioning that the information is not accessible free of charge. Perchard's is selling reports that provide an update of the situation in each of the EU MS. The report to which is being referred is five years old (accessible free of charge).
- The principle of producer responsibility in the EU waste management acquis and its implementation in the Netherlands Germany, France, Sweden, Wallonia and Flanders, prepared for the Brussels Institute for Environmental Management, by Wim Van Breusegem (December 2006, updated in June 2009).
- Towards sustainable WEEE Recycling, EERA. EERA is a branch organization for recyclers of electrical appliances. EERA has carried out this study to contribute to the WEEE review process as instructed in Article 17.5 of the WEEE Directive (EC 2002/96).

- Research into complementary waste streams for e-waste in the Netherlands, Witteveen+Bos. Witteveen+Bos provides consultancy and engineering services for projects in water, infrastructure, environment and economics.
- Websites of all relevant key players in the European e-waste management working field:
 - European Union website on e-waste;
 - WEEE Forum;
 - StEP;
 - Joint Research Centre of the European Commission;
 - European Electronics Recyclers Association (EERA).

9 REFERENCE GUIDE

European authorities on e-waste legislation

U.K	Ireland	Norway	Netherlands	Denmark
Environment agency Department for business, innovation and skills	Department of environment, heritage and local government	Climate and pollution agency	Ministry of housing, spatial planning and environment	Danish Ministry of the environment

European trade and industry associations

U.K	Website Association	Vision on recast WEEE directive	Vision on recast RoHS
Household appliances	CECED	Paper (05-03-2009)	Paper (05-03-2009)
Consumer electronics	DIGITAL EUROPE	Paper (04-03-2009)	Paper (04-03-2009)
Lamps	ELC	Several related documents	Paper (28-11-2008) Paper (24-04-2009)

Other associations

Type of association	Website European umbrella Association	Vision on recast WEEE directive
Collective Compliance systems association	WEEE Forum	Paper (24-04-2009)
Consumer associations	Bureau Européen des Unions de Consommateurs	No policy position statements known on WEEE Directive
Associations of waste management	FEAD	Paper (16-03-2009)
Retail associations	EuroCommerce	Paper (27-08-2009)
Recyclers associations	EERA	Paper (23-11-2009)

Collective compliance systems in Europe (members WEEE forum)

Country & system	Website
Austria UFH	www.ufh.at
Belgium RECUPEL	www.recupel.be
Czech republic ELEKTROWIN ASEKOL RETELA	www.elektrowin.cz www.asekol.cz www.retela.cz
Denmark Elretur	www.elretur.dk
France Eco-Systemes EcoLogic	www.eco-systemes.com www.ecologic-france.com
Germany LightCycle	www.lightcycle.de
Greece Appliances Recycling	www.electrocycle.gr
Hungary Electro Coord	www.electro-coord.hu
Ireland WEEE Ireland	www.weeeireland.ie
Italy ECODOM Ecoped EcoR'it Re.Media	www.ecodom.it www.ecoped.org www.ecorit.it www.consorzioremedia.it

Country & system	Website
Netherlands NVMP ICT	www.nvmp.nl www.ictoffice.nl
Norway Elretur	www.elretur.no
Poland ElektroEko	www.elektroeko.pl
Portugal Amb3E	www.amb3e.pt
Romania RoRec	www.rorec.ro
Slovakia SEWA Envidom	www.sewa.sk www.envidom.sk
Slovenia ZEOS	www.zeos.si
Spain Ecoasimelec Ecofimatica ECOTIC ECOLEC	www.asimelec.es www.ecofimatica.es www.ecotic.es www.ecolec.es
Sweden El-Kretsen	www.el-kretsen.se
United Kingdom Lumicom REPIC	www.lumicom.co.uk www.repic.co.uk

ANNEX 2

EXTENDED PRODUCER RESPONSIBILITY

This section is literally extracted from the paper on EPR “The Principle of Extended Producer Responsibility”, a document written by Wim Van Breusegem (2009) for the EU-India Action Plan Support Facility – Environment, Technical Assistance project.

Many OECD and other countries have implemented policies and programmes to prevent pollution and promote waste minimisation. Yet, environmental pressures from waste generation and management of waste continue to be a concern. To address this concern, different policy measures are being evaluated, developed and implemented by both government and industry. Key among the policy measures are those based on the principle of Extended Producer Responsibility (EPR).

What is Extended Producer Responsibility?

The roots of the principle of Extended Producer Responsibility (EPR) can be found in product liability, under which the manufacturer of a product is held liable for damage caused by that product to the consumer, if it was somehow defective or unreasonably dangerous. Product liability extended the producer’s responsibility beyond their existing responsibilities—for worker health and safety and environmental impacts of the manufacturing process.

A core feature of any EPR-based policy is that it places some responsibility for a product’s end-of-life environmental impacts on the original producer and seller of that product. As such, it further extends the responsibility of the producer to the post-consumer stage of a product’s life-cycle (downstream).

In addition, it is also important that an EPR-based policy provide incentives to producers to incorporate environmental considerations in the design of their products (upstream). With this extension, the responsibility of the producers extends across the whole life-cycle of the product, from selection of materials and design to its end of life. This “life-cycle thinking”, together with “pollution prevention”, is a cornerstone of the EPR principle.

The EPR principle is an application of the Polluter Pays principle. The polluter is not necessarily the person whose activities give rise to pollution, but rather the economic operator that plays a decisive role in the pollution, like the producer, rather than the polluter himself.

The EPR principle can be implemented through a variety of policy measures. However, requiring the producer and/or retailer to take back the product or its packaging after use and ensuring its environmentally sound management is the purest form of the EPR principle.

There may be differences in the way take-back programmes are designed and implemented, but all take-back programmes have three key elements in common:

1. They extend the responsibility of the producer to the post-consumer stage.
2. The responsibility of the producer is physical and/or financial.
3. Guidelines, usually mandatory and set by government, set specific collection and recycling rates, define what counts as recycling, and require data collection and reporting, to allow the government to monitor compliance.

The producers have primary responsibility under EPR, but sharing responsibilities across the product chain is an inherent part of EPR. Indeed, all actors in the product chain and in society must participate, in particular in collection, in order to optimise its effects.

An EPR programme should be designed such that it meets the desired objectives. It is thus crucial that a government agrees on the desired objectives, prior to designing and implementing an EPR programme.

Objectives of Extended Producer Responsibility (EPR)

Governments can have several objectives for developing EPR programmes, the principal ones being environmental, economic and social.

Environmental objectives

Environmental objectives focus on designing for the environment and reducing the consumption of natural resources through high recovery of products and materials. Design improvements are achieved by improving the design of both products and product systems. The EPR system should provide incentives for manufacturers to design and produce their products such that their environmental performance is improved.

Reducing the consumption of natural resources is an objective which can be divided further into three sub-objectives:

- Effective separate collection of discarded products, keeping products and materials out of the general waste stream to facilitate better recovery and disposal of the product and its material.
- High recovery of products and materials and components incorporated in the products.
- Environmentally sound disposal of products that cannot be re-used or recovered.

Economic objectives

The economic objective of EPR is to shift all or part of the physical and/or financial burden of the management of post-consumer products from local governments, and thus the general tax payer, to

- the producer and other economic operators in the value chain of a product (including importers, distributors and retailers); and
- the consumer, through internalisation by the producer of the waste management costs incurred in the retail price of new products.

Social objectives

An EPR-based system can and should lead to increased recycling, under conditions desirable from the perspectives of the environment, health and society, and as such to the creation of meaningful jobs in the labour-intensive recycling sector.

The objectives of the EPR policy should be clearly spelled out before the EPR programme is being designed and implemented. Clearly stated objectives are also essential for evaluating whether the EPR programme has achieved them.

Meeting the objectives will contribute to easing the critical dependence on primary raw materials, reducing import dependency and improving the environmental balance, as well as meeting industrial and consumer needs.

EPR policy instruments

Extended Producer Responsibility is a policy principle, which can be applied using a number of policy measures, or their combinations, that can potentially target all stages in the life-cycle of the products.

There are three types of policy instruments: regulatory, economic and voluntary/informational.

A Regulatory instruments

Regulatory instruments that more or less embody EPR can include:

- product take-back mandate and collection and recovery targets, with or without a tradable recycling credit;
- mandatory collection and recovery targets;
- minimum recycled content standards/ Mandatory use of used parts and materials;
- product and materials bans/restrictions;
- landfill and incineration bans; and
- liability.

Product take-back mandate and collection and recovery targets

By the means of a product take-back mandate, the government mandates that manufacturers and/or retailers take back products at the end of the product's useful life. Combined with such mandates are targets for collection, recovery (usually weight-based) or waste diversion. Take-back targets can apply to either individual producers or to the industry as a whole. Targets should be set as precisely as possible. Targets that are too low will not result in much improvement, while targets

that are too high might force policy makers to adjust them, which would hurt policy makers' credibility. Targets should be challenging, but achievable, considering the resources and the targeted parties.

The legislation should provide for monitoring arrangements and for penalties for not meeting the targets. In case of tradable recycling credits, targets do not apply to each individual producer but to the industry. The tradable credits are issued and firms are allowed to trade among themselves. An industry-wide recovery target is thus met, even though some producers better the target and others fall short.

Mandatory collection and recovery targets

Mandatory targets include targets for reduction (prevention), collection, for recycling, for diversion from landfill or incineration. These targets can apply to either individual producer or to the industry as a whole.

Minimum recycled content standards/ Mandatory use of used parts and materials
Minimum recycled content standards means that a target of a minimum amount of recycled content per product is set.

Product and materials bans/restrictions

Rules can clearly define harmful materials that are banned or need to be phased out by a set deadline. A well known example of this instrument is the EC RoHS Directive, restricting the use of six substances and the phase-out of CFCs in cooling appliances.

Landfill and incineration bans

Land filling and incineration of wastes that can be recovered at an acceptable cost are banned by law.

Liability

Some environmental management approaches are based on laws that make individuals or enterprises liable for proven environmental damage caused by their products. The extent of the liability is determined by legislation and may embrace different parts of the life-cycle of the product, including usage and final disposal. Liability systems reduce or prevent pollution only to the extent that individuals or facilities fear the consequences of potential legal action against them.

B Economic instruments

Economic instruments that embody EPR to some extent can include:

- advanced disposal fee/advanced recycling fee;
- deposit/refund schemes;
- recycling subsidies;
- product taxes; and
- material taxes.

Advanced disposal fee/advanced recycling fee

This includes a fee that the customer pays for certain products at the point of sale. The fee is based on estimated costs of collection, recovery and disposal. Fees are often assessed per unit of the product sold, but can also be assessed by weight.

The fee can be either visible or invisible, that is incorporated into the product retail price. Visible fees at the point of purchase are the clearest mechanism to make the consumer aware of the environmental implications of their purchase and to motivate them to change their purchase behaviour accordingly.

The beneficial effects of an ADF/ARF depend on what is done with the revenues. The fee should be used to support environmentally sound recycling of the post-consumer product.

Deposit/refund schemes

The aim of a deposit/refund scheme is to shift some of the burden of waste disposal and the recovery of materials back to the manufacturers of products by ensuring that retailers, and then wholesalers, take back materials. In a deposit/refund system, a payment (the deposit) is made when the product is purchased and is fully or partially refunded when the product is returned to the retailer.

It is usually developed by central governments (mandatory), but also by “producers” (voluntary). The producers and retailers (and distributors) have to make administrative arrangements at the onset of the deposit/refund system.

A benefit of a deposit/refund scheme is that products are taken back at the end of their useful life and then directed towards the appropriate recovery, treatment or final disposal facilities.

Recycling subsidies

Recycling subsidies are all forms of financial assistance given by producers to communities and organisations, which are often social enterprises involved in the collection and recycling of products. Recycling subsidies can be given in the form of a payment per unit, or per kg of material recycled, or as lump sum grants.

Product taxes

Product taxes are applied to products that create pollution when they are manufactured consumed or disposed of. The objective of these taxes is to modify the relative prices of the products and/or to finance collection and treatment systems. One form that product taxes may take in practice is that of tax differentiation, leading to more favourable prices for “environmentally friendly” products and vice versa (for example, tax differentiation between leaded and unleaded fuel).

Material taxes

Material taxes have to be paid by the manufacturers when they use materials that have a significant impact on the environment, like virgin materials, materials that are

difficult to recycle or that contain toxic substances. Material taxes would not have to be paid when manufacturers are environmentally favourable materials.

The objective of material taxes is to favour the usage of environmentally favourable materials. Such a tax has an immediate effect on the design of products. The tax should be earmarked and used for the collection, sorting and recovery of post-consumer products.

C Voluntary/Informational instruments

Voluntary/informational instruments can include

- voluntary take-back programmes with recycling targets;
- leasing and servicing;
- public education and awareness-raising;
- providing information; and
- labelling and marking

Voluntary take-back programmes with recycling targets

Firms in an industry undertake purely voluntary action to organise a take-back system for their products and set recycling goals, without the government mandating compliance or setting penalties for not meeting the goals.

Leasing and servicing

Companies as diverse as photocopier manufacturers to carpet manufacturers lease their products or provide services, thereby retaining ownership of the product, including responsibility for its end-of-life disposal.

Public education and awareness-raising

Producers should be required to promote community awareness on preventing and recycling waste and on disposing of certain products/wastes safely.

Providing information

Producers should provide information to three parties: the government, the public and recycling facilities.

Producers should inform the government on results achieved, that is on the collection and recycling rates achieved.

They should inform the public on

- the product's potential environmental impacts during stages of its life cycle;
- the extent to which the product is re-usable and recyclable; and
- their options to discard their waste in an environmentally sound manner

Finally, the producers should inform recycling facilities on the composition of

the product, the location of dangerous substances and preparations on how to dismantle the product properly, etc..

Labelling and marking

Labels on products and equipment are a means to

- provide information to the consumer on the products' or equipment's energy consumption and environmental characteristics, so that they can make an informed choice;
- inform the consumer on his role in the separate collection of the product; and
- distinguish between historical and new products, which is a requirement for effective EPR programmes.

Marking of product components can provide useful information to treatment facilities, including recycling facilities.

Decision criteria

Before introducing a product take-back programme, whether or not in combination with any of the other policy instruments discussed in this chapter, policy makers should assess whether less administratively costly instruments could not achieve the same environmental and economic objectives more efficiently. The decision criteria listed in the table below can help with this assessment.

Similarly, when the decision on the mix of policy measures has been taken, they should be implemented such that they meet these decision criteria. There are three types decision criteria:

- Effectiveness
- Efficiency
- Administrative feasibility
- Political and social acceptability
- Incentives for innovation

Effectiveness

Effectiveness is the extent to which the instrument could be used to achieve the stated environmental and financial objectives of EPR. Questions that might be raised include, for example:

- If a take-back programme is not put in place, what will be the fate of products at the end of their useful life (post-consumer phase)?
- Could other policy measures, or combinations of policy measures, encourage the organised collection, sorting and recovery of post-consumer waste and at the same time decrease the costs incurred by local governments?
- Are other policy instruments unable to provide the appropriate signals up the chain?

Many industrial and hazardous wastes, such as asbestos and PCBs are more effectively controlled through direct regulatory mechanisms, including licensing or specific legal provisions on their substitution, collection and disposal.

Efficiency

The efficiency criterion requires that the economic benefits of policies exceed their costs. Establishing whether introducing a take-back programme would be economically efficient requires an analysis of the costs of implementing the policy and of enforcing compliance, and of net value of the benefits. Transaction costs incurred by participants, for example, producers, retailers or municipalities, in the marketplace in the course of complying with the policy should also be considered. Ways to economise on or reduce the administration costs should be investigated, if need be. To limit the administrative and transaction costs, producer responsibility organisations have been established in many countries. The administration costs could be high, if a highly sophisticated institutional structure would be required. EPR is likely to be most efficient where the administration costs are not excessive relative to alternative policy instruments.

Administrative feasibility

The extent to which the policy can be carried out in the given institutional set-up, for example:

- Has the environment ministry alone all the powers and responsibilities required to design and implement the EPR programme, or are these spread over a variety of ministries?
- Is there a culture of cooperation between the different regional ministries within a federal country, that would introduce take-back programmes?

The existing administrative culture will influence the feasibility: has the government a tradition of negotiating with different stakeholders, industry in particular? The public administration must have the ability, that is sufficient staff with the appropriate skills and expertise, to implement the policy and to enforce compliance with the mandated requirements. If the majority of businesses are SMEs, they might find difficulties in obtaining information on and meeting new take-back requirements. Reporting requirements under an EPR programme should be kept reasonable, in order not to suffocate SMEs.

Political and social acceptability

It is desirable that policy changes are acceptable to the actors affected and do not encounter serious resistance in the political process. A policy that achieves little, but at great political cost and arousing much public antagonism, is clearly undesirable. There should normally be some proportionality between the effort that goes into introducing a policy measure (the sacrifice of political goodwill, the resources involved in overcoming resistance and in lobbying, etc.) and the pay-off from that policy.

Obviously, there will be always some resistance, and there would normally be gainers and losers in any policy change. Nevertheless, the ground needs to be

carefully prepared through early involvement of the stakeholders in the design of the EPR programme. A policy is more likely to be acceptable if:

- it is seen to be tackling a severe problem;
- it is seen to be 'fair' in its respective impact on the various groups of actors, which will require an apparently equitable distribution of costs and benefits;
- there is a strong lead from prominent (political, industry and community) stakeholders; and
- if all stakeholders are involved in the design of the policy at an early stage.

Incentives for innovation

The incentives for innovation include the extent to which the policy can stimulate technological (for example, the development of facilities for high-quality recycling) and managerial improvements (for example, improved collection logistics).

EU-INDIA ACTION PLAN SUPPORT FACILITY – ENVIRONMENT

This project is funded by the European Union and implemented by a consortium led by Euroconsult Mott MacDonald, Arnhem, The Netherlands. The activity on e-waste has been implemented in collaboration with Toxics Link and Centre of Environment Education.

The Ministry of Environment and Forests represents the Government of India as counterpart for the implementation of the project.

The project implementation period is from December 2007 until April 2011.

The objectives are:

- Improved sector policy analysis and knowledge
- Enhanced mutual understanding and cooperational links and dialogue
- Enhanced regulatory function and improved technical and institutional capacity of the Indian administration
- Enhanced dialogue, information exchange and awareness among civil society's organisations

The areas covered by the project are waste, chemicals, water, air, and climate change.

Project activities to develop the policy dialogue between India and the EU include advisory services, workshops, seminars, training, studies, and capacity building.

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